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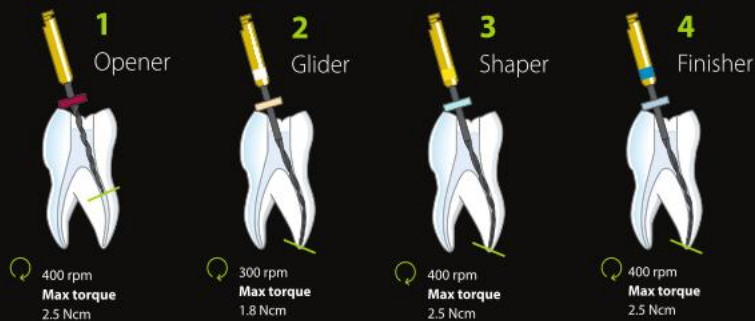
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Editorial

From The Desk of Guest Editor.....

Proximal Restorations and Pulpal Health Management

Introduction

With advancements in biomaterials, vital pulp therapy has emerged as a promising approach for clinicians. The prevalence of deep proximal carious lesions is notably high, making proximal restorations crucial for maintaining both pulpal and periodontal health. The primary goal in managing deep carious lesions is to preserve pulp vitality, ensuring the long-term survival of the tooth. However, deep proximal lesions that extend close to a healthy pulp pose significant clinical challenges. These lesions not only reach deep into the pulp but also extend towards the cervical margins, leading to substantial loss of tooth structure. Their subgingival location further complicates isolation, accessibility, and the attainment of an optimal seal, particularly when the cervical margins lack enamel and are surrounded by dentin or cementum¹.

Challenges in Managing Deep Proximal Lesions

The management of deep proximal lesions is complex due to multiple factors. The subgingival nature of these lesions creates difficulties in rubber dam isolation, visibility, and accessibility during cavity preparation. Additionally, placement, finishing, and polishing of the restoration at the cervical margin become technically demanding². The intricate nature of these procedures necessitates the use of advanced tools such as magnification devices, digital radiography, and dental handpieces equipped with LED lights to ensure precise and effective treatment.

Classification of Deep Carious Dentin Lesions

Deep carious dentin lesions are categorized based on their extent of penetration. A deep carious lesion radiographically extends into the pulpal quarter of the dentin but retains a well-defined zone of radiopaque dentin separating the infected, demineralized dentin from the pulp. In contrast, an extremely deep carious lesion extends through the entire thickness of the dentin, often lacking a radiopaque barrier between the lesion and the pulp³. In such cases, microbial invasion reaches the tertiary dentin and the pulp, increasing the risk of pulpal inflammation and infection⁴. Despite the clinical significance, the precise degree of carious lesion penetration is rarely described in literature concerning vital pulp therapy (VPT) due to the heterogeneity of carious lesions⁵.

Pulpal Response to Carious Lesions

The thickness of the remaining dentin plays a critical role in pulpal response. As carious lesions progress, gram-negative bacteria release lipopolysaccharides (LPS), which diffuse through dentinal tubules and interact with Toll-like receptors 4 (TLR-4) on pulp nociceptors. These nociceptors extend within 0.16 mm of the dentinal tubules, producing an early warning signal to the pulp and the patient³. On a molecular level, metalloproteinase-9 (MMP-9) expression is triggered only when tissue breakdown occurs in the pulp, serving as a marker for pulpal inflammation severity. Interestingly, MMP-9 levels can be measured from blood samples of an exposed pulp, providing a potential diagnostic tool for evaluating pulpal health⁶.

Management Strategies for Deep Proximal Lesions

Deep proximal lesions in cases where the pulp remains healthy but is not exposed can be managed using indirect pulp capping followed by direct restoration. Direct restorations are cost-effective, require reduced chair time, and necessitate fewer clinical sessions, making them a preferred choice for both clinicians and patients. However, given the presence of bacteria and specific dentin microstructures, adequate dentin preparation is essential prior to placing pulp-preserving materials such as calcium silicate cement⁷. The use of sodium hypochlorite and ethylenediaminetetraacetic acid (EDTA) over caries-affected dentin before material placement enhances the tooth-material interface and bonding strength.

In cases where pulpal exposure occurs, effective management involves controlling hemorrhage and reducing bacterial load. Sodium hypochlorite is widely used for hemostasis due to its efficacy in controlling bleeding and decontaminating the pulp. This is followed by the application of calcium silicate cement, which promotes reparative dentin formation without tunnel defects, thereby improving long-term prognosis⁷.

Clinical Perspectives on Pulp Exposure Management

From a clinical standpoint, pulp exposure presents both advantages and challenges. Direct exposure of the pulp to the oral cavity allows for the precise placement of biomaterials in direct contact with the pulp, facilitating better evaluation and management of pulpal health, including assessing pulpal bleeding. However, avoiding pulp exposure is often advantageous as it minimizes the risk of bacterial contamination and preserves the

odontoblast layer, which plays a crucial role in reactionary or reparative dentinogenesis. Additionally, dentin serves as a reservoir for growth factors that are released by capping materials and contribute to the reparative process. Given the tubular structure of dentin, if the remaining dentin thickness is less than 1 mm, it becomes permeable to bacterial challenges, mimicking a pulp exposure scenario⁸.

Pulp Capping vs. Pulpotomy

The choice between pulp capping and pulpotomy depends on the extent of pulpal involvement. Pulp capping involves the direct placement of biomaterials over an exposed pulp without tissue removal⁹. In contrast, pulpotomy involves the either removal of 2–3 mm of pulp tissue at the exposure site or in some cases, the complete removal of the coronal pulp to eliminate infected or inflamed tissue, allowing for a healthier pulpal environment for biomaterial placement⁷.

Assessing Pulpal Hemostasis and Inflammation

Effective assessment of pulpal hemostasis is essential in determining the degree of inflammation. Increased vascular permeability and hyperemia associated with inflammation can prolong bleeding, necessitating at least five minutes for hemostasis under normal physiological conditions. If bleeding persists beyond this timeframe, it may indicate residual inflammation, requiring further pulp removal until healthy, non-inflamed tissue is exposed⁷.

Failure Patterns in Deep Proximal Lesion Management

An analysis of existing literature highlights two distinct failure patterns in deep caries management:

1. Early failures, occurring within days of treatment, leading to symptomatic pulpitis. These failures are often linked to the misdiagnosis of pulpitis severity and inadequate pulp tissue removal.
2. Long-term failures, detected several months post-treatment, typically associated with apical lesions resulting from pulp necrosis and subsequent root canal infection. These failures are commonly attributed to compromised sealing ability of the restoration or breakdown of the mineralized bridge, allowing secondary infection³.

Influence of Various Factors on Pulpal Response

Several factors influence pulpal response to restorations, including bacterial contamination, remaining dentin thickness, material biocompatibility, and postoperative time. Studies have shown that pulpal response diminishes over time. In accordance with the Federation Dentaire Internationale (FDI) standards, research recommends evaluating pulpal healing over both short-term and long-term periods. An in vivo study demonstrated a significant reduction in thermal sensitivity six months postoperatively, which may be attributed to the natural decrease in dentin permeability observed following cavity preparation¹⁰.

Conclusion

The maintenance of pulp vitality remains at the core of deep caries management. By considering factors such as bacterial control, dentin thickness, and material selection, clinicians can optimize treatment approaches to preserve pulpal health and enhance the longevity of proximal restorations. Ultimately, a precise diagnosis, careful case selection, and adherence to evidence based protocols contribute to successful outcomes in the manage-

ment of deep proximal lesions.

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Heal Talk A Journal of Clinical Dentistry. (2025). Proximal Restorations and Pulpal Health Management. In Heal Talk A Journal of Clinical Dentistry (Vol. 17, Number 4, p. IV-V). Zenodo. <https://doi.org/10.5281/zenodo.15245147>



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Print ISSN 0975-6329

A Journal of Clinical Dentistry 'Heal Talk' is indexed/listed with Index Copernicus, Ulrich's International Periodical Directory, Genamics Journal Seek, Open J-Gate, Jour Informatics, Infobase Index, Open Academic Journals Index, Google Scholar & Inno Space etc.

The Journal is based on Clinical Dentistry & issues are published Bi-monthly in the last week of February, April, June, August, October, December.

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Marketing & Circulation Office :
"Media House"
Zaidi Colony, Near New Era Public School
Eidgah Road, Qazi Para
Bijnor-246701 (U.P.) India.

Website : <http://www.healtalk.in>
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Printed, Published & Owned by : Sehba Zaidi, 'Express House', 967/21-C, Housing Board Colony, Faridabad-121001 (Haryana) India.

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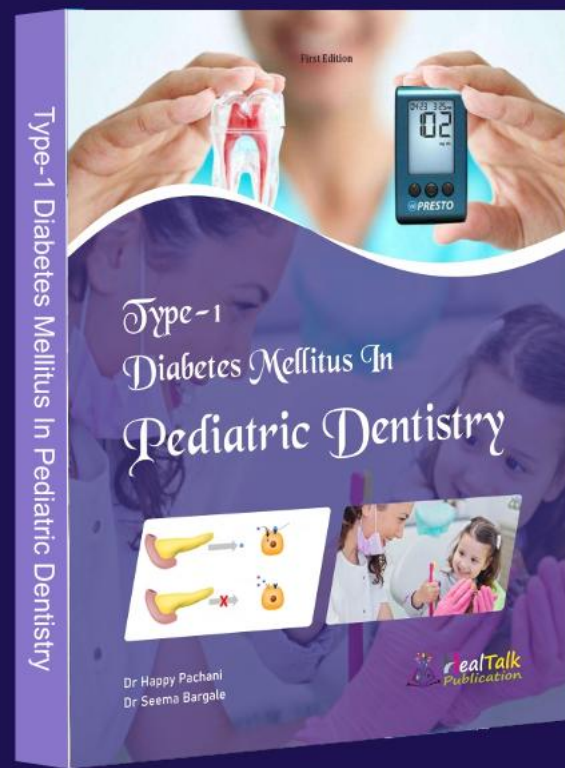
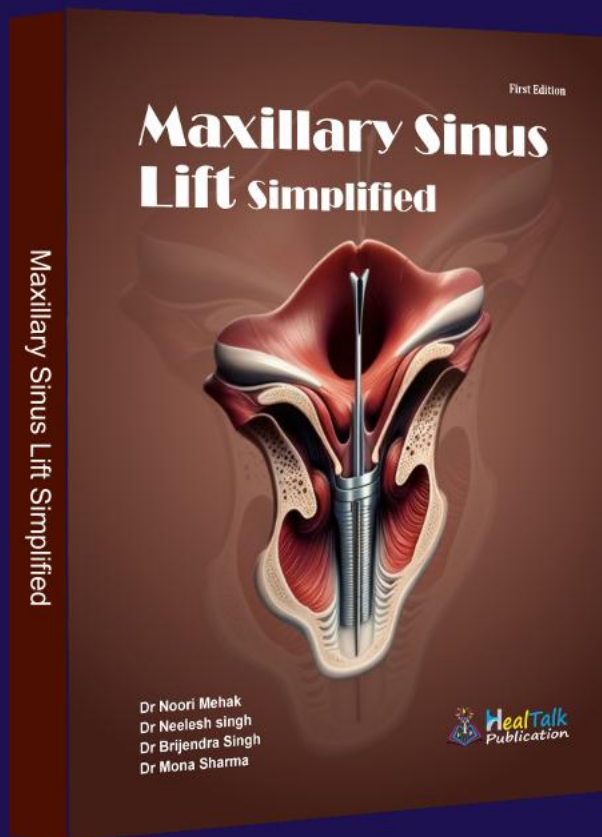
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Cone Beam Computed Tomography In Endodontics

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Introduction

Since Kells first reported the usefulness of visualizing a lead wire in a root canal on a “radiogram” in establishing the length of a root canal in 1899, radiography has been a pivotal tool in the practice of endodontics. Almost a century later, building on the pioneering efforts of those using conventional computed tomography (CT) and micro-CT, the introduction of maxillofacial CBCT in 1996 provided the first clinically practical technology demonstrating application of 3D imaging for endodontic considerations.

Role of Imaging in Endodontics

Radiography is essential to successful diagnosis of odontogenic and nonodontogenic pathoses, treatment of the pulp chamber and canals of the root of a compromised tooth via intra-coronal access, biomechanical instrumentation, final canal obturation, and assessment of healing. Imaging serves at all stages in endodontics:

1. Preoperative Assessment

Imaging achieves visualization of dental and alveolar hard tissue morphology and pathologic alterations to assist correct diagnosis. It provides information on the morphology of the tooth including location and number of canals, pulp chamber size and degree of calcification, root structure, direction and curvature, fractures, iatrogenic defects, and the extent of dental caries. The effects of peri-radicular and periapical disease can be determined, including the degree of root resorption and characteristics of periapical osteolysis. Larger lesions, only determined by imaging, may necessitate adjunctive surgical procedures in addition to conventional intracanal therapy. Diagnostic radiographs help predict the potential for complications, permit root fracture detection, and demonstrate periapical lesions.

2. Intraoperative

During therapy two intraoral periapical images may be performed. The first is a “working” radiograph achieved by placement of a metallic file(s) into the root canal(s) to a length that approximates that of the root as radiological and anatomic root apexes are almost never coincident. This ensures that mechanical debridement of the intracanal contents extends to the apical terminus of the canal and that obturation

is dense, homogeneous, and contained within the root canal system. In addition, prior to final obturation, a “final” or pre-condensation radiograph is made to assure proper fitting of the master cone.

3. Postoperative

A “postoperative” radiograph immediately after root canal obturation is made to assess the sealing condensation and containment of the root canal filling material within the root canal system. In cases where peri-radicular healing is incomplete, it acts as a baseline for assessment of healing in the medium and potentially long term. Imaging is important in evaluating the results of previous therapy, delayed healing, evaluating potential obstacles to retreatment, as well as surgical considerations.

Radiological aspects of CBCT

The pulp of a tooth is structurally complex. The dental pulp comprises a sophisticated arrangement of hard tissues, intricate root canals, and a network of nerves and blood vessels. Precise visualization of these internal components is essential for successful root canal treatment. This requires a comprehensive understanding of tooth anatomy. To examine the dental pulp, dental professionals use various aids, including traditional diagnostic techniques and modern imaging methods such as cone-beam computed tomography (CBCT). CBCT offers a cost-effective and non-invasive approach for capturing tooth anatomy details.

The two-dimensional (2D) representation of three-dimensional (3D) objects in intraoral radiography hampers the interpretation of root morphology, which in turn, affects treatment and endodontic healing. Studies found that when using 2D periapical radiographs to evaluate the healing of a periapical lesion, only 47% agreement was achieved among six examiners. Moreover, there was only 19%–80% agreement between two evaluations of the same films. A limited understanding of 2D imaging increases the risk of errors and can lead to an underestimation of the endodontic problem compared with 3D imaging.

In dentistry, CBCT is the preferred three-dimensional imaging method. The use of CBCT in Endodontics is increasing rapidly worldwide. The three-dimensional radiographic assessment of teeth and their surrounding structures with cone beam computed tomography (CBCT) is desirable for aiding

diagnosis and/or management of complex endodontic problems.

Cone beam computed tomography is a modification of the computed tomography (CT) concept, involving the single rotation of an X-ray source around the dental subject. CBCT uses a rotating arm and a cone-shaped ionizing radiation source to capture images via an X-ray source and detector. CBCT offers rapid and precise 3D imaging by capturing multiple cross-sectional images. Currently, CBCT is being utilized as an adjunctive aid together with traditional 2D methods for specific dental applications.

The data are analysed and reconstructed using a CT-based algorithm to create a volume of data, which can be viewed in three conventional planes (axial, sagittal and coronal) and multiple alternative planes on manipulation of the data set.

Image acquisition is rapid and uses technology, which is becoming relatively affordable. A three-dimensional visualization of the region of interest is obtained in sufficient detail to localize teeth and adjacent anatomy in a manner, which is simply not achievable with conventional, 2D, plain dental film imaging.

The potential benefits of CBCT must be balanced with the comparatively higher levels of risk from radiation exposure, compared to conventional imaging.

The 3D visualization of CBCT is superior to that of traditional scans, providing inter-relational images in three planes and allowing data reorientation for accurate spatial representation in endodontics. CBCT has a lower spatial resolution than that of digital- and film-based intraoral radiography. Moreover, CBCT illuminates the entire field of view (FOV) but may struggle to detect minimal attenuation changes. Furthermore, CBCT is prone to artifacts, similar to other imaging modalities.

Specific Requirements For Endodontics

Cone beam computed tomography imaging in Endodontics requires exceptionally high detail and resolution to appreciate the intricacies of the root canal system and periodontium. High image resolution comes at the cost of higher patient radiation exposure.

Only small FOV CBCT scans are recommended for the diagnosis and management of endodontic problems. A small FOV scan reduces the volume of exposed tissue, and therefore, the effective radiation dose, but, favourably, this also reduces scatter,

which improves image quality. The generated images may be easily degraded by subtle patient movement; the most suitable machines for maintaining patient stability are where the patient sits, or even lies down, rather than stands. This is an important consideration when using CBCT imaging, as the dedicated CBCT units are often designed for a seated or supine patient whilst hybrid panoramic/CBCT units usually have the patient standing. The trend for hybrid panoramic/CBCT units appears to be the predominant growth area in CBCT imaging currently, most probably because these units are cheaper yet multifunctional. However, it must be recognized that image quality is at risk of being lower.

Limitations


The presence of metallic restorations (e.g. amalgam restorations, metal posts and/or crowns, and implants) or even gutta-percha can cause significant radiographic artefact, sufficient to compromise details of root canal anatomy and relevant pathosis such as root resorption and root fractures. Metal artefact reduction algorithms (MAR) are becoming more common in operating and viewing software in order to overcome this disadvantage.

Concluding Remarks

- A CBCT scan should be tailored to the individual patient and their diagnostic needs;
- The potential benefits of the CBCT scan should outweigh the potential risks;
- Clinicians must regularly update their core knowledge in CBCT;
- Undergraduate curricula should include an introduction to CBCT radiology;
- Post-graduate endodontic programmes should incorporate the use of CBCT.

To be continued.....

(It's a review of literature and not an original article)

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<small>Heal Talk A Journal of Clinical Dentistry. (2025). Cone Beam Computed Tomography In Endodontics. In Heal Talk A Journal of Clinical Dentistry (Vol. 17, Number 4, pp. 01-02). Zenodo. https://doi.org/10.5281/zenodo.15245278</small>	

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 2. Periodicity of its Publication : **Bi-Monthly**
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Assessment of Knowledge, Attitude And Practices of Tobacco Cessation Counselling And Nicotine Replacement Therapy Among Dental Professionals

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Received on: 15 March 2025; Accepted on: 24 March 2025; Published on : 19 April 2025

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Abstract

The tobacco epidemic is a significant global health challenge, with over one-third of Indian adults using tobacco in some form. Despite the known adverse effects of tobacco on oral and general health, many individuals continue its use due to nicotine addiction. Nicotine Replacement Therapy (NRT) is an effective pharmacological approach to aid in tobacco cessation by alleviating withdrawal symptoms. This study assesses the knowledge, attitude, and practices of dental professionals regarding tobacco cessation counseling (TCC) and NRT. A survey was conducted among 250 dental students, including interns, postgraduates, and faculty members, to evaluate their training, confidence, and practices in TCC and NRT. The results revealed that while all participants recognized the harmful effects of tobacco, only 28% were trained in TCC and 54% were aware of NRT agents. A significant portion of participants lacked confidence in prescribing NRT due to insufficient training. This study underscores the need for enhanced curriculum, certification courses, and continuous education programs to improve the competency of dental professionals in tobacco cessation efforts.

Keywords : Tobacco Cessation Counseling (TCC), Nicotine Replacement Therapy (NRT), Dental Professionals, Tobacco Epidemic, Oral Health, Addiction, Pharmacotherapy, Dental Education, Survey, India

Introduction

Globally, one of the greatest health challenges of today is tobacco epidemic. According To global adult tobacco survey (GATS), WHO India (2020) revealed that over one third of Indian adults (22.3%) use tobacco in some form.^{1,2} Tobacco has deleterious effects on oral and general health, regardless of which, many people consume tobacco due to their addiction towards it. Both smoked and smokeless forms of tobacco contain nicotine, a highly addictive chemical, making it difficult for habituated tobacco users to quit.³ This urge towards tobacco is due to the presence of an extremely compelling psychoactive drug nicotine 11-methyl-2 pyrrolidine in it. Over time, users become dependent on nicotine and suddenly stopping produces physical as well as psychological withdrawal symptoms.⁴ Tobacco dependence is a chronic condition that often requires repeated interventions. As Smokers are 7–10 times more likely to develop oral cancers as compared to those who have never smoked.^{5,6} So, Dentists play an important role in TCC as dentist are first to observe oral changes and can educate patients. DCI mandates TCC training during internship. TCC aims for psychological cou-

nselling of tobacco consumers but along with this pharmacological approach should also be practised so as to increase quit rates.⁷ Pharmacotherapy like nicotine replacement therapy (NRT) can help reduce the symptoms of nicotine withdrawal, which makes quitting easier. The study is conducted to assess the level of the knowledge, attitude, and effectiveness of dental students and professionals towards tobacco cessation & to assess if the dental practitioner is able to educate, motivate, and counsel the patient with tobacco dependence.

Materials and Methods

250 dental students including interns, postgraduate, and faculty members of Shree Bankey Bihari Dental College And Research Center, Ghaziabad, U.P were enrolled in the study. A printed survey proforma of 29 questions, divided into four sections: Demographic details (question nos. 1–3), knowledge (question nos. 4–18) -if dental practitioners

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<https://doi.org/10.5281/zenodo.15245341>

How to cite this article : Srivastava et al. - Heal Talk A Journal of Clinical Dentistry. (2025). Assessment of Knowledge, Attitude And Practices of Tobacco Cessation Counselling And Nicotine Replacement Therapy Among Dental Professionals. In Heal Talk A Journal of Clinical Dentistry (Vol. 17, Number 4, pp. 03–07). Zenodo. <https://doi.org/10.5281/zenodo.15245341>

are trained for tobacco cessation counselling (TCC), NRT'S, attitude (question nos. 19–25) - if dental practitioners think counselling/NRT/drugs can help patients quit tobacco and practices (question nos. 26–29) - if dental practitioners practice TCC at their workplace. The questionnaire comprised 29 questions to evaluate the attitude, awareness of smoking cessation, willingness to provide tobacco cessation services [Table 1] which had to be answered by each respondent. The data obtained was then entered in Microsoft Excel and descriptive analysis was done.

Table 1: The questionnaire for the study -

Questionnaire

Demographic data

1. Gender- Male Female (Tick the appropriate option.)
2. Current Designation-Intern/Postgraduate student/Dental faculty (Tick the appropriate option.)
3. Experience in months-

Knowledge

4. Are you aware of the role of tobacco in oral cancer and general health?

a. Yes	b. No
--------	-------
5. Can you identify the lesions caused by tobacco products?

a. Yes	b. No
--------	-------
6. Are you trained for tobacco cessation counselling (TCC) in terms of questions to be asked and providing guidance to the addict?

a. Yes	b. No
--------	-------
7. Do you know about 5As and 5Rs in Tobacco Cessation Counselling?

a. Yes	b. No
--------	-------
8. Do you know about agents used as Nicotine Replacement Therapy (NRT)?

a. Yes	b. No
--------	-------
9. If yes, name the product used as NRT.....
10. Do you know how to prescribe NRT?

a. Yes	b. No
--------	-------
11. Do you know about the side effects of NRT?

a. Yes	b. No
--------	-------
12. If yes, name them.....
13. Do you know about the medications for deaddiction?

a. Yes	b. No
--------	-------
14. If yes, name them.....
15. Do you know about the side effects of medications used?

a. Yes	b. No
--------	-------
16. If yes, name them.....
17. Are you aware about the organisations/NGOs that help patients quit tobacco?

a. Yes	b. No
--------	-------
18. Do you know that each dental institute across India has a Tobacco Cessation Cell to help the patients?

a. Yes	b. No
--------	-------

Attitude

19. Do you ask the patients about history of or current use of tobacco?

a. Yes	b. No
--------	-------
20. Do you think it is your responsibility to counsel patient in private set-up and in dental institutions?

a. Yes	b. No
--------	-------
21. Do you think counselling/NRT/drugs will help patients quit tobacco?

a. Yes	b. No
--------	-------
22. Are you concerned that such counselling in dentistry may upset the dentist-patient relationship in private practice?

a. Yes	b. No
--------	-------
23. Are you willing to spare time to advise patients about tobacco cessation in your professional career?

a. Yes	b. No
--------	-------
24. Will you be interested in gaining knowledge about TCC?

a. Yes	b. No
--------	-------
25. What are patient's main reasons for wanting to quit?
 - Health concerns
 - Cost
 - Family/friends
 - Support groups

Practices

26. Do you practise TCC at your workplace in terms of counselling/NRT/Drug prescription?

a. Yes	b. No
--------	-------
27. If yes, are you satisfied with the results?

a. Yes	b. No
--------	-------
28. If no, tick for the appropriate reason/reasons-
 - Not interested
 - It is not money-fetching as other dental treatments
 - Belief that TCC doesn't really help patients
 - Lack of time
 - Lack of knowledge and training for TCC and NRT
 - Lack of resources
29. What challenges are faced by patient in quitting tobacco?
 - Craving
 - Weight gain
 - Stress management
 - Social situations

Results & Discussion

Demographic data

Out of the total 250 participants in the study, 67 were dental faculty members, 52 were postgraduate students and 131 were interns. 86 males and 164 females participated in the study. Mean experience of the candidates was 24.81 months.

All participants (100%) were aware of the role of tobacco products in oral cancer and general health and identify the lesions caused by tobacco products. Only (28%) candidates were trained for TCC in terms of questions to be asked and giving guidance to the addict; Q6 [Table 1]. 54% - Over half of the dental

professionals belong to Group 1 who were aware of NRT agents ;Q8 [Table 2]. Nicotex chewing gum was known by most people (35%), as it is easily available in local chemists' shops and advertised more as compared to other agents. only 36% knew how to prescribe NRT. Most of the candidates have a positive attitude toward tobacco cessation but do not feel confident to prescribe NRT due to no training or not being updated about NRT. (40%) knew about the side effects of NRT like indigestion, headache, mood swings, bad taste, etc. Besides NRT agents, only (28%) knew about the drugs used for de-addiction. Q13 [Table 3]. Bupropion and Varenicline were known by most of the candidates. All candidates felt that it is their responsibility to counsel the patients for de-addiction; Q20 [Table 4]. (90%) felt that such anti-tobacco counselling might upset doctor-patient relationship in a private set-up Q22 [Table 5]. Hence, many of them did not try to counsel the patients and prioritised dental issues. (30%) were currently practising TCC at the workplace in terms of counselling or NRT or drugs Q26 [Table 6] The survey found that 30% of dental professionals regularly provide tobacco cessation counseling, nicotine replacement therapy, or drug prescriptions to their patients at the workplace. However, 60% of participants reported a lack of knowledge and training for tobacco cessation counseling and nicotine replacement therapy as a barrier to providing these services.

Few challenges are faced by patient in quitting tobacco like craving (64%) Q29 [TABLE 7], but none of them were satisfied as the patients were often lost to follow-ups. This can be overcome by the use of behaviour modification approaches for the patients. In an institutional set-up, customised short counselling visits, use of audio-visual aids, clubbing dental visits with counselling appointments, personalised reminder messages, involving family members for help and offering small rewards to the patients will surely help in increasing patient follow-up visits. While Other participants did not practice it; the main reason being lack of knowledge and training for TCC and NRT.

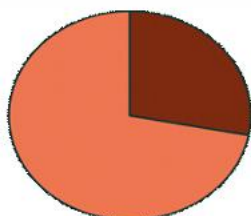
Results

Table 1 : Q6. Frequency and percentage of participants trained for TCC

Group Frequency Percent

1	70	28.0
2	180	72.0

Total 250 100.0



Group 1 ■ Group 2 ■

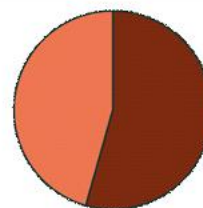
The pie chart shows the frequency and percentage of participants who have received training for TCC. (28%) of the dental professionals belong to Group 1, Trained for TCC in terms of questions to be asked & giving guidance to the addict indicating a fair level of training among the participants.

Graph 1 showing Only 28% candidates were trained for TCC ;

Table 2: Q8. Frequency and percentage of participants who know about various agents used as NRT.

Group Frequency Percent

1	136	54.0
2	114	46.0
Total	250	100.0



Group 1 ■ Group 2 ■

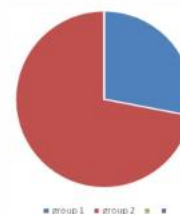
The pie chart shows the frequency and percentage of participants who know about various nicotine replacement therapy (NRT) agents. Over half (54%) of the dental professionals belong to Group 1 who were aware of NRT agents – Nicotex chewing gums

Graph 2 showing 54% of the dental professionals were aware of NRT agents ;

Table 3: Q13. Frequency and percentage of participants who know about the drugs used for tobacco de-addiction

Group Frequency Percent

1	71	28.0
2	179	72.0
Total	250	100.0



The pie chart shows the frequency and percentage of participants who Know About De-addiction Drugs- Bupropion, Varenicline. 28% of the dental professionals belong to Group 1 who knew about the drugs used for Tobacco de-addiction.

Graph 3 showing 28% knew about the drugs used for Tobacco de-addiction.

Table 4:Q20. Frequency and percentage of participants who think it is their responsibility to counsel the patients.

Group	Frequency	Percent
1	250	100
2	00	
Total	250	100.0

Graph 4 showing All candidates felt that it is their responsibility to counsel the patients for de-addiction;

Table 5 : Q22. Frequency and percentage of participants who think that such counselling in dentistry may upset the dentist-patient relationship.

Group	Frequency	Percent
1	224	90.0
2	26	10.0
Total	250	100.0

Graph 4 showing All candidates felt that it is their responsibility to counsel the patients for de-addiction;

Table 5:Q22. Frequency and percentage of participants who think that such counselling in dentistry may upset the dentist-patient relationship.

Group	Frequency	Percent
1	224	90.0
2	26	10.0
Total	250	100.0



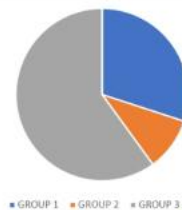
The pie chart shows the frequency and percentage of participants who felt that such anti-tobacco counselling might upset doctor-patient relationship in a private set-up. 90% of the dental professionals belong to Group 1 who felt that such anti-tobacco counselling might upset doctor-patient relationship in a private set-up. 10% of the dental professionals belong to Group 2 who felt that such anti-tobacco counselling might upset doctor-patient relationship in a private set-up.

Graph 5 showing 90% felt that such anti-tobacco counselling might upset doctor-patient relationship in a private set-up .

Table 6:Q26. Frequency and percentage of participants who practise TCC at workplace in terms of counselling/NRT/drug prescription

Group	Frequency	Percent
1 Practice TCC	75	30.0
2, because of lack of resources	00	
2, because of lack of time	00	
2, TCC doesn't help	2510	

2, because of lack of knowledge and training for TCC and NRT	150	60
	100	40
Total	250	100.0

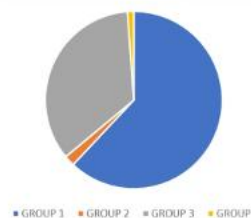


The pie chart shows the frequency and percentage of participants who practice tobacco cessation counseling, nicotine replacement therapy, or drug prescriptions to their patients at the workplace. 30% of the dental professionals belong to Group 1 who practice tobacco cessation counseling, nicotine replacement therapy. While group 2 (10%) felt that, TCC doesn't help. Whereas group 3 (60%) do not practice TCC because of lack of knowledge and training for TCC and NRT.

Graph 6 showing 30% of dental professionals who practice tobacco cessation counseling, nicotine replacement therapy, or drug prescriptions to their patients at the workplace.

Table 7: Q29. what challenges are faced by patient in quitting tobacco?

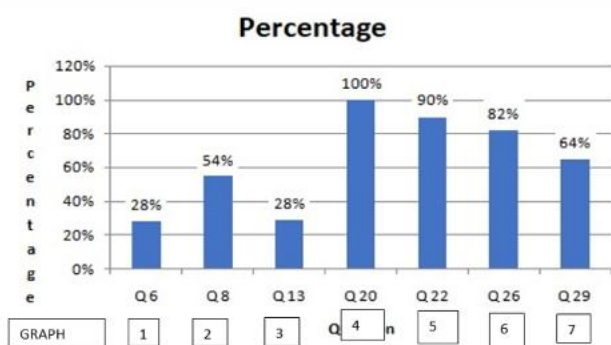
Group	Frequency	Percent
1 Craving	161	64.0
2, Weight gain	42	
2, Stress management	65	36
2, Social situations	198	
Total	250	100.0



The pie chart shows the frequency and percentage of participants (64%) who faced challenges like craving in quitting tobacco when asked by dental professionals. 64% of the patients belong to Group 1 who faced challenges like craving. While group 2 (2%) patients felt that challenges like Weight gain are faced by patient in quitting tobacco whereas group 3 (36%) required stress management techniques. And group 4 (8%) patients felt that challenges like Social situations affect in quitting tobacco.

Graph 7 showing 64% challenges like craving are faced by patients in quitting tobacco when asked by dental professionals.

Discussion



Dental professionals role in TCC is that they can easily recognize patient's tobacco status owing to the oral implications such as staining, habit-related lesions like leukoplakia, oral cancer; can effectively manage tobacco dependence and provide counselling & support to patients.

Tobacco cessation is a multidisciplinary approach. There are 5 major steps (the "5 As") Ask, Advise, Assess, Assist and Arrange in tobacco cessation services. It is important for the dental practitioner to "Ask" the patient if he or she uses tobacco, "Advise" him or her to quit, "Assess" willingness to make a quit attempt, "Assist" the patient in making a quit attempt, and "Arrange" for follow-up contacts to prevent relapse. and the 5 Rs are Relevance, Risk, Rewards, Repetitions and Roadblocks.

Acc. To study by Shete AV et al (2023) only (22%) candidates were trained for TCC, whereas we found 28% participants trained for TCC.

Acc. To study by Shete AV et al (2023), 71 clinicians out of 200 (35.5%) knew how to prescribe NRT; the other 129 clinicians (64.5%) had no clue about it. Almost similarly in our study 36% knew to prescribe NRT, although 56% were not aware of NRT.

Conclusion and Key Points

Majority of oral physicians are actively participating in recording the patient habit and counselling by means of warning and advising to quit the habit. There is limited stress on pharmacological and behavioural interventions and referral in case of high dependence and limited additional training regarding cessation. Thus, there is a need for alteration in the curriculum, More Certification courses by government of India are needed to be implemented in BDS Postgraduate course and more CDE programs to enhance the knowledge and effective role in tobacco cessation.

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Dental Home - A Paradigm Shift In Paediatric Oral Health Care Article

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Received on: 17 March 2025; Accepted on: 26 March 2025; Published on : 19 April 2025

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Abstract

The concept of a Dental Home is modelled after the Medical Home and is aimed at providing children with a comprehensive, prevention-based, and family-centered approach to oral healthcare. Established by the American Academy of Pediatric Dentistry (AAPD), the Dental Home is envisioned as an accessible and continuous source of oral care that fosters early intervention, reduces healthcare costs, and enhances long-term oral health outcomes. This article explores the history, benefits, challenges, and strategies for implementing the Dental Home in developing countries, particularly in India, emphasizing its potential to improve oral health care accessibility and disease prevention.

Keywords - American Academy of Pediatric Dentistry, anticipatory guidance, dental home

Introduction

Home is the one place in this entire world where hearts are sure of each other. It is the place of confidence. It is the place where we tear off that mask of guarded and suspicious coldness which the world forces us to wear in self-defence, and where we pour out the unreserved communications of full and confiding hearts. It is the spot where expressions of tenderness gush out without any sensation of awkwardness and without any dread of ridicule. - Frederick W Robertson^[1].

The dental home is the ongoing relationship between the dentist and the patient, inclusive of all aspects of oral health care delivered in a comprehensive, continuously accessible, coordinated, and family-centered way. Establishment of a dental home begins no later than 12 months of age and includes referral to dental specialists when appropriate. - American Academy of Pediatric Dentistry (AAPD), 2004^[2].

Concept of Medical Home

A Medical Home is defined as an approach to providing comprehensive primary care that facilitates partnerships between individual patients, their families, and healthcare providers. The American Academy of Pediatrics (AAP) supports the notion that an ideal medical home should be accessible, continuous, comprehensive, family-centered, coordinated, and compassionate^[3].

The Medical Home model provides essential services such as:

- Preventive care, including immunization, growth and development assessment.
- Round-the-clock provision of ambulatory and inpatient services.
- Coordination of subspecialty consultation and continuity of care.

This model forms the basis for the Dental Home, extending these principles to oral healthcare.

History and Evolution of Dental Home

- The term Dental Home was first described in 1999 by Nowak, highlighting the importance of early and continuous preventive oral health supervision^[4].
- The Access to Baby and Child Dentistry (ABCD) Program demonstrated that early association with a dentist leads to an increase in preventive services and a reduction in treatment costs^[5].
- Research by Grembowski and Milgrom showed that children with a Dental Home had better-managed oral health and fewer invasive procedures^[6].

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<https://doi.org/10.5281/zenodo.15245371>

How to cite this article : Malhotra et al. - Heal Talk A Journal of Clinical Dentistry. (2025). Dental Home - A Paradigm Shift In Paediatric Oral Health Care Article. In Heal Talk A Journal of Clinical Dentistry (Vol. 17, Number 4, pp. 08-10). Zenodo. <https://doi.org/10.5281/zenodo.15245371>

Need for the Dental Home Concept^[7-8]

The Dental Home is crucial due to:

1. The advent of social medicine in pediatric healthcare, emphasizing disease prevention.
2. Expanding knowledge of pediatric oral health risks and disease management.
3. Trends in oral health disparities, particularly among children from lower socioeconomic backgrounds and those with special healthcare needs.
4. Perceived barriers to dental care, including financial limitations, accessibility issues, and lack of awareness.
5. Recognition of dentistry as an independent health profession, advocating for early intervention.
6. Dental capacity system for all children, ensuring care for those with special dental care needs.

Core Principles of the Dental Home^[9]

A well-established Dental Home is characterized by the following:

1. **Accessibility** : Located within the community, accepting all insurance, and minimizing financial barriers.
2. **Family-Centered Approach** : Educating parents and caregivers about oral health.
3. **Continuous Care** : Providing treatment from infancy through adolescence.
4. **Comprehensive Services** : Encompassing preventive, primary, and specialized care.
5. **Coordination of Care** : Linking families with support services, specialists, and public health programs.
6. **Compassionate and Culturally Competent Care** : Respecting diversity and addressing individual healthcare needs.



Evidence-Based Benefits of a Dental Home

Economic Benefits

- A 2004 study in Pediatrics demonstrated that children receiving dental care before age 1 had lower treatment costs than those who had their first dental visit at ages 4–5^[10].
- Medicaid-enrolled children who had an early preventive dental visit were more likely to use subsequent preventive services and experience lower dental costs^[11].
- Clinical Benefits^[9]

- Regular preventive visits lead to better-managed oral health, fewer caries, and lower risk of periodontal disease.
- Anticipatory guidance and risk-based prevention strategies provide long-term benefits.

The Dental Home in the Indian Context

India's healthcare infrastructure requires adaptations to implement the Dental Home concept effectively. Strategies include:

- Establishing Preventive Dentistry Clinics within Primary Health Centers (PHCs).
- Training Community Health Workers (CHWs), Anganwadi Workers, and ASHAs to educate caregivers on oral hygiene.
- Integrating oral health with government initiatives such as the National Health Mission (NHM) and Rashtriya Bal Swasthya Karyakram (RBSK).
- School-Based Dental Care Programs to improve access to routine check-ups.
- Use of Telemedicine and Mobile Dental Clinics to reach remote areas.

Challenges in Establishing a Dental Home^[12]

Despite its benefits, implementing the Dental Home model faces several challenges:

1. Lack of trained dentists willing to treat young children.
2. Financial constraints and inadequate insurance coverage.
3. Transportation and accessibility issues in rural areas.
4. Parental ignorance about pediatric oral health.
5. Limited availability of pediatric dental services in low-resource settings.

Conclusion

The Dental Home concept is a transformative approach to pediatric oral health. Its implementation ensures early preventive care, better health outcomes, and reduced treatment costs. In India and other developing countries, government policies, public-private partnerships, and community-based programs are essential to make the Dental Home a reality. By adopting a multi-level strategy, involving screening, education, and preventive care, oral health disparities can be significantly reduced.

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A Review of Modern Obturation Techniques

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Received on: 06 March 2025; Accepted on: 21 March 2025; Published on : 19 April 2025

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Abstract

A key theme in the root canal treatment procedure is the proper obturation of the root canal system. Obtaining a hermetic seal is essential for a successful endodontic procedure. The best obturating material for most applications is gutta percha with sealer. However, a major disadvantage is its inability to bond with the root canal dentin. Materials made of bonded resin were created to address this problem. Conventionally, the two fundamental techniques that have been in use for obturation are the lateral condensation and warm vertical compaction techniques. The science and practice of root canal therapy have undergone significant change in the last ten years due to the development of highly improved obturation materials and techniques based on evidence-based protocols. Numerous materials and techniques were created to improvise the root canal obturation. They consist of compaction, injection, heat, vibration, and carrier-based methods. The carrier-based technique using Therafil is the most promising among the recently improvised techniques.

Introduction

The three-dimensional obturation of the endodontic spaces after they have been thoroughly cleaned, shaped, and disinfected is the ultimate clinical goal of root canal therapy. Obturation, as described by the American Association of Endodontists in 1994, is the process of filling the complete root canal system in three dimensions as near to the cementodentinal junction as feasible.^[1] The primary root canals and all "portals of exit" are sealed during obturation in order to prevent any further exchange of information between the endodontium and periodontium. Therefore, the root canal space must be entirely and permanently filled with the filling in order for there to be no open gaps. It has been demonstrated that inadequate root canal obturation is linked to a number of endodontic failures. The clinician should strive to achieve optimal debridement and shaping of the root canals for effective treatment outcomes. This should be performed using an obturation technique that establishes a three-dimensional seal at the apical, lateral, and coronal levels within the root canal system. Endodontic obturation has advanced to the point where we now understand that the sealer is indispensable for achieving a hermetic seal. Identifying a

sealer that can bond effectively with both the gutta-percha or a comparable core material and the canal wall at the same time has been the challenging aspect. Only if that is achieved we can create a true monobloc.

The preferred obturation method in the past has been the gutta percha point mixed with the sealer. Although gutta percha has a long history of use and is versatile, one disadvantage is that it does not adhere to root canals. Using heat or gutta percha that has been chemically softened, injectable methods, ultrasonics, vibration, and carriers are some of the methods used to obturate root canals. There are materials that use a core carrier around which coating material is wrapped called carrier-based materials. With the introduction of bonded obturation materials, such as methacrylate resins, Clinicians are now able to create an adhesive seal to the root canal dentin even in areas where etching and adhesive agents have not fully penetrated. Additionally, a carrier-based solution for bonded obturation is now accessible and combines a carrier technique with adhesive

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<https://doi.org/10.5281/zenodo.15245412>

How to cite this article : Sulaiman et al. - Heal Talk A Journal of Clinical Dentistry. (2025). A Review of Modern Obturation Techniques. In Heal Talk A Journal of Clinical Dentistry (Vol. 17, Number 4, pp. 11-16). Zenodo. <https://doi.org/10.5281/zenodo.15245412>

technology.^[2]

History

Prior to 1800, gold was the sole material utilized for root canal fillings. Subsequently, other materials including other metals, zinc oxychloride, paraffin, and amalgam came into use, each with a different degree of success and patient satisfaction. In 1847, Hill developed "Hill's stopping," the first root canal filling material made from gutta-percha^[7]. By 1848, its solution based on mostly bleached GP, quartz and carbonate of lime was available commercially for dental application. Bowman in 1867 reported filling an extracted molar with gutta-percha, as presented in History of Dentistry in Missouri (1938)^[7]. In 1883, Perry made a report about the use of a pointed wire of gold wrapped in soft gutta-percha for obturation^[7]. SS White started producing gutta-percha points in 1887^[7]. Rollins presented a new type of gutta-percha in 1893, containing vermilion. Callahan introduced the employment of rosins by 1914 to dissolve and soften gutta-percha, which would act as a cementing agent^[7]

Rationale of Obturation

The prevention of microorganisms from reaching the periradicular tissues from the oral cavity by ensuring a tight seal is the ultimate goal of obturation. Although it is impossible to achieve a completely impervious or leak-proof seal in practise, every possible measure should be taken to achieve this. A well-protected system's establishment would fulfil three purposes in particular.

- Prevent the entry of microorganisms or substances that could enhance the microbial proliferation into the vacant spaces of the root canal network through coronal leakage.
- Block periodontal or periapical fluids from seeping into the endodontic canal system, which could otherwise sustain bacterial growth.
- Seal off any remaining bacteria to inhibit their survival and potential pathogenic effects following the cleaning and shaping stages of treatment.^[1]

The question of single or multiple visit treatment is brought up by the timing of obturation. Only after thorough chemical and mechanical cleansing of the endodontic canal network may obturation be performed.^[9] If the canal is completely dry and time allows, obturation in the same appointment is recommended. However, if dryness cannot be achieved due to the presence of blood or exudate, placing an inter-appointment dressing is the preferred approach to protect the tooth. While EDTA has been proposed for smear layer removal during canal cleaning, there is no definitive evidence supporting its routine use in endodontic treatment procedure. Nevertheless, it has been demonstrated that its usage in retreatment instances improves the course of treatment.^[12]

Research has demonstrated that root canals lacking an adequate coronal seal are prone to leakage soon after treatment, regardless of the quality of obturation.^[13] This highlights the importance of establishing a proper coronal seal promptly to minimize the risk of coronal leakage. It is well established that therapeutic results can be strongly impacted by the integrity of this seal,^[14] with improved healing rates being demonstrated in teeth with adequate restorations. Cuspal covering restorations are

advised for posterior teeth that have lost their marginal ridges because they increase the likelihood that the tooth will survive by preventing fracture.^[15] To further reduce coronal leakage, the installation of a foundational seal below the core has been advocated.^[16,17] In multi-rooted teeth, the pulp chamber floor and canal orifices should be covered with this sub-seal material.^[16] For this purpose, a number of materials have been suggested, including glass ionomer cement and intermediate restorative material (intermediate restorative material [Dentsply Caulk, Milford, USA]) reinforced with polymethylmethacrylate.

Obturation Techniques

Endodontic obturation can be performed using a variety of procedures. It is crucial to explore different techniques since they each have unique purposes and can produce superior clinical results.

1. Cold lateral compaction

This technique involves pressing gutta-percha cones against the canal walls to ensure complete filling. Its effectiveness is largely due to its simplicity, affordability, and the absence of a need for specialized equipment.^[18] However, some drawbacks include the potential for void formation, inadequate adaptation of the filling material to the canal walls, and incomplete coverage in difficult-to-access areas of the root canal system.^[19]

The procedure requires selecting a master cone that should be positioned roughly 0.5 mm short of the determined working length and is usually one size larger than the master apical file. If the cone does not fit securely at the working length, a larger size should be chosen, or the tip should be trimmed by 1 mm and adjusted for a better fit.^[20] In cold lateral compaction, the master point should exhibit a slight-tug-back and be marginally shorter than the working length.^[21] Once the master point is properly positioned and shows slight resistance to removal, accessory points are added and compacted laterally using a spreader until the canal is completely sealed.^[22]

Variations of lateral compaction techniques are used in cases of curved canals and blunderbuss canals. NiTi spreaders are utilized in curved canals while thermoplasticized gutta percha technology is suited for severely bent canals like dilacerated canals. In blunderbuss canals apexification should be done due to their distinguishable flared out canals. heated gutta percha technique or custom gutta-percha/tailor-made gutta percha are favoured for full obturation of such canals.

Technique for making tailor-made gutta percha: Multiple gutta-percha cones are aligned end-to-end to form a roll, which is then softened using ethyl chloride spray. The outside of the custom-made cone is coated with chloroform, eucalyptus oil, or halothane before being used in the canal.^[23]

2. Warm Lateral Compaction

A simple modification to the cold lateral compaction method includes introducing heat to the gutta-percha. Heating the material makes it more adaptable, allowing for improved condensation and a denser root filling. However, traditional finger spreaders are not efficient at retaining heat for this approach. Instead, specialized heat carriers should be used. These tools are equipped with a blunt plugger tip, which facilitates controlled vertical

compaction of the softened gutta-percha, while the sharp tip facilitates lateral compaction. There are other spreaders that can be heated electrically. It's crucial that the instruments are warmed up very slowly. If the spreader overheats, it may soften the gutta-percha, causing it to get stuck to the instrument and possibly be pulled out of the canal.^[22] The benefits of using this procedure include greater root canal complexity adaption, a decreased risk of void development, and the production of a dense filler.^[24,25]

3. Single Gutta-percha Cone with Sealer

Gutta-percha points with a corresponding taper may be chosen when preparation methods with a greater taper are preferred. Clinicians utilize a single gutta-percha point along with a sealer, as these components provide an optimal fit for the prepared canal. This method's simplicity is its only benefit. The main concern is that most sealers exhibit some degree of solubility. The sealer may eventually be dissolved by tissue fluids because the canal won't be completely filled in three dimensions.^[26] However, in complex anatomical situations, a specially fitting cone can be essential. A slightly bigger cone is chosen, and its apical portion is softened by placing it in hot water or applying solvents like chloroform, rectified turpentine, or eucalyptus oil. The softened cone is then carefully guided to the working length with gentle pressure. After ensuring proper placement, it is marked for orientation, and the process is repeated until the fit is optimal. Once the cone is free from any solvent residues, the canal can be filled using sealer in the standard manner.^[27]

4. The matic Compaction of Gutta-percha

A motorized compactor, essentially a reverse-configured H file, was created by McSpadden in 1979. Gutta-percha becomes plasticized by the compactor's frictional heat, and under pressure, the softened gutta percha is directed into the root canal. A key challenge was maintaining control over the gutta-percha's apical portion, as when softened it could be forced out beyond the apex. To overcome this issue, Tagger introduced a modification to the technique by suggesting the lateral condensation of a master cone along with two or three accessory cones before plasticizing the coronal gutta-percha using a condenser. Extrusion is effectively prevented by sealing the apical portion with lateral compaction of gutta percha.^[28]

5. Vertical Compaction of Warm Gutta-percha

This technique is currently regarded as the gold standard for endodontic obturation. The vertical compaction of warm gutta-percha granules was introduced in 1967 by Schilder. In conditions like C-shaped canals, internal resorption, and canals with webs or fins, it is especially helpful. Although it produced good results, the procedure was time-consuming and challenging to perfect.^[29] The Buchanan technique, which utilizes the System-B heat source to deliver controlled heat to the plugger tip, is widely used today. A non-standard gutta-percha cone is precisely adapted to the canal. A plugger is used to apply a continuous wave of heat to soften and compact the gutta-percha, ensuring a well-condensed filling of the canal in the apical portion. Additional increments may be used to obturate the remaining canal.^[30]

6. Thermoplasticized Injection Techniques

Thermoplasticized injection techniques involve utilizing specialized devices through which heated gutta-percha is compacted into the prepared canal enhancing material adaptability to complex canal anatomies. The commonly used systems include Calamus, Elements, Obtura III, HotShot & Ultrafil 3D.

Obtura III

This technique utilizes a gun with a heating compartment, warming GP upto 160–200 degree celisus. The heated material is injected via a needle (20, 23, or 25-gauge) placed 3-5 mm shy of the working length. Gradual needle withdrawal ensures precise apical filling, which is compacted using pluggers. Incremental filling is employed to achieve optimal sealing.

Limitations: Control over the filling length is challenging, potentially resulting in overextended or underfilled canals. Studies indicate that Obtura II demonstrates better canal wall adaptation compared to other methods.

Ultrafil 3D

The Ultrafil 3D system (Coltène/Whaledent) comprises an injection syringe, a heating unit and 22-gauge stainless steel cannulas. The gutta-percha remains flowable for approximately 45–60 seconds, allowing adequate canal filling.

Calamus

The Calamus system (Dentsply Tulsa Dental Specialties) uses temperature-regulated cartridges with 20 and 23-G needles. Its precise temperature regulation and adjustable flow rates enhance gutta-percha delivery, with specialized pluggers assisting in material compaction.

Elements

The Elements obturation system (SybronEndo) features a handpiece for delivering plasticized gutta-percha, System B heat source, and pluggers. It supports various needle gauges (20, 23, and 25), while Real Seal cartridges utilize 20 and 23-gauge needles for effective obturation.

HotShot

The wireless HotShot system (Discus Dental) is an adaptable tool designed for use with both resilon and gutta-percha. Operating within a temperature range of 150–230°C, it offers needle sizes of 20, 23, and 25-gauge for diverse clinical scenarios.

GuttaFlow

GuttaFlow (Coltène/Whaledent) is a polydimethylsiloxane-based matrix integrated with gutta-percha. It is provided in capsules, offering around 15 minutes working time and setting within 25–30 minutes. While it demonstrates adequate sealing capabilities in some studies, others report inconsistent performance.^[31,33]

7. Coronal back-filling

The terminal 5-7 mm of the root canal can be successfully sealed off using the System-B previously mentioned. The canal is wide enough at that part to accommodate the needle tip of the Obtura. The canal wall is covered with a sealant film. The device is heated to 200°C. To warm the needle, a tiny portion of the heated GP is forced out and then discarded. The needle is swiftly inserted into the canal after that. A void between the two

components of the filling could develop if this part of the protocol is not followed. Once the trigger is activated, the needle is carefully withdrawn while the thermoplasticized GP is dispensed in the root canal. After filling the canal, gutta-percha can be compacted using standard pluggers before being sealed as usual with glass ionomer.^[33]

8. Carrier-based

A carrier coated with GP is used in carrier-based procedures. The carriers were once constructed of stainless steel and titanium. Thermafil, however, is now solely made of plastic Thermafil. A recently developed carrier-based system known as Gutta Core features a crosslinked gutta-percha core. The benefit of this cross-linked GP carrier is that it may be more readily removed in cases of retreatment or post and core. For each of these, the method is the same. The appropriate carrier size is selected using a verifier. It is subsequently warmed for a predetermined period in a specially designed oven to render the outer layer of gutta-percha more pliable. Once heated, the carrier is carefully positioned at the working length within the sealant-coated canal. The coronal GP is then compressed vertically once the carrier's handle has been removed. There are carriers that are compatible with systems like Protaper, Reciproc, Wave one, etc. Although this method saves time, there might be issues with length control and post-operative discomfort.^[34]

9. Continuous Wave Compaction

Interrupted wave compaction and continuous wave compaction techniques are modifications of the warm vertical compaction technique.

The Continuous Wave Compaction Technique

Downpack

- Whether standardized or non-standardized, the master cone should be placed approximately 0.5 mm short of working length until a “tug-back” sensation is achieved. It is essential to maintain canal moisture during this process to promote irrigant movement. This can be facilitated by gently inserting and withdrawing the cone to improve irrigant circulation.
- A System B plugger should be gently inserted into the shaped canal until it slightly binds at a distance of approximately 5 to 7 mm from the working length. Once in place, the position is made by applying a silicone stop.
- Apply a thin layer of sealant to the master cone before applying it to the walls of the root canals. The master cone is then placed.
- The System B heat source should be set to 200°C with a power level of 10 for optimal use. The most user-friendly option is the touch mode.
- Guide the heated plugger steadily through the gutta-percha, stopping 5 to 7 mm short of the working length within three seconds before activating the touch spring.
- Apply consistent apical pressure for a continuous ten-second duration to counteract any shrinkage that may take place as the gutta-percha's apical portion cools.

- The contact spring is again pressed for one full second to ensure proper activation.
- While keeping apical pressure. The plugger was rapidly withdrawn after releasing the switch and pausing for one full second. The excess coronal component of GP should be eliminated as a result.
- After removing the System B plugger, gutta-percha is compacted in the apical region using a (Machtou) or a Buchanan plugger. Any excess material adhering to the walls of the root canal should be collected and condensed onto the apical mass.^[35]

The down-pack process is executed in multiple stages rather than a single continuous motion in this technique. While it closely resembles the continuous wave method, it incorporates incremental compaction steps for more controlled obturation. Wider canals are advised for this method.

10. Apical Barrier

The preferred choice of material for apical fillings in cases of immature or blunderbuss apices, an appropriate material should be carefully placed and compacted to establish an apical barrier is now calcium silicates. If used properly, these characteristics make them ideal for preventing extrusion. The majority of calcium silicate cements are liquidized powders that must be blended to the desired consistency. The placement of these materials can be aided by a variety of specialized tools, For both orthograde and retrograde applications, systems like the MAP system (Produits Dentaires, Vevey, Switzerland) allow precise material placement at the intended location.^[36] Adding a first dose of calcium hydroxide dressing might provide positive effects in post-procedure using this approach.^[37] When used for obturating a wide root canal or repairing a perforation, calcium silicate cement should be carefully delivered at the designated depth. Unlike conventional materials, it should not be densely compacted but rather gently positioned using a plugger or a broad, flat-ended paper point. This material helps absorb excess moisture within the canal. Additionally, due to the spongy nature of the periradicular tissues, there is no natural resistance form to pack against, necessitating careful placement to ensure an optimal seal. This cement helps absorb excess moisture within the canal. Due to the soft nature of periradicular tissues, which do not provide resistance for compaction, careful placement is crucial. An ideal apical fill should measure 6 mm. For retrograde use, the material can be applied with a carrier or shaped on a Lee block, which forms a thin column that can be easily transferred with an appropriate instrument and accurately positioned in the prepared cavity.^[36]

11. The Hot Modified Obturation Technique

The hot modified obturation technique is a novel approach aimed at enhancing the penetration of bioceramic sealers within the root canal system. Unlike traditional methods, this technique facilitates deeper penetration into lateral canals and dentinal tubules without compromising the properties of the biosealer.

The process begins by positioning the biosealer and gutta-percha cone within the canal, followed by a rapid down-packing procedure at 180°C, maintaining a depth of 6 mm from the working length. This controlled heating ensures the biosealer remains

intact, enabling improved adaptation and sealing of intricate canal structures. Compared to conventional single cone techniques, the hot modified technique demonstrates superior sealing efficiency and filling of complex anatomies, thereby enhancing the potential for greater clinical success.^[38]

Conclusion

Effective obturation is a fundamental step in endodontic therapy, ensuring the sustained effectiveness of root canal therapy. By achieving a three-dimensional seal, obturation prevents microbial invasion, entombs residual bacteria, and protects periradicular tissues from reinfection. Over time, various materials and techniques have been developed to optimize this process, ranging from traditional cold lateral compaction to modern thermoplasticized injection techniques and carrier-based systems.^[39]

Although gutta-percha still remains the most commonly used obturation material, advancements in adhesive sealers and calcium silicate-based materials have improved bonding and biocompatibility. The selection of an obturation technique should depend on the complexity of the endodontic canal network, the clinician's expertise, and the need for long-term clinical success. Moreover, ensuring an adequate coronal seal is just as critical as the obturation itself to prevent reinfection.^[40]

Future innovations in endodontic materials and techniques will likely focus on improving adaptability, durability, and antibacterial properties to enhance treatment outcomes further. Continuous research and clinical advancements will continue to refine obturation strategies, leading to more predictable and successful endodontic therapy.

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Deep Caries Management

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Received on: 06 March 2025; Accepted on: 21 March 2025; Published on : 19 April 2025

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Abstract

Worldwide, the prevalence of dental caries is still significant. When dental caries is not treated, it can extend into the dentin, causing inflammation, infection, and eventual pulp damage. However, conservative treatment approaches can promote pulpal healing, even in cases of extensive decay. Caries can be managed by diet modification which leads to change in the biofilm preventing the nutrient supply of the tooth. This way caries can be controlled by partial excavation without much damage to tooth structure. Effective management of deep caries relies on evidence-based treatment strategies and proper education on managing pulp exposure. Maintaining a healthy pulp is essential for the long-term stability of the tooth, as it supports natural defense mechanisms. Contemporary conservative dentistry prioritizes pulp preservation using minimally invasive approaches.

Definitions

Deep Caries

Caries reaching the inner quarter of the dentin, yet separated from the pulp by a layer of firm or hard dentin, can be identified on radiographs, especially on interproximal or occlusal surfaces. Recognizing this distinction is crucial for determining appropriate treatment strategies that prioritize pulp preservation while controlling disease progression.. During the surgical treatment, pulp exposure is a possibility.¹

Deeply Seated Caries

Dentine-thickening caries is radiographically visible when they are present on an occlusal or interproximal surface. The exposure of the pulp during surgery cannot be avoided.¹

Affected Dentin

Firm & leathery in texture. Strength are determined by the balance of mineral content and collagen, which play a crucial role in its structural composition.. Can be scraped off with more pressure. Does not contain microorganisms. Can be mineralized

Infected Dentin

It is soft in consistency due to a lack of minerals & collagen. Can be scraped off with gentle pressure. Contains microorganisms. They cannot be remineralized. It should be completely removed in cavity preparation.

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<https://doi.org/10.5281/zenodo.15245445>

Introduction

Dental caries is the microbiological destruction the hard structure of the tooth weakens over time due to mineral loss, resulting in demineralization and increased susceptibility to damage. localized portion tooth due to various factors like dietary carbohydrates, dental plaque, and cariogenic bacteria. Because Concerns about the invasive nature of traditional dental treatments, along with the risks of overtreatment and the repetitive cycle of restorations, have led to the adoption of minimally invasive, biologically based treatment

approaches². As a result, the management of deep caries has transitioned from complete removal of decayed tissue to selective removal, reducing the likelihood of pulp exposure³. Extensive carious lesions are classified into two radiographic categories: deep and extremely deep. This classification helps assess the risk of pulp exposure and may also

How to cite this article : Singh et al. - Heal Talk A Journal of Clinical Dentistry. (2025). Deep Caries Management. In Heal Talk A Journal of Clinical Dentistry (Vol. 17, Number 4, pp. 17-22). Zenodo. <https://doi.org/10.5281/zenodo.15245445>

indicate the point at which pulp inflammation becomes more severe and potentially irreversible⁴. Effective caries management focuses on eliminating microbial irritation and preventing further bacterial infiltration by using advanced dental biomaterials that shield exposed dentin and pulp from external factors..

Aetiology

The dental biofilm consists of both commensal as well as non-invasive microorganisms. According to the ecological plaque hypothesis, frequent carbohydrate consumption disrupts the microbial balance, allowing acidogenic and aciduric species to thrive, leading to caries⁵. Streptococci, Lactobacilli, and Bifidobacteria initiate the demineralization of the tooth surface. As carious lesions progress, the microbial composition becomes more diverse, with increased levels of *Streptococcus mutans* and *Lactobacillus* species. Additionally, other bacterial taxa, including novel *Prevotella* species, *Selenomonas* species, *Eubacterium* species, and *Fusobacterium* species, have also been identified in advanced lesions⁶.

Response of Tooth To Caries

The dental-pulp complex responds to irritation through a process that involves both inflammation and mineralization, maintaining a delicate balance between tissue damage and repair to preserve pulp vitality⁷. When caries develop, bacterial acids, lipopolysaccharides (LPS), and metabolic byproducts from plaque penetrate toward the pulp, moving against the natural flow of pulpal fluids. This triggers an increase in odontoblast activity, leading to the formation of tertiary dentin as a protective response⁸. The outermost layer of exposed dentin undergoes degradation due to acid activity and bacterial enzymes, causing demineralization within the zone of sclerosis².

Diagnosis

A thorough patient history, detailed examination of the affected tooth, and additional diagnostic tests, such as radiographic assessment for clinical decision-making to be effective, caries depth and clinical indicators such as symptoms, progression rate, and color sensitivity tests are crucial⁹. Radiographs should clearly display the entire tooth, including at least 3 mm of apical tissue beyond the root tip, without any interproximal overlap, distortion, or processing errors. The depth of a carious lesion can be estimated using bitewing radiographs, while CBCT provides a more precise diagnosis of lesions¹⁰.

How To Detect Carious Dentin

Dentin hardness is regarded by many general dentists as the most crucial factor in caries excavation because it contains minerals or collagen. Infected dentin is soft and its texture is comparable to cottage cheese due to the presence of collagen network & minerals. Affected dentin is firmer than infected dentin. It could be described as having a leather-like consistency. Clinically, soft, discolored, and moist tissue can be used to identify the first active carious environment.

How to Manage Deep Caries Without Pulp Exposure

The removal of carious tissue can be carried out either in a single-step procedure¹¹ or through a stepwise two-stage approach¹², depending on the clinical condition of the tooth. These methods are typically considered when the tooth shows no

symptoms or presents with indications of reversible pulpitis.. Round burs and hand excavators are commonly used in less intrusive removal of carious tissue techniques¹¹. Methods for removing carious tissue in one or two stages appear to be an effective approach to reducing the risk of pulp exposure.¹³ Regardless of the selected carious tissue removal technique, it is essential to remove decay from the cavity's periphery until only hard dentine remains, ensuring optimal bonding and effective sealing from the oral environment. On the pulpal aspect, preserving soft or firm dentine may be beneficial in reducing the risk of pulp exposure. Further more, before the placement of a definitive resin-based composite restoration, a conventional glass-ionomer cement may be applied as a protective barrier over the dentine¹⁴.

Reparative Dentin Bridge Formation

The goal is to form a barrier of hard tissue protection. After the primary odontoblasts are lost as a result of direct pulp exposure, Defects in the pulp-dentin are corrected. by the formation of a hard tissue barrier formed by pulp-derived cells¹⁵ of which are induced by using appropriate biomaterial.

Balance Between Inflammation And Repair in the Dentine-pulp Tissue Complex

The DP complex depends on a delicate equilibrium between repair and inflammation to sustain its health. When irritants are eliminated and an appropriate restoration is placed, the pulp has the ability to recover and maintain function. However, if inflammation dominates, leading to ongoing caries progression, the protective dentine structure weakens, allowing deeper bacterial infiltration. As decay advances into the tertiary dentine layer, the pulp undergoes increasing levels of inflammation, which may escalate to localized infection and tissue breakdown, ultimately leading to pulpal necrosis if left untreated.⁴⁵

What to be Done When the Caries is Approaching the Pulp or There has been Pulp Exposure

Treatment options include procedures like indirect & direct pulp capping.

Procedure for pulp capping: Preventing external irritation of exposed tissue is the main goal of pulp capping, mostly caused by bacteria.

History of Pulp Capping

In the 1990s, dental adhesive materials used in direct pulp caps initially produced positive results¹⁶; however, after a few months, the marginal bond deteriorated and was then invaded by bacteria, causing pulpal inflammation or necrosis. Resin-based adhesives were not widely recommended¹⁷, prompting the development of biologically driven materials aimed at supporting the formation of mineralized bridges¹⁸

Indirect pulp capping: The procedure of placing material on a delicate layer of carious dentin in immature permanent teeth that, if removed, may result in pulp exposure. is known as "indirect pulp capping."¹⁹ Although this method has been debatable for years, it now exhibits remarkable success in non-symptomatic teeth without radiographic signs of pathosis.²⁰ Indirect pulp capping is indicated When decay is near the pulp, or the remaining dentin thickness is below 0.5 mm. On the pulpal floor, when covered by only firm or soft dentin, caries excavation should be

done to place a biomaterial that acts as a dental barrier, followed by which a permanent restoration can be placed.¹

Two-stage: Soft carious dentine is excavated in the first stage such that there is enough space for proper placement of a temporary restoration. This method of selective caries removal requires two visits. Altering the cariogenic environment is the goal of the first stage, to the extent necessary for an effective temporary restoration to be placed., selected removal of decayed dentin. is carried out to carious dentine. The initial soft dentine turns into more hard & dark dentine with time. The second stage of caries removal is performed after a few months, allowing the remaining dentin to change in texture, making it easier to remove. During this period, a protective base, such as calcium hydroxide (Ca(OH)₂) or hydraulic calcium silicate cement, is applied to promote healing. The tooth is then restored using a glass-ionomer material to ensure proper sealing and protection..

Determining when the excavation should be terminated during the clinical procedure (one or two stages) is a significant challenge. The presence of voids beneath the restorative material during the remineralization process is an essential factor to evaluate. These voids may increase the risk of lesion reactivation, affect the stability of the restoration, and lead to additional complications.

Direct pulp capping: Direct pulp capping involves sealing an exposed pulp site with a biomaterial to promote the formation of reparative dentin and preserve pulp vitality¹⁹. This procedure is recommended in cases of pulp exposure caused by trauma, caries removal, or tooth preparation. Direct pulp capping, however, may not be the best option for pulp tissue that has experienced acute inflammation and has been exposed to oral microorganisms for a prolonged period of time.

Steps in Pulp Capping

1. In order to achieve favourable results for direct pulp capping, the careful removal of caries under dental dam isolation, with the aid of optical magnification and a caries detection dye, is crucial for effective treatment.²¹
2. Tissue haemostatic; The most widely accepted method to control haemorrhage of exposed pulps is by placing gentle pressure on the exposed area with cotton pellets dampened in saline or sterile water helps manage bleeding and safeguard the pulp. Laser and electrosurgical haemorrhage control have shown limited effectiveness²². However, NaOCl has been promoted since the late 1950s as a successful hemostatic agent for direct pulp capping and is an accepted antimicrobial irrigant used in orthograde endodontic therapy.²³ Several advantages of NaOCl solutions demonstrate its superiority over other agents. This agent aids in the chemical amputation of fibrin and blood clots, the removal of biofilm, the clearing of dentinal chips, cavity interface disinfection, The removal of compromised cells at the exposure site and effective hemorrhage control are crucial for successful pulp management²⁴. Sodium hypochlorite (NaOCl) solutions, with concentrations between 5.25% and 8.0%, primarily target surface pulp cells while preserving deeper tissue²⁵. To ensure proper bleeding control, NaOCl is applied for approximately 5 to 10 minutes.

3. Carefully place a thin layer of biomaterial over the exposed site using a small ball applicator or similar instrument. Use a dry cotton pellet to remove any excess moisture. Apply a minimal amount of flowable compomer, light-cured resin, or a glass-ionomer liner to cover the biomaterial. Apply 34% to 37% phosphoric acid gel to the remaining cavity walls for 15 seconds to enhance adhesion, then rinse thoroughly. Gently dry the cavity, ensuring the dentin stays slightly moist. Apply the bonding agent and cure it following the manufacturer's instructions. Complete the restoration with composite material and ensure proper curing. Regularly assess pulp responsiveness every six months and conduct radiographic evaluations every three to six months or as needed²¹.

The Final Restoration

If microleakage is reduced or eliminated, the pulp has the best chance of healing and surviving²⁶. To Ensure a reliable seal against microleakage for optimal long-term restoration success. the appropriate restorative material for each case must be carefully selected and the delivery executed with a high level of skill²¹. Conservative restorative treatment that best preserves Maintaining the intact tooth structure significantly improves the potential for pulp survival.¹²⁷

Materials used for Pulp Capping

For effective pulp capping, the material should have the following essential properties³¹:

- Encourage the development of reparative dentin
- Preserve the vitality of the pulp
- Release fluoride to reduce the risk of secondary caries
- Possess antibacterial properties to inhibit bacterial growth
- Form a secure bond with dentin
- Be compatible with restorative materials
- Withstand mechanical forces during placement and throughout the restoration's lifespan
- Maintain sterility to prevent contamination
- Be radiopaque for clear visibility in radiographic imaging
- Provide a strong barrier against bacterial penetration
- **Ca(OH)₂** : Recognized as the standard material for pulp capping²⁸, it promotes the natural formation of mineralized tissue. This process often leads to the development of porous osteodentin. However, when applied directly to the pulp, the resulting mineral barrier is irregular, does not bond effectively with the dentin walls, and fails to establish a complete seal.²⁹, Tunnel defects in the dentin,²⁹, lack of adequate sealing, time dependant dissolution and lack of antibacterial properties. Clinical trial that have been conducted over a period of time reveals that the success rates of calcium hydroxide which is commonly used as a pulp capping agent in carious exposures were unsuccessful, not reliable for the long term and uncertain.³⁰ After two years beneath the pulp capping material Ca(OH)₂ was found to have flaws in the reparative dentin formation.

- **Mineral Trioxide Aggregate:** MTA has been shown to stimulate the formation of mineralized tissue beneath exposed pulp and aids in the healing process. to preserve pulp vitality. MTA's biocompatibility and sealing ability are due to the material's dominant calcium ion, It interacts with phosphates in tissue fluid, leading to the formation of hydroxyapatite.³¹ The layer thus formed is a critical feature that helps to form a seal between MTA and the dentinal walls. Production of calcium silicate hydrate and calcium hydroxide is done by mixing water with Tricalcium & dicalcium silicate. The most significant disadvantage of MTA is its long duration of setting. (5 hrs)³² difficulty in handling the material, heavy metals in its composition leading to the discoloration of the material. Furthermore, Pulp capping procedures are made easier by using MTA as it shows less toxicity leading to reduced pulpal inflammation than Ca(OH)²³³. An analysis of clinical studies spanning 9-10 years suggested that MTA-treated pulp-capped teeth demonstrated favorable long-term results achieved 92.5-97.96% success.³⁴ According to recent research, MTA's performance was superior regarding the bond strength compared to that of composite or rinse adhesive.³⁵
- **Calcium Silicate-Based Cements (CSCs):** These advanced cements primarily consist of dicalcium and tricalcium silicate, components also present in MTA and Portland cement. Their hydraulic properties enable rapid strength development upon hydration. Research has demonstrated that these materials promote angiogenesis and regulate transcription factors²¹. Additionally, calcium silicate cements (CSCs) exhibit bio inductive capabilities that facilitate cell proliferation, differentiation, and the formation of hard tissue barriers, which are essential for pulp healing. Their minimal inflammatory response makes them highly suitable for pulp capping. Furthermore, with a setting time of approximately 10 minutes, CSCs provide an efficient solution for single-visit pulp capping and pulpotomy procedures³⁶.
- **Biodentine :** It has a fast set time of ten minutes and impressive properties that actively interact with biological tissues, supporting healing and tissue regeneration interact with biological tissues to promote healing and regeneration. useful for both indirect and direct pulp capping procedures. The cement has no effect on human fibroblast cytodifferentiation and has no genotoxic/According to the Ames mutagenicity test³⁷, the compound has been evaluated for potential cytotoxic effects. As a pulp capping agent, it is biocompatible with pulp tissue, aiding in the recruitment of odontoblast-like fibroblastic cells and supporting the development of a calcified barrier comparable to MTA.³⁸
- **Theracal LC :** It is Calcium silicate-based which can be light cured and used as DPC and IPC material, allowing immediate final restoration placement.³⁹ Calcium and hydroxide ions are released by TheraCal LC. The bioavailability of calcium ions released by TheraCal LC has been demonstrated to be in levels lower to biodentine in terms of stimulatory activity.⁴⁰ The presence of a resin matrix alters its setting mechanism resulting in decreased ability to

produce calcium.⁴¹ It showed greater performance when compared to Biodentine or MTA because of its sealing ability & reduced microleakage.⁴² When layered with composite or glass ionomer cement, TheraCal LC has higher bond strength values than Biodentine⁴³

Future Directions in Deep Caries Management

Advancing approaches to preserve pulp vitality is essential for minimizing invasive procedures, reducing the need for repeated restorative interventions, and improving long-term tooth retention. To ensure a uniform, evidence-based approach, it is necessary to integrate current research into both undergraduate and postgraduate dental education. Significant differences in treatment standards for managing deep caries and pulp exposure highlight the need for greater consistency in clinical guidelines.

A collaborative effort among Cariology and Endodontic specialists is vital to develop standardized, research-backed protocols that can be applied across primary and secondary dental care settings. Establishing well-defined clinical recommendations will help reduce variations in practice, ensuring that all patients receive effective and consistent treatment based on the latest scientific evidence.⁴⁴

Conclusion

A paradigm shift in conservative dentistry has occurred due to the development and use of newer dental materials like MTA, Biodentin, and Growth factor with pulp capping material. The standard of dental care is shifting in favor of more conservative and regenerative treatment options like vital pulp therapy. The principles of pulp capping are to control bacteria, halt caries progression, Inducing pulp cells to produce new dentin with a sound seal that protects the pulp. Selective caries removal strategies can be one-visit as indirect pulp treatment or two-visit using a stepwise approach. Understanding the biology of caries, being aware of technological advancements, and believing in better restorative materials have led to the beginning of a pulp preservation program that is both beneficial to the dentist and the patient.

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Endodontic Disinfection Using Photodynamic Theory Investing The Effectiveness of PDT As An Adjunct to Conventional Irrigation Systems For Root Canal Disinfection

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Received on: 06 March 2025; Accepted on: 21 March 2025; Published on: 19 April 2025

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Introduction

Efficient root canal disinfection is basics to successful endodontic treatment and is currently focused on mechanical debridement using nickel-titanium (NiTi) rotary file systems, irrigation using antimicrobial agents such as sodium hypochlorite (NaOCl), and inter appointment dressings^[1]. Despite the improvement in the efficiency of NiTi system, studies that compare between rotary and hand instruments showed no significant difference in bacterial reduction. NaOCl remains the “gold standard” due to its antibacterial and tissue dissolving traits, but bacterial eradication is not uniformly attainable with any available method.^[2] Moreover, 40% to 60% of root canals contain viable bacteria even after chemomechanical preparation with antimicrobial irrigants in place.^[3] Calcium hydroxide dressing between appointments has been demonstrated to increase the removal of bacteria.^[1]

Apical periodontitis, a bacterial infection of the root canal system, demands a drop in intracanal bacterial populations for therapy to be successful. Although it is desirable to eliminate bacteria totally, the current objective is merely to diminish the population of bacteria to levels compatible with healing of periradicular tissues.^[4] This is the basis of the debate over if RCT should be performed in one or two visits, and protocols that can effectively disinfect the root canal in a single visit are a key area of interest. The potential of laser technologies, including PDT, to speed up disinfection while maintaining efficacy offers promise in this regard. For better disinfection, new techniques like laser therapies, hydraulic, sonic, and ultrasonic irrigation, gaseous ozone, and photodynamic therapy (PDT) have been studied.^[2]

The use of nontoxic photosensitizer PDT, which, with a specific wavelength of light in the presence of oxygen, activates reactive

oxygen species that could eradicate bacteria. Evidence exists that PDT has more antibacterial potential and has been proposed as an supplement to conventional endodontic disinfection protocols.^[3] In vitro, ex vivo, and in vivo studies demonstrated PDT's effectiveness in reducing the bacterial load, mainly against *Enterococcus faecalis*. It is, however, unexplored to what extent PDT may be effective in supplementing chemomechanical preparation in comparison between commonly used photosensitizers such as methylene blue and toluidine blue.^[3]

Photodynamic Therapy (PDT) in Endodontics

Mechanism of PDT

Photodynamic therapy (PDT) is a two-stage treatment process involving the application of a photosensitizing (PS) compound to target tissues, followed by activation through exposure to visible light of a specific wavelength. In the first stage, the PS compound is applied and retained within the target tissues.^[5] It undergoes a light-activating process where the light used might be directly targeted at the targeted area or transmitted to more inner tissues. Upon being exposed to light, PS transitions from its ground state to an excited triplet state.^[6] Activation of the sensitizer in the presence of oxygen results in two types of chemical reactions with biomolecules. Type I reactions include electron or hydrogen abstraction, resulting in the production of free radicals. In combination with oxygen, these reactive species produce highly reactive oxygen^[7]

Type I reactions can lead to direct cellular damage through the effects of free radicals.^[8] On the other hand, type II reactions produce

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<https://doi.org/10.5281/zenodo.15245483>

How to cite this article : Patil et al. - Heal Talk A Journal of Clinical Dentistry. (2025). Endodontic Disinfection Using Photodynamic Theory Investing The Effectiveness of PDT As An Adjunct to Conventional Irrigation Systems For Root Canal Disinfection. In Heal Talk A Journal of Clinical Dentistry (Vol. 17, Number 4, pp. 23–29). Zenodo. <https://doi.org/10.5281/zenodo.15245483>

singlet oxygen, an electronically excited and very reactive oxygen species, which is the primary mechanism responsible for microbial cell destruction. While it is difficult to differentiate between the two kinds of reactions, both may occur, and the equilibrium is determined by variables such as oxygen tension and PS concentration.^[9]

This can create oxidative stress in the targeted region, which may potentially harm the target cells.^[10] There are two major mechanisms associated with the bactericidal activity of PDT: the disruption of the plasma membrane and/or DNA of the cell, which causes death to the cell.^{[11][12]} Cellular damage ensues when ROS overwhelm the cell's biochemical defense mechanisms by oxidizing cellular components, such as membranes and DNA, ultimately leading to death of the cell (Konopka & Goslinski, 2007).^[9] From a clinical standpoint, PDT is both cytotoxic and vasculotoxic (Babilas et al., 2010).^[13]

Additionally, PDT can cause damage to the bacterial cytoplasmic membrane through the generation of cytotoxic species, which have effects on membrane transport systems, inhibit enzyme activities, and cause lipid peroxidation, among other effects (Takasaki et al., 2009).^[12] Singlet oxygen species can efficiently kill a vast range of microbes eg bacteria, fungi, viruses, and protozoa.^[12]

Photosensitizers Used in Endodontic

Many natural and synthetic photoactive compounds have "photosensitizing potential." Nonetheless, to be effective microbicides, the most powerful photosensitizers must come from groups such as the halogenated xanthenes, phenothiazines, acridines, and formed chlorines. Ideally, the photosensitizer should not be toxic and cause any side effects, not be mutagenic, selectively accumulate in the target tissue, be easy to administer, be inexpensive, have a high light absorption efficiency, and have an efficient energy transfer to ground-state oxygen.^[14] Moreover, the quantum yield should be high, the state lifetimes long, and the efficiency should be high.^[15]

PDT in RCT has been validated with various combinations of photosensitizers and light sources, and the results have been inconsistent.^[14] Even when the same photosensitizer and light source are used, differences in illumination protocols, photosensitizer concentrations, light exposure time, and intensity make comparisons difficult. Some of the critical groups of photosensitizers used in PDT comprise those that absorb light at ranges 621-651 nm, phenothiazines (621-701 nm), cyanines (601-804 nm), phytotherapy agents (551-701 nm), and phthalocyanines (661-701 nm).^[16] Some widely explored and used dyes during PDT are phenothiazines such as methylene blue and Toluidine blue O. Even, curcumin present primarily in turmeric was in recent times investigated by researchers in dentistry also as a photosensitizer agent for PDT.^[17]

Studies show that methylene blue has a maximum absorption peak at 660 nm, while Toluidine blue O absorbs at 630 nm. Both have similar bactericidal effects and can inactivate both Gram-positive and Gram-negative bacteria. The choice of photosensitizers in dentistry depends on the light source used. For effective PDT, photosensitizers typically require the longest wavelength

possible and adequate light intensity at that wavelength. The commonly used light sources fall within the wavelengths of 634 to 806 nm and include helium-neon lasers, 638 nm; gallium-aluminum-arsenide diode lasers, 620-677 nm; and argon lasers, 485-524 nm.^[18]

The common clinical PDT light sources include lasers, LEDs, and incandescent lights. The most preferred PDT light source is the diode laser, which is easy to handle, relatively inexpensive, and portable. Laser light has many advantages such as it can be delivered through fiber optics, is very efficient, monochromatic, and high intensity.^[19] They are costly. Non-laser sources like LEDs are increasingly used for illuminating easily accessible tissue surfaces. Incandescent lights are advantageous because they can be filtered to match the absorption characteristics of any photosensitizer but are less efficient when coupled with optical fibers or liquid light guides, leading to heat generation and reduced output.^[16]

From a perspective of bacterial and photosensitizer interaction, three major factors relate the effectiveness of PDT: (i) the ability of the photosensitizer to interact with the bacterial membrane, (ii) its ability to penetrate and act within the bacterial cell, and (iii) the generation of singlet oxygen around the bacterial cell upon light activation.^[19] The more structural differences in outer membranes between Gram-negative bacteria limit their susceptibility to the effectiveness of killing by PDT based on hydrophobic as well as charge interaction factors on a photosensitizer. Charges may also play a significant role, depending on the bacterial surface and the photosensitizing agent used: more cationic drugs being capable of inactivating both Gram-positive as well as Gram-negative bacteria due to methylene blue, Toluidine blue O.^[20]

Generally, Gram-negative bacteria are less susceptible to photosensitizers commonly used in PDT because of their impermeable peptidoglycan layer and the acid pH of the outer cytoplasmic membrane. Gram-positive species are more permeable and can allow the photosensitizer to diffuse inside the cell. There are also claims of bacterial inactivation due to the failure of penetration of the photosensitizer into the cells.^[21] From various studies, damage to critical structures can be caused even if sufficient singlet oxygen is produced near the bacterial membrane. The proximity of the photosensitizer's reactive oxygen species to the bacteria would suffice for effective PDT, without which direct contact with the photosensitizer and bacteria might not be required. Such challenging locations could also lead to effective treatment without such direct interaction between the photosensitizer and bacteria. Therefore, it could be essential to the effectiveness of PDT to access more inaccessible areas.^[22]

Photodynamic therapy is thus deemed a type II mechanism in which singlet oxygen serves as the active species causing cell damage.^[21]

Challenges in Root Canal Disinfection

Anatomical Complexity:

Anatomical complexities in root canal systems, such as curvatures, isthmuses, lateral canals, and irregular shapes (e.g., C-shaped, oval, or flattened canals), create significant challenges during endodontic treatment. These structures make it difficult

for instruments to reach all areas of the canal, especially smaller or more intricate spaces. As a result, some regions of the canal may remain untreated, leading to insufficient cleaning and disinfection.^[23]

Even when treatment follows acceptable standards, these anatomical features can prevent full bacterial reduction. Bacteria may persist in areas that are hard to access with conventional instruments, which contributes to a higher risk of post-treatment apical periodontitis. Consequently, the complexity of root canal anatomy plays a crucial role in the effectiveness of endodontic procedures and the risk of persistent infection.^[24]

Endodontic Biofilm

Endodontic biofilms play a significant role in therapeutic challenges as they represent a primary survival strategy for bacteria, particularly during periods of starvation. These biofilms are a major contributor to endodontic treatment failures due to their ability to protect bacterial colonies in several ways. First, biofilms provide a protective barrier against the external environment, allowing bacteria to survive hostile conditions. Additionally, they facilitate the entrapment of nutrients, supporting the growth of microbial communities. The biofilm also creates a secure environment for genetic exchange among bacterial species, contributing to their adaptability. Furthermore, the biofilm's structure offers inherent resistance to antimicrobial agents, including endodontic irrigants and intracanal medicaments.^[25]

The antimicrobial resistance of biofilms is a significant clinical concern, as they possess several characteristics that make them highly resilient to treatment. One such feature is the slow penetration of antimicrobial agents due to the polysaccharide matrix (extracellular polymeric substance, or EPS) that impedes the diffusion of these agents.^[26] Biofilms also exhibit enhanced tolerance to antimicrobials because of a higher density of cells, including persister cells that are dormant and resistant to treatment. The arrangement of cells within the biofilm further protects the microorganisms at its core, as they are shielded from medications that primarily target cells at the periphery. Additionally, the reduced growth rate and lower nutritional requirements of the cells within the biofilm contribute to their resistance, making the treatment of these infections more challenging.^[27]

Effectiveness of PDT

There are many relevant studies regarding the use of photodynamic therapy (PDT) in endodontics. Several studies have explored its potential as an adjunct to conventional root canal treatments, showing that PDT can significantly reduce bacterial loads

The study by Firmino, R^[29] evaluates the effectiveness of photodynamic therapy (PDT) as a support to conventional endodontic treatment, highlighting its ability to significantly reduce microorganisms and promote periapical healing. The use of PDT, combined with a diode laser and methylene blue as the photosensitizing agent, resulted in faster periapical repair compared to traditional treatments, with bone formation and periodontal ligament restructuring observed as early as six months. PDT's advantages include its non-thermal effects on periapical tissues, making it a safer option compared to high-power lasers. However, factors such as photosensitizer penetration, light deli-

very systems, and energy doses require further research to standardize protocols for optimal results. Overall, PDT offers a cost-effective, easy-to-implement alternative that enhances conventional endodontic treatments, leading to quicker recovery and improved clinical outcomes.

A study by Miranda^[30] evaluated the ex vivo antimicrobial effectiveness of the EndoVac irrigation system combined with PDT, chemomechanical debridement, and intracanal calcium hydroxide (CaOH₂) in treating root canal infections caused by *Enterococcus faecalis*. The study found that while all protocols significantly reduced bacterial levels, PDT did not provide additional antimicrobial benefits beyond conventional chemomechanical debridement and intracanal medication. The use of methylene blue as the photosensitizer, combined with specific concentrations and irradiation times, was effective in reducing *E. faecalis* levels. However, the limited penetration of PDT into biofilms within dentinal tubules, low oxygen availability, and ineffective photosensitizer delivery may have contributed to the modest results. Intracanal medication showed a modest but beneficial reduction in bacterial counts, emphasizing its role in controlling residual bacteria. Despite the reduction in microbial load, total elimination of bacteria was not achieved, likely due to the persistence of *E. faecalis* in complex canal structures.

In a study Rios A^[31] evaluates the effectiveness of photodynamic therapy (PDT) with LED light and TBO (Toluidine Blue O) as an adjunctive antimicrobial treatment for root canal disinfection, particularly against *E. faecalis* biofilms. *E. faecalis* biofilms were allowed to develop in root canals for two weeks, simulating clinical conditions. The results show that PDT with LED light significantly reduced the survival rate of *E. faecalis*, with a survival rate of 2.9% after 30 seconds of PDT. When combined with NaOCl irrigation, the survival rate dropped further to 0.1%. These findings suggest that PDT with TBO and LED light can significantly enhance bacterial reduction in the root canal system compared to traditional disinfection methods. The study also observed that TBO alone and LED light alone reduced bacterial survival, but the combination with NaOCl was most effective. The study concludes that PDT could serve as an effective adjunct to conventional root canal treatments, though further clinical studies are necessary to confirm these in vitro results.

The study by Silva^[32] investigates the effectiveness of adjunctive antimicrobial photodynamic therapy (aPDT) in endodontic treatment for teeth with apical periodontitis, where infection is present in both the root canal and periapical tissues. The results demonstrate that aPDT significantly reduced inflammatory cells, with moderate fibrogenesis and neoangiogenesis observed in the treated groups. These findings suggest that aPDT can promote tissue healing and reduce inflammation in the periapical region. However, despite the absence of inflammatory cells, the healing process was still in the early stages after 90 days, likely due to the potential extrusion of photosensitizer into the periapical area, which may have caused mild toxicity to host cells. While previous studies show aPDT's potential in treating periodontal diseases without damaging host cells, the current study indicates that the parameters used for aPDT might not be

optimal for complete periapical healing. The study highlights the need for further research to determine the ideal aPDT parameters and the therapeutic window that can effectively eliminate bacteria without harming healthy tissue, suggesting that aPDT could be a promising adjunct to conventional root canal treatment for apical periodontitis.

Another study by Samiei M et al^[33] compared the antibacterial effects of photo-activated low-level lasers (PAD), 2% chlorhexidine (CHX), and 2.5% sodium hypochlorite (NaOCl) on *Enterococcus faecalis* in infected root canals. The results showed that all three agents significantly reduced bacterial counts compared to the control group, with no significant difference between PAD and 2% CHX. However, 2.5% NaOCl proved to be the most effective, demonstrating superior antibacterial efficacy. While PAD alone showed some effectiveness, it was less potent than NaOCl, though it did contribute to the reduction of *E. faecalis* in complex root canal areas. The study suggests that further research is needed to evaluate the most effective disinfection protocols in vivo, particularly for diverse bacterial species in root canals.

Study by Meire, M. A^[34] investigated the effectiveness of Nd:YAG, KTP lasers, and photo-activated disinfection (PAD) in eliminating *Enterococcus faecalis* in both in vitro and ex vivo root canal models, comparing them to sodium hypochlorite (NaOCl) as a control. The results showed that neither the Nd:YAG nor KTP lasers effectively reduced the viability of planktonic *E. faecalis* cells, likely due to poor absorption of the laser wavelengths by water. PAD, despite methodological issues, resulted in a significant reduction of bacterial counts in vitro, but its effect was less pronounced in the ex vivo model. NaOCl, while showing the most effective results in vitro with a 100% bacterial kill, demonstrated only a 2-log reduction in the infected tooth model, likely due to inactivation by organic material in the root canal. Overall, while lasers did not provide clinically relevant reductions in bacterial load, NaOCl showed some effectiveness, but all treatments were limited in eradicating infections, especially in areas difficult to access in the root canal. The study concluded that more research, including randomized clinical trials and the exploration of different laser settings, is needed to improve root canal disinfection protocols.

One study by Nunes MR, Mello^[35] investigated the potential of photodynamic therapy (PDT) as an antimicrobial treatment for infected root canals, comparing its effectiveness to traditional sodium hypochlorite (NaOCl) irrigation. The results showed that PDT significantly reduced the microbial load (99.41% to 99.65%) in root canals, but NaOCl provided higher reductions (99.99%). While PDT's effectiveness improved with longer irradiation times, higher energy doses, and appropriate photosensitizer concentrations (such as methylene blue, MB), the use of conventional optical fibers did not significantly enhance the antimicrobial effect. Despite high reductions in *E. faecalis* populations, PDT did not achieve total bacterial elimination, likely due to limited oxygen availability in the root canal and the complexity of dentinal tubule penetration. The study concluded that while PDT shows promise, further research is needed to optimize its parameters and address the challenges of achieving complete disinfection.

One of the review assessed the methodological quality of in vitro studies comparing photodynamic therapy (PDT) and sodium hypochlorite (NaOCl) in reducing *E. faecalis* in root canals, highlighting the lack of standardized parameters for clinical PDT application in endodontics. The review identified significant methodological variations among the studies, such as differences in root canal instrumentation, NaOCl concentrations and exposure times, and the use of photosensitizers like methylene blue (MB) and toluidine blue (TB). While PDT demonstrated effectiveness, its antimicrobial impact was enhanced when combined with NaOCl, yielding better results than conventional treatments alone. However, the lack of consistency in PDT parameters (e.g., laser power, photosensitizer concentration, and exposure time) hindered comparisons and meta-analysis, underlining the need for further studies to establish standardized protocols for PDT in clinical endodontics. The review concluded that PDT could be a valuable adjunctive treatment in endodontic disinfection but requires more research to optimize its application.

A study done by Muhammad^[36] evaluated the efficacy of Photodynamic Therapy (PDT) in combination with ultrasonic irrigation for treating microbial biofilms in root canals, specifically targeting *E. faecalis*. The researchers compared two PDT methods—using a 650 nm diode laser and LED light—against ultrasonic irrigation using sodium hypochlorite (NaOCl) and EDTA. PDT was used as an adjunct to conventional root canal treatment, performed after chemo-mechanical debridement to target biofilm remnants. The study found that while PDT reduced bacterial colonies, its effectiveness was not as strong as ultrasonic irrigation, which demonstrated superior results in removing biofilm due to acoustic streaming. The study also highlighted the challenge of biofilm resistance, particularly from *E. faecalis*, and discussed the limitations of PDT, including the potential for incomplete bacterial elimination and the need for additional techniques like real-time PCR or FISH for more accurate bacterial assessment. Ultrasonic irrigation proved to be more time-efficient and cost-effective, making it a preferred method in clinical practice.

PDT Against Resistant And Complex Cases

Several studies have explored its potential as an adjunct to conventional root canal treatments, showing that PDT can significantly reduce bacterial loads, particularly *Enterococcus faecalis*, and promote tissue healing in periapical areas.

Study by Asnaashari M^[28] investigates the effectiveness of antimicrobial photodynamic therapy (aPDT) compared to calcium hydroxide in disinfection of root canals, particularly against *E. faecalis*, a common pathogen in refractory infections. While both treatments reduced bacterial load, aPDT demonstrated superior efficacy in eliminating *E. faecalis*. The study employed a randomized design to minimize bias and used both biofilm and planktonic bacteria samples. It highlights the advantages of aPDT, especially with LED light, which is safer and more cost-effective than high-power lasers. The results suggest that aPDT could be a promising alternative for root canal disinfection, but further research is necessary to optimize protocols and confirm its role in routine clinical practice.

The study by^[37] Garcez, A. S., demonstrated the effectiveness of Photodynamic Therapy (PDT) as an adjunct to conventional endodontic surgery for reducing bacterial load in periapical lesions, including drug-resistant infections. PDT achieved a significant reduction in microbial contamination without contributing to microbial resistance, making it a safer and more effective alternative to long-term antibiotic use. The study found that PDT, when combined with mechanical debridement, provided superior microbial reduction compared to conventional treatments, and the surrounding tissue was not harmed. After 36 months, all patients were asymptomatic, and the treated teeth regained normal function. The results suggest that PDT can enhance the outcomes of endodontic surgery by providing additional microbial decontamination and improving the healing of periapical lesions without cytotoxic effects.^[37]

These findings collectively suggest that while PDT offers a promising alternative or adjunct to traditional endodontic therapies, further research is needed to optimize its protocols and address its limitations in achieving full bacterial eradication.

Challenges and Limitations of PDT

- **Access to Light**

1. The effectiveness of PDT is dependent on the light source used, which should match the activation spectrum of the photosensitizer (PS). The light sources used in PDT include lasers and light-emitting diodes (LEDs) with wavelengths typically between 630-800 nm^[17,20].
2. **Laser and LED Use:** Low power lasers are most commonly used in PDT due to their high efficiency, portability, and ability to focus light precisely through fiber optics. Diode lasers are particularly favored due to their ease of handling and lower cost^[20].
3. **Thermal Side Effects and Alternatives:** Lasers concentrate energy in a small area, which can induce thermal injury, while LEDs avoid this issue, making them safer for surrounding tissues^[38]. LED light sources are suggested to minimize temperature rise while still providing effective energy delivery for PDT^[20].

- **Optimal Photosensitizer Selection**

1. The selection of a PS is crucial for PDT efficacy. Factors like phototoxicity, absorption wavelengths, and ability to penetrate bacterial membranes affect the choice. Methylene blue (MB) and Toluidine Blue O (TBO) are frequently studied for their effectiveness in deactivating both Gram-positive and Gram-negative bacteria^[20].
2. The PS should have high absorption in the light wavelength used and must generate singlet oxygen effectively^[39]. Cationic PSs, like MB and TBO, are effective against a range of bacterial species^[9].

- **Toxicity and Safety**

1. PDT is generally safe within the therapeutic window, with studies showing lower cytotoxicity compared to traditional endodontic irrigants like NaOCl^[29]. Curcumin, for example, has been used as a non-cytotoxic PS in dental applications^[29].

- **Cost**

1. **Cost of Light Sources:** While diode lasers are more affordable and portable compared to other lasers, they can still be relatively costly compared to LED or halogen lamps, which are cheaper but less efficient^[20].

2. **Ease of Use:** Diode lasers, being portable and user-friendly, have become the preferred light source for PDT^[40].

- **Practical Concerns with PS and Light Sources**

1. The practical use of PDT in clinical settings requires careful consideration of the PS's toxicity, the light source's intensity, and the treatment's safety profile^[41]. The potential for tissue damage due to thermal effects requires caution when using high-intensity light sources^[12].

Conclusion

In conclusion, the studies reviewed demonstrate that photodynamic therapy (PDT) has significant potential as an adjunct to conventional endodontic treatments, offering benefits such as enhanced microbial reduction and improved periapical healing. While PDT has shown promising results in reducing bacterial loads, especially *Enterococcus faecalis*, its effectiveness can vary depending on factors such as the photosensitizer used, light delivery systems, and energy doses. Several studies have highlighted PDT's advantages, such as its non-thermal effects on periapical tissues, which make it a safer alternative to high-power lasers. However, challenges such as limited penetration into dentinal tubules, oxygen availability, and incomplete bacterial elimination remain. While PDT may not achieve total bacterial eradication on its own, its combination with other disinfection protocols, like sodium hypochlorite, has proven to yield better outcomes. Despite these promising results, further research is necessary to standardize PDT protocols, optimize its application in clinical practice, and address the limitations that prevent it from being a complete solution for root canal disinfection. Overall, PDT appears to be a valuable adjunct in endodontic therapy, with the potential for improved clinical outcomes when integrated into comprehensive treatment regimens.

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Vital Pulp Therapy

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Received on: 06 March 2025; Accepted on: 21 March 2025; Published on: 19 April 2025

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Abstract

One of the most contentious dental topics is vital pulp therapy for cariously exposed permanent teeth. Following pulp exposure, it is preferable to preserve the vitality and health of the exposed pulp rather than replacing it with a root-filling material. Vital pulp therapy (VPT) is important for preserving and maintaining healthy pulp tissue. Recent advancements in pathobiology, bioactive materials, and clinical studies have improved VPT. The current review summarises the clinical outcomes and prognostic factors of VPT in mature permanent teeth with carious pulp exposure, including direct pulp capping, partial pulpotomy, and full pulpotomy, and briefly introduces new progress in this field.

Materials and Methods- An electronic search of the following databases- Pubmed, JOE, Scopus

Introduction

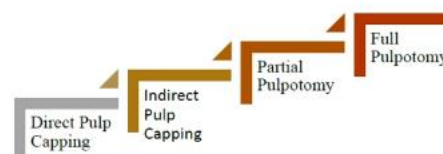
[i12] Due to its constantly high success rates, RCT has been viewed as the most effective action for permanent teeth with³ pulpal exposure but a canal with filling materials is biologically substandard to the natural coronal or radicular pulp because they lack the biological immune defense mechanisms and neural innervation.⁴ The prognosis of an endodontically treated teeth is inferior than that of vital teeth. As a result,⁵ procedures preserving the natural tooth with the best available material should be considered.⁶ Vital pulp therapy is used to make teeth symptomless and preserve their strength and functionality. The aim of vital pulp therapy is to protect and sustain the health of the pulp in teeth that have been affected by trauma, decay, restorative treatments, or anatomical irregularities.

The extent of injury to the pulp depends on the treatment modality like for minimal injury a more conventional approach like the Vital Pulp therapy should be approached while in cases of severe injuries a with irreversible pulpitis or Pulp necrosis a Root Canal Treatment should be performed.⁶

Dentistry has recognized the ability of the injured pulp to repair since Philipp Pfaff's first description of direct pulp capping using gold foil in 1756.⁷ Superior sealing properties are now provided by new materials to protect the pulp from microorganisms and

their toxic byproducts. The incorporation of MTA and other hydraulic calcium silicate cements along with new treatment approaches, has challenged the traditional view that VPT should be avoided following carious exposure.⁸

Vital pulp therapy (VPT) is one such method of preserving the vitality of the pulp as well as removing the carious exposure. It includes -



Diagnostic Criteria For VPT

Before proceeding for a VPT a correct diagnosis should be made. The diagnostic criteria mainly includes patients pain history and a proper clinical evaluation by pulp sensibility tests (cold testing and electrical pulp testing) to check the pulp vitality; Mechanical tests like tenderness on percussion; intra-oral radiographs⁹.

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How to cite this article: Bhardwaj et al. - Heal Talk A Journal of Clinical Dentistry. (2025). Vital Pulp Therapy. In Heal Talk A Journal of Clinical Dentistry (Vol. 17, Number 4, pp. 30-35). Zenodo. <https://zenodo.org/records/15245538>

Dental pulp pain is transmitted through two distinct nerve pathways. Myelinated A-delta ($A\delta$) fibers facilitate rapid pain conduction, producing a piercing, localized, and fast response. When a thermal stimulus is applied to the tooth, it triggers a rapid $A\delta$ fiber response, which subsides almost instantly. In contrast, unmyelinated C-fibers are accountable for slower pain conduction, which is more difficult to localize and primarily induced by heat stimuli. The pain response is initially brief but can become more intense and frequent over time before gradually subsiding. The A fibers are mainly used in the diagnostic criteria.

Indication for Vital Pulp Therapy

VPT is advised for teeth with reversible pulpitis or partly inflamed pulps where the remaining pulp can be preserved to produce a strong barrier that prevents the pulp from future microbial insults. The following methods can be used for the evaluation of teeth for Vital Pulp Therapy-1

Types of Vital Pulp Therapy

1. Indirect Pulp Capping

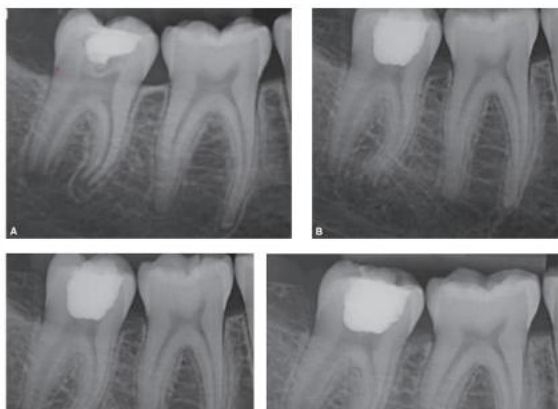
"A procedure in which a pulp capping material is placed on a thin partition of the remaining carious dentin that, if removed, might expose the pulp in permanent teeth"¹¹ There are two approaches for indirect pulp capping- Two-stage and One stage approach

Two-Stage Approach

All the infected dentin is excavated from the tooth, leaving a layer of the deep carious dentin on the floor as its removal may cause exposure of the pulp.¹¹ Usually, this layer is covered by a liner followed by a temporary/provisional restoration. A follow up After few months the patient revisits where the temporary restoration is removed followed by removal of residual caries and placement of final restorative material.

One Stage Approach

¹¹With a one-stage approach, all/most of the carious structure (usually the infected dentin) is removed leaving behind the affected dentin (demineralised dentin with an intact collagen structure and the ability to undergo remineralisation) during the initial appointment followed by placement of an indirect pulp capping agent near but not directly in contact with the pulp; followed by placement of the final restoration. All the treatment is done in the same appointment. Various dyes and caries detecting solutions can and should be used for differentiating between the carious and sound tooth structure.¹²



1. Direct Pulp Capping

¹²Direct pulp capping is stated as "placing a dental material directly on a mechanical or traumatic vital pulp exposure" and "sealing the pulpal wound to facilitate the formation of reparative dentin and maintenance of the healthy pulp. The most common material used for the direct pulp capping procedure is ¹³Calcium Hydroxide as it has the potential to dissociate into its ionic form, its alkaline pH, bacteriostatic and bactericidal properties and to stimulate the pulp and dentin forming cells in different ways to form reparative dentin.



Ruiz-González et al. analyzed the outcomes of direct pulp capping (DPC) with Irreversible pulpitis. Three studies were studied in a meta analysis involving ⁶² teeth showed a joint success rate of 95.3%, including all tested biomaterials achieving success rates above 80%. While the findings support DPC as a potential treatment option, limitations such as small sample sizes and methodological weaknesses underscore the need for more robust research¹³

Priya et al. examined the efficacy of laser-assisted direct pulp capping (DPC) in permanent teeth. Their meta-analysis, which included seven studies, indicated that laser treatment significantly reduced both clinical and radiographic failure rates compared to conventional non-laser techniques. This improvement is likely attributed to enhanced decontamination and bio-stimulation. However, variations in study methodologies limit the generalizability of these findings.¹⁴

Pulpotomy

"The removal of the coronal portion of the vital pulp as a means of preserving the vitality of the remaining radicular portion"¹⁴ The process of pulpotomy can be of two types-

Partial Pulpotomy- Partial pulpotomy involves the excavation of a minor section (1-2mm) of the vital pulp to help preserve the remaining pulp tissues.

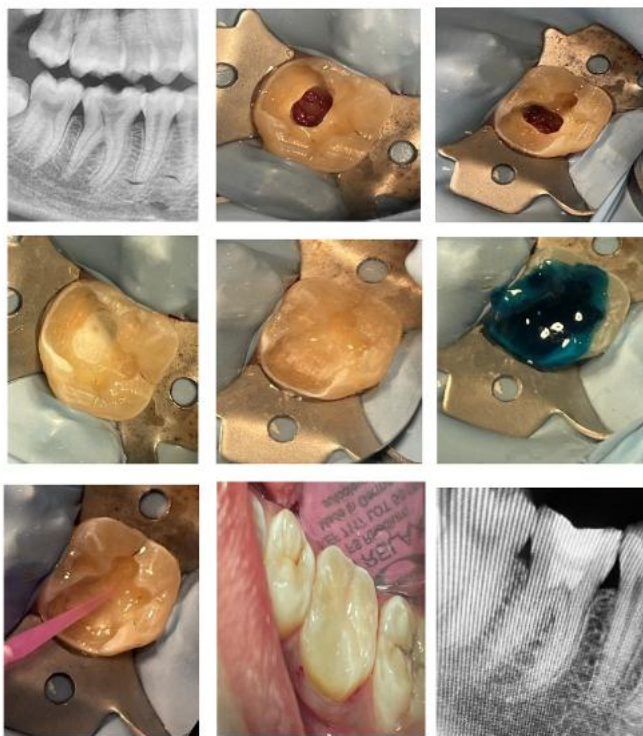
Steps For Partial Pulpotomy

¹⁶Local anaesthesia and rubber dam application is done to avoid any contamination. The affected area is cleaned by NaOCL or CHX. ¹⁶Caries excavation is done using a high speed #2-6 round burs in a slow-speed handpiece with a hand instrument. The area is irrigated with saline or 1.5% to 5.25% NaOCL to achieve hemostasis by comping the area with a cotton pellet for 5 minutes. ¹⁶In cases of no bleeding, the area is assessed for any necrotic tissue. Uncontrolled bleeding for more than 10 min

should be managed by doing full pulpotomy pulpectomy.¹⁶ Using the appropriate instrument the affected area is sealed with a liner followed by

Lin et al. assessed the clinical and roentographic results of partial pulpotomy and full pulpotomy (FP) in the adult posterior teeth with infected pulpal exposure. The success rates for FP ranged from 92.2% to 99.4%, while Partial pulpotomy showed good success rates between 78.2% and 80.6%. The review found that the choice of material did not significantly influence FP outcomes but had a notable impact on PP success. Although both techniques exhibited high success rates, the study emphasized the need for further long-term research to confirm these findings^v.

Madhumita et al. evaluated the effectiveness of partial pulpotomy (PP) as a conservative approach for managing pulpal involvement in traumatized permanent anterior teeth. Their analysis revealed 89% success, with no evidence of conflict of interest in the study. The review determined that Partial Pulpotomy is a dependable treatment option for symptomless injured permanent single rooted teeth, yielding superior results compared to full pulpotomy (FP)^{vi}



Matoug-Elwerfelli et al. reviewed 14 studies on the effectiveness of Vital Pulp Therapy on teeth with Ellis fractures with or without pulpal. Partial pulpotomy (PP) showed the highest success rates (82.9%–100%), while full pulpotomy (FP) and direct pulp capping (DPC) had less success rates. Bioceramic materials like MTA, Biodentine, iRoot BP and Calcium Hydroxide demonstrated success rates between 79.4% and 100%. The study emphasized the necessity for more rigorous clinical research to validate these findings^{vii}

Donnelly et al. evaluated the pulpotomy success in managing complicated fractured permanent single rooted teeth. The review study reported good results for both partial and full pulpotomy (FP) (70%–98%) but highlighted limitations due to less sample sizes and medium risk of bias. The review recommended Partial Pulpotomy over Pulp Capping in such cases but cautioned that the results should be inferred carefully due to variability among included studies^{viii}

Full Pulpotomy- It is described as the removal of the portion of the vital pulp in the coronal part of the tooth while preserving the vitality of the remaining pulp tissue. This treatment can also be performed as an intervention for symptomatic relief or as a therapeutic approach, such as in Cvek pulpotomy.

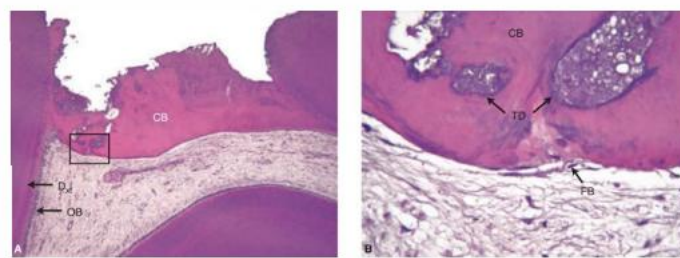
Materials used

The ideal material should be biocompatible, possess antibacterial properties, offer strength, create a secure barrier over the pulp wound, stimulate hard tissue formation, and support tissue regeneration^{ix}. Historically various materials were used in vital pulp therapy

¹⁷Calcium Hydroxide - ¹⁸In 1920, calcium hydroxide was presented as a pulp capping agent in endodontics. Calcium hydroxide has long been regarded as the "gold standard" in vital pulp therapy.⁹

Antibacterial action- This feature is due to the release of highly reactive hydroxyl ions, the mode of action of which can be considered to be due to the following mechanisms: bacterial cytoplasmic membrane destruction; protein lysis, and bacterial DNA damage¹⁹. It is effective against the majority of endodontic pathogens.²⁰

Mineralisation Property - This characteristic is caused by the hydroxyl ions, which cause an alkaline pH. The high pH of 10-13 initially causes necrosis on the pulp's surface (1.5-2mm). The toxicity of calcium hydroxide is neutralised in deeper portions of the pulp, resulting in the formation of a layer of tissue that undergoes necrosis at the synapse of necrotic and living pulpal tissue. Calcium hydroxide starts acting as a mild irritant after some point hence, stimulating the formation of hard tissue.²¹ Osteodentine is defined as the calcified material because it has qualities of both bone and dentin.²² CH and MTA may assist in hard tissue growth by disintegrating dentinal growth factors, resulting in the adhesion of pulp stem cells.



Demerits- The osteodentine barrier formed is often incomplete, thus, forming tunnel defects. Such defects allow bacterial re-infection, reducing the efficiency of the procedure.

²⁴The sterile pulp may get infected due to marginal leakage/faulty restoration which can further lead to pulpal necrosis if left undiagnosed.

Mineral Trioxide Aggregate

Mineral Trioxide Aggregate (MTA) was introduced for procedures such as Vital Pulp Therapy by Torabinejad and colleagues in the mid-1990s. It has been found to promote mineralization beneath exposed pulp and help preserve pulp vitality. This cement is composed of a hydraulic calcium silicate powder that includes oxide compounds such as calcium oxide, ferric oxide, silicon oxide, sodium and potassium oxides, magnesium oxide, and aluminum oxide.

MTA has beneficial properties supporting reparative dentin formation by stimulating hard tissue-forming cells, encouraging matrix production, and facilitating mineralization. The extracellular matrix contains soluble cytokines and growth factors that play a role in the repair of the dentin-pulp complex. MTA aids in the formation of hard tissue by capturing the growth factors and cytokines within the adjacent dentin matrix. As it sets, MTA gradually releases calcium ions, which contribute to the development of a barrier by activating signaling molecules such as vascular endothelial growth factor (VEGF), macrophage colony-stimulating factor (MCSF), transforming growth factor (TGF), and interleukins like IL-1. The release of calcium ions from MTA induces an inflammatory response, creating an alkaline environment that leads to tissue necrosis.

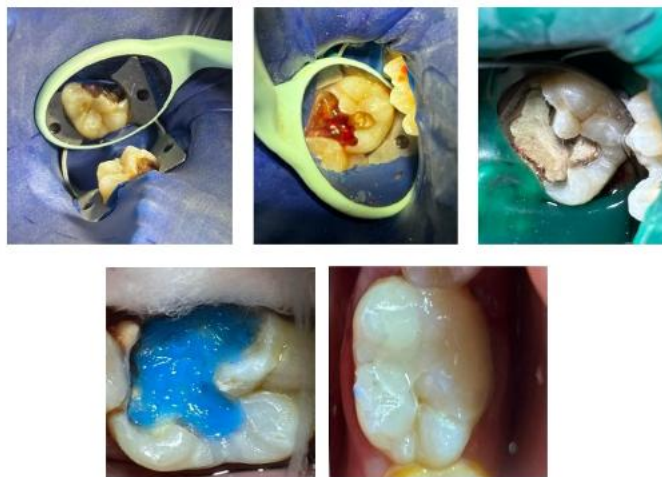


Biodentin

BD comes in a capsule containing a powdered blend of tricalcium silicate, dicalcium silicate, zirconium oxide, calcium carbonate, calcium oxide, and iron oxide. Each 0.7 g capsule is mixed for half a minute with a device operating at 4000-4200 rpm with precisely 5 drops of liquid. This liquid includes calcium chloride, which acts as a setting accelerator, a water-soluble polymer that reduces water content. The accelerator enhances handling, improves mechanical strength thus reducing the risk of material loss and interface variation as compared to MTA. However, a notable drawback of BD is its that it has a lower radiopacity than MTA, even after the inclusion of zirconium oxide. Additionally, its radiopacity diminishes over time, making long-term radiographic assessment challenging.

In both direct and indirect pulp capping procedures, BD interacts with hard and soft tissues, ensuring marginal sealing and protecting the preserved vitality by stimulating reactionary dentin formation and remineralization. The release of ions like calcium (Ca^{2+}) and hydroxyl group (OH^-) suggests that tricalcium silicate-based materials like BD may be preferable for indirect pulp capping.

BD achieves marginal sealing through micromechanical retention, as it penetrates tubular structure of dentin and forms tags, providing bond strength to dentin comparable to MTA. However, research findings on its sealing ability are inconsistent, with some studies indicating that BD outperforms MTA in this aspect.



Permanent Restoration

⁶During the next appointment, the tooth is restored with a permanent restoration. ⁶The location of the permanent restoration can be critical to the prolonged preservation of pulp vitality, even more so than the actual pulp treatment. The pulp has the highest chance of repairing if the microleakage is minimal or eliminated. ¹¹The final restorative material is specific for each patient and should be chosen carefully. ⁹Although amalgam has proven to be a reliable material due to its low cost and ease of placement, it does have drawbacks such as aesthetic concerns and potential health risks for dental providers and due to technology advancements and the drawbacks of amalgam it is being replaced by the more advanced adhesive restorative materia

Post Operative Follow Up-

⁹¹¹A post-operative follow-up is always appreciated to assess the treatment outcome. A study defined the sufficient time period for a tentative diagnosis of pulp survivability as 3 months where direct pulp capping was completed with Calcium Hydroxide. ⁹¹¹A two-visit protocol is also helpful in diagnosing the condition of the tooth. Usually, the second visit is after 5-10 days, followed by consecutive visits by 6 weeks, 6 months, and 12 months. The recent advancement of technology in bioactive materials that consistently promote pulp repair and healing has made a progressive and significant contribution to our understanding and ability to protect and maintain living pulp.

Conclusion

Vital pulp therapy (VPT) encompasses various conservative treatments aimed at conserving pulp vitality in teeth, regardless of their stage of development. Techniques such as stepwise removal of caries, IPC, DPC and Pulpotomy, have shown promising success rates depending on clinical indications and pulp status. The introduction of bioceramic materials like MTA, CEM cement and Biodentine™ has notably enhanced treatment outcomes, improving its efficacy and prolonged survival. Neverthe-

less, variations in protocols and the necessity for well-designed, long-term studies remain challenges. Even after these limitations, VPT remains a viable alternative to more invasive procedures like complete pulpectomy, root canal treatment, or tooth extraction. Further research is necessary for ideal protocols and optimized methods for improved success. Further research is required to assess the long-term success of VPT, standardize treatment protocols, and establish objective diagnostic criteria for evaluating pulpal health. Existing evidence indicates that VPT can be effectively performed in both primary and mature permanent teeth with reversible or irreversible pulpitis, provided strict aseptic protocols are followed. These include the use of a dental dam, complete caries removal, confirmation of pulpal vitality through hemostasis and direct visual inspection under magnification, application of biocompatible calcium silicate-based cements (CSCs), and immediate placement of high-quality restorations^{xi}

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Sex Assessment Using Odontometry and Cranial Anthropometry : Evaluation in North Indian Population

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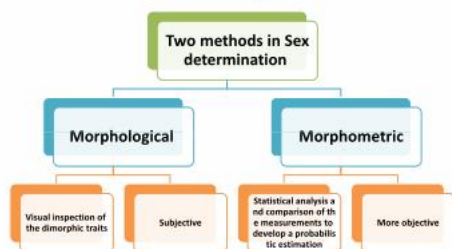
Received on: 06 March 2025; Accepted on: 21 March 2025; Published on : 19 April 2025

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Introduction

- Determination of sex is an essential parameter which helps in establishing the biological profile of the deceased in forensic and archaeological examinations.
- Esthetics is the primary consideration for patients seeking any prosthetic treatment.
- Dental and cranial parameters can help in biological profiling and sex determination of individuals
- Also has Esthetic Significance



- Proper selection of size and shape of tooth is one of the most important factors contributing to a harmonious esthetics and smile.
- Cranial and odontometric parameters are useful adjuncts in sex determination.
- Considerable dimorphism in males and females.
- They exhibit sexual dimorphism and can be useful in personal profiling, forensic identification and anthropological studies.
- The purpose of this study is Sex assessment using Odontometry and cranial anthropometry in North Indian Population.



Aim of The Study

- To correlate the odontometric measurement of six maxillary anterior teeth with interpupillary distance, intercanine width and head circumference in sex determination in North Indian population.

Objectives

- To compare the mesiodistal width in maxillary anterior teeth with head circumference, interpupillary distance and inter canine width.
- To correlate the odontometric measurements with cranial morphometric measurements.
- To determine the significance of these parameters in sex determination.

Material and Methods

- Cranial anthropometric measurements i.e. maximum head circumference, interpupillary distance and intercanine width were measured.
- Tooth size (maximum mesiodistal dimensions) of six maxillary anterior teeth were measured with digital caliper.
- To ascertain the usefulness of absolute measurements of interpupillary distance, cranial circumference and teeth and the combination of these parameters in sex prediction, Pearson's correlation analysis and Wilcoxon sign rank analysis was done.

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<https://doi.org/10.5281/zenodo.15245578>

How to cite this article : Afzal et al. - Heal Talk A Journal of Clinical Dentistry. (2025). Sex Assessment Using Odontometry and Cranial Anthropometry : Evaluation in North Indian Population. In Heal Talk A Journal of Clinical Dentistry (Vol. 17, Number 4, pp. 36-38). Zenodo. <https://doi.org/10.5281/zenodo.15245578>

Inclusion and Exclusion Criteria

Inclusion Criteria

1. No missing maxillary anterior teeth.
2. No gingival or periodontal conditions or therapies that would undermine a healthy tissue to tooth relationship.
3. Not undergone any previous dental restorative, esthetic or orthodontic treatment.
4. All anterior teeth were erupted.

Exclusion criteria

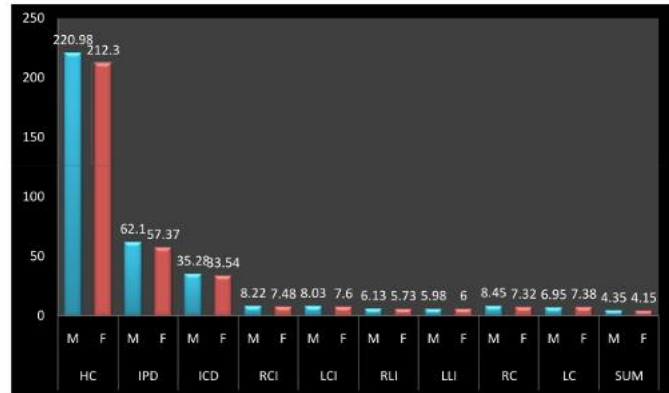
1. Periodontal disease with interproximal gingival recession greater than 2.0 mm.
2. Previous history of periodontal surgery.
3. Subject undergoing orthodontic therapy during study.
4. Subject with open bite.
5. Apparent loss of tooth structure due to attrition, fracture, caries or restorations

Statistical Analysis

- Data analyzed by using SPSS software (v.20).
- Student T- test and descriptive statistics applied .
- The independent t-test performed to observe the differences of the ratio of six maxillary anterior teeth between different head circumferences at 95% confidential and $p \leq 0.05$ considered statistically significant.
- Pearson’s correlation coefficient calculated for each parameter.



Comparison of Means of Variables in Males and Females in the study groups



Independent Sample Student T test , $p \leq 0.05$ considered statistically significant with 95% confidence intervals

Inter and Intra Group Comparison

Parameters		Sum of Squares	Mean Square	F	Sig.
Head Circumference	Between Groups	1883.56	1883.56	40.449	≤ 0.05
	Within Groups	4563.48	46.566		
	Total	6447.04			
Inter Pupillary distance	Between Groups	558.85	558.85	30.856	≤ 0.05
	Within Groups	1774.908	18.111		
	Total	2333.758			
Inter canine distance	Between Groups	75.169	75.169	4.225	≤ 0.05
	Within Groups	1743.513	17.791		
	Total	1818.682			

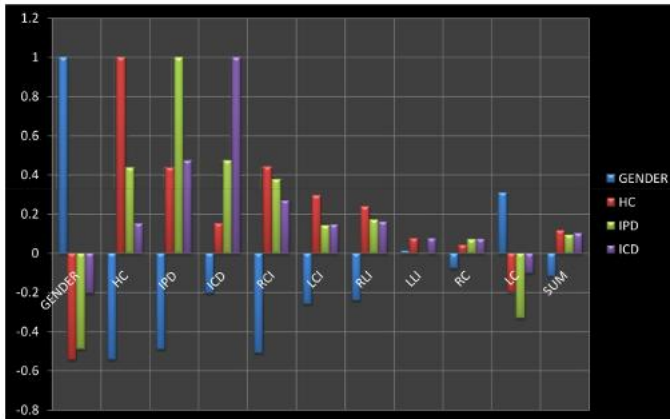
ANOVA test, $p \leq 0.05$ considered statistically significant with 95% confidence intervals

Inter and Intra Group Comparison

Parameters		Sum of Squares	Mean Square	F	Sig.
RCI	Between Groups	13.764	13.764	34.145	0
	Within Groups	39.505	0.403		
	Total	53.269			
LCI	Between Groups	4.796	4.796	7.035	0.009
	Within Groups	66.811	0.682		
	Total	71.608			
RLI	Between Groups	3.891	3.891	5.92	0.017
	Within Groups	63.761	0.657		
	Total	67.652			
LLI	Between Groups	0.008	0.008	0.016	0.899
	Within Groups	49.19	0.502		
	Total	49.198			
RC	Between Groups	31.81	31.81	0.576	0.45
	Within Groups	5415.238	55.258		
	Total	5447.048			
LC	Between Groups	4.641	4.641	10.148	0.002
	Within Groups	44.362	0.457		
	Total	49.003			
SUM	Between Groups	99.202	99.202	1.363	0.246
	Within Groups	7133.758	72.793		
	Total	7232.96			

ANOVA test, $p \leq 0.05$ considered statistically significant with 95% confidence intervals

Correlation Coefficient of Dental and Craniofacial parameters in the study groups



Pearson Correlation Coefficient, $p \leq 0.05$ considered statistically significant with 95% confidence intervals

Discussion

- The estimation of sex from osteological and dental records has long been an interdisciplinary field of dentistry, forensic medicine and anthropology.
- Forensic tools for dental sex determination can broadly be categorised into metric, non-metric, and biochemical methods.
- The cranial and odontological sex estimation methods are highly population-specific and there is a great need for these methods to be applied to and verified on more populations.
- This study analyzed the clinical crown dimensions of maxillary anterior teeth to determine whether consistent relationships exist between tooth width and several cranial measur-

ements in a subset of the North Indian population.

- In the present study, there was significant difference in the odontometric measurements in males and females.
- Jatana et al. (2022) observed that maxillary canines had strong sexual dimorphism and can be utilised for sex determination in Punjab population.
- Proportional relationships between the bizygomatic width and the width of the central incisor, and the intercanine distance and the interalar width in women were observed by Hasanreisgolu et al. (2015).
- Jamayat et al. (2014) observed that mesiodistal crown width and lengths correlated with facial types in Bangladeshi population.
- The odontometric difference between males and females is generally explained as a result of greater genetic expression in males.
- However, Iscan and Kedici (2003) cautioned that an overlap exists between male and female tooth dimensions, and this makes accurate diagnosis of sex challenging, even for experienced dentists. They emphasized that success is greater when all available teeth are used.

Conclusion

- There exists significant differences between tooth-mesiodistal width and head circumference dimensions, intercanine width and interpupillary width in study population.
- The craniometric and odontometric measurements are useful adjunctive tools in sex determination and forensic identification in North Indian population.
- This can also help in selection of missing anterior teeth as per individual esthetic and restorative requirements based on cranial and anatomical morphometric measurements.

The Versatility of Nasolabial Flaps in Oral and Maxillofacial Surgery : A Functional and Aesthetic Reconstructive Solution

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Received on: 06 March 2025; Accepted on: 21 March 2025; Published on : 19 April 2025

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Abstract

Nasolabial flaps are a cornerstone in oral and maxillofacial surgery, offering unparalleled versatility in reconstructing defects resulting from trauma, tumor resections, or congenital anomalies. Their regional nature, rich vascular supply, and compatibility with facial skin ensure functional restoration and aesthetic outcomes. This article explores the anatomy, vascularity, applications, and challenges of nasolabial flaps while examining their evolution and innovations in surgical techniques. Through a detailed analysis of historical perspectives, clinical applications, and case studies, the nasolabial flap emerges as a reliable tool for surgeons aiming to restore facial integrity and improve patients' quality of life.

Keywords - Nasolabial Flap, Oral and Maxillofacial Surgery, Reconstruction, Facial Anatomy, Aesthetic Restoration, Surgical Innovation, Tissue Perfusion, Oral Defects, Functional Outcomes

Introduction

In oral and maxillofacial surgery, reconstructive techniques aim to restore function and aesthetics in patients with defects resulting from trauma, congenital anomalies, or tumor resections. Among the various reconstructive options, nasolabial flaps have emerged as a reliable and versatile solution, striking a balance between functionality and cosmetic outcomes.¹

The nasolabial flap is a regional flap sourced from the nasolabial fold the natural crease between the nose and the upper lip. Its unique advantages, including a rich vascular supply, proximity to the defect site, and compatibility with surrounding facial tissues, make it an indispensable tool in reconstructive surgery.² The skin and subcutaneous tissue from the cheek, constitute the flap. Nasolabial flaps are frequently used to reconstruct deformities in the maxillofacial region that arise from trauma, cancer resection, congenital malformations or prior surgical treatments.

The flap is transferred to cover the defects paying close attention to retain symmetry and present an aesthetically pleasing features after it has been elevated along the nasolabial fold to ensure an adequate blood supply from the facial artery. The donor site is often closed with little scarring. They complement the

surrounding facial skin in terms of colour and texture, which improves the aesthetic appearance of the recipient site. There is usually little functional damage or cosmetic deformity at the donor location and the morbidity rate is low.

For minor oral cavity abnormalities, the options for reconstruction include primary closure, secondary mucosalization, and split thickness skin grafting over the preferred defect location. Inferiorly based subcutaneous pedicled nasolabial flap can be used safely and with minimal complications. It is possible to elevate superior, inferior, medial, and lateral based flaps due to the abundant vascular supplies and viable anastomosis between the terminal branches of the supplying vessels of the flap. Most of these methods could cause hindrance with speech and swallowing. The modification that has been incorporated as a single-stage flap surpasses most of the disadvantages and therefore, it has become the preferred design of nasolabial flap.

The aim of this study is to evaluate the effectiveness, versatility and outcomes of the

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How to cite this article : Rajhans et al. - Heal Talk A Journal of Clinical Dentistry. (2025). The Versatility of Nasolabial Flaps in Oral and Maxillofacial Surgery : A Functional and Aesthetic Reconstructive Solution. In Heal Talk A Journal of Clinical Dentistry (Vol. 17, Number 4, pp. 39–43). Zenodo. <https://doi.org/10.5281/zenodo.15253725>

nasolabial flap in the reconstruction of defects in oral and maxillofacial surgery, with a focus on functional restoration, aesthetic results and postoperative complications. This allows us to explore various aspects of the nasolabial flap, including its applications, benefits, challenges and overall impact on patient care in this specialized surgical field. Due to limited resources & studies on this topic, this study might prove to be an additional enlightenment and set a trademark for future applications.

Historical Perspective and Evolution

The origins of nasolabial flaps trace back to ancient Indian surgical texts, such as the ‘Sushruta Samhita’, which described their use in nasal reconstruction.³ Over the centuries, this

technique has undergone significant evolution. By the 20th century, it became a cornerstone in addressing defects in oral and maxillofacial regions, thanks to advancements in surgical techniques and anatomical understanding.⁴ The same is represented in Table 1. Today, the nasolabial flap is used for reconstructing a wide range of defects, from those affecting the oral cavity like the floor of the mouth and buccal mucosa to external facial deformities involving the nose, lips, and cheeks.⁵

Year/Period	Event/Innovation	Details
1500 BC	First nasal reconstruction in India	Prince Lakshmana amputated the nose of Lady Surpunakha as punishment, which was later reconstructed by order of the King Ravana using pedicled forehead flap ³
600 BC	Nasolabial flap (cheek flap) described	Sushruta Samhita reports intraoral reconstruction ³
1400	Delayed forearm flap for rhinoplasty	Introduced by Gustavo and Antonio Branca (Italy) ⁴
1450	Distant flap technique used	Vaneo brothers and Heinrich Von PfolSprundt applied for nasal reconstruction ⁴
1545–1599	Tagliacozzi's development	Gaspare Tagliacozzi elaborates Branca's methods in his seminal work ⁵
1800s	Nasolabial flap visuals in print	Karl Ferdinand von Graefe reestablished Tagliacozzi's method ⁵
1818	First formal nasal reconstruction	Performed by Karl Ferdinand von Graefe ⁶
1830	Superiorly based nasolabial flaps	Used by Pers Michael for nasal alae ⁷
1838	Composite flap from lower lip	Described by Pietro Sabattini (Italy) ⁸
1840	Nasolabial flap for nasal defects	Used by Warren ⁹
1864	Flap to reconstruct the nose	Used by Von Langenbeck ¹⁰
1868	Transbuccal flap transfer	Introduced by Thiersch for oral cavity closure ¹¹
1869	First “fresh skin” allograft	Jacques-Louis Reverdin developed “Reverdin graft” ¹²
1889	Cutaneous vascular anatomy	Carl Manchot published detailed vascular mapping ¹³
1898	Nasolabial flap reintroduced	By Gustavo Passavant for nasal reconstruction ¹⁴
~1900	Abbé flap report	Robert Abbé's labial flap widely publicized ¹⁵
1906	Muscle flaps introduced	Louis Ombredanne (pectoralis minor), Iginio Tansini (latissimus dorsi) ¹⁶
1912	First myocutaneous flap in Italy	Introduced by Stefano d'Este ¹⁶
1917	Major facial reconstructions	Harold Gillies' work on Walter Yeo during WWI ¹²
1918	Palatal fistula closure	By Esser using nasolabial flap ¹⁷
1921	Surgical microscope innovation	Carl-Olof Nylén pioneered microsurgical tools ¹²
1930s	Rediscovery of Manchot's work	William D. Morain republished anatomical research ¹³
1965	Subcutaneous pedicled nasolabial flap	Barron and Emmet used for nasal ala reconstruction ¹²

Year/Period	Event/Innovation	Details
1971	Flap vascular supply theory	Stuart Milton on pedicle-based survival ¹⁸
1972	Axial and groin flaps	Described by Ian McGregor
1981	Fasciocutaneous flaps	First harvested by Bengt Pontén ²⁰
1989	Perforator flap foundation	Koshima and Soeda highlighted microvasculature ²¹
Early 1900s	Expansion by Morestin	Improved nasolabial techniques for facial defects ²²
Mid-20th Century	Standardized techniques	Advanced by Harold Gillies and contemporaries ¹²
Late 20th Century	Improved imaging	CT, X-ray aided flap planning ¹²
21st Century	Combined CT/3D tech	Used for accurate flap orientation and results ¹²
Present	Ongoing innovations	Incorporation of stem cells, personalized surgery, and low-morbidity reconstructions ²³

Table 1: Tabular Representation Tracing Evolution of Nasolabial Flap Over Years.

Anatomy and Vascularity

The success of the nasolabial flap lies in its robust blood supply (Figure 1: Vascular supply of Nasolabial flap), vascularized by branches of the facial artery, including the angular and inferior labial arteries, the flap ensures excellent perfusion, even in patients with compromised vascular health.²⁴ This reliability reduces the risk of ischemia and necrosis, enhancing postoperative outcomes.²⁵

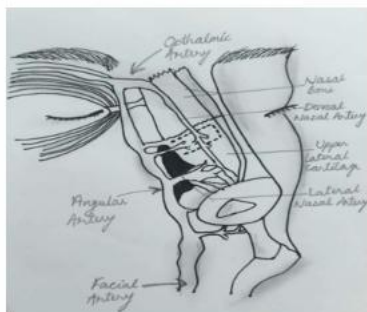


Figure 1: Vascular supply of Nasolabial flap

Depending on the defect's location, the flap can be designed as superiorly or inferiorly based, allowing surgeons flexibility in addressing various reconstructive needs. Superiorly based flaps are ideal for defects in the upper lip and nasal region, while inferiorly based flaps are suited for reconstructing the lower lip and intraoral tissues (as shown in Figure 2,3).⁷



Figure 2: Superiorly based Nasolabial flap



Figure 3: Inferiorly based Nasolabial flap

Applications and Benefits

- 1. Functional Restoration :** Nasolabial flaps provide well vascularized tissue, essential for promoting healing in compromised areas. In cases of oral submucous fibrosis, for example, they help improve mouth opening and oral functions.²⁶
- 2. Aesthetic Outcomes :** The flap matches the color and texture of the surrounding facial skin, ensuring minimal scarring and natural contours.²⁷
- 3. Versatility :** From tumor resection sites to congenital anomalies like cleft palate, nasolabial flaps address defects of varying size and complexities.²⁸
- 4. Accessibility :** The relatively straightforward harvesting technique, combined with its regional nature, minimizes operative time and donor site morbidity when compared to free flaps requiring microvascular anastomosis.²⁹

Challenges and Limitations

Despite its advantages, nasolabial flaps have their own setbacks such as in cases of larger defects, its tissue availability may be limited. Additionally, in patients with previous radiation therapy, scarring, vascular compromise; the flap's viability might be affected. Meticulous planning and patient selection are key to overcoming these limitations.³⁰

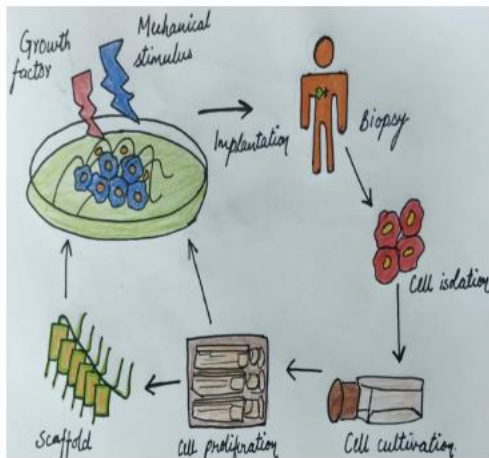


Figure 4: Role of Stem cell

Discussion

Over the years, a variety of surgical techniques have been promoted and used with the primary goal of giving the patient functional comfort. The recurrence of contracture following release of fibrous bands and split-thickness skin grafting is high in operated oral submucous fibrosis cases. The limitations of using island palatal flaps as observed by Khanna et al., included the need to extract maxillary second molars to cover the defect with the flap under no tension however limited donor tissue prevents extensive flap reach. This also lead to scarring at the donor site by fibrosis.³¹

In addition to causing severe dysphagia and disarticulation, the bilateral tongue flaps increase the risk of aspiration following surgery. Uncontrolled tongue movements frequently results in dehiscence and instability of tongue flaps.³² After the fibrous bands are removed, the flaws can potentially be covered with buccal fat pads. The access to the buccal fat pad is easy and harvesting it is straightforward. Nonetheless, substantial shrinkage of the buccal fat pads has been seen by several writers in chronic illness patients. Furthermore, the area anterior to the cupid must be left raw because the buccal fat pad's anterior reach is frequently insufficient.²⁰ This raw area undergoes fibrosis after healing by secondary intention, which causes a slow recurrence. Forty percent of patients require additional debulking procedures, free tissue transfer facilities are not always available. Adding to the limitations of flap which don't hold pleasant aesthetics in these area are bilateral radial forearm free flaps as they are hairy.³³

Tauro D.P in the year 2009, conducted a study in which one hundred and seventy flaps were performed in 85 patients with bilateral submucous fibrosis. In this central subcutaneous pedicle, was preferred over the last ten years and followed up for a mean period of five and a half years.²⁵ The flap was referred to as "sea gull nasolabial flap," which offers outstanding features, providing supple soft tissue lining and adequate flexibility to the cheek, thus facilitating excellent mouth opening on a long-term basis.

R.M. Borle in the year 2008, evaluated the use of extended nasolabial flaps and coronoidectomy in the management of 47 randomly selected patients with oral submucous fibrosis and concluded that the use of extended nasolabial flap provides a long-term, relapse-free, and economical option.²⁴

In the study conducted by R. Kshirsagar et al. in 2009, found that none of the flaps showed partial or complete flap loss, bulky appearance of the flap in 16.6% of their cases where no further management was employed as the patient had no complaints however the bulkiness reduced over a period of 2 months. and hypertrophic scar in 33.3% which required scar revision after 3 months.²² Five (17.2%) among the 29 flaps had visible scar at the donor site postoperatively upto 3 months. With the flap acceptance rate at 100%.²² In the year 2011, Mohit agrawal et al. performed a study in which they encountered intraoral hair growth in men, they experienced mild discomfort which was managed by plucking the hairs under topical anesthesia.³⁵

Conclusion

The nasolabial flap exemplifies the harmony between function and aesthetics in reconstructive surgery. Its adaptability, reliability, and effectiveness make it a preferred choice for oral and maxillofacial surgeons.³⁶ As techniques continue to evolve, this humble flap is poised to play an even more significant role in restoring both form and function to patients in need. Its enduring legacy is a testament to the ingenuity and dedication of surgeons throughout history.³⁷

Innovations and Future Directions

Recent advancements are further enhancing the scope of nasolabial flaps. The integration of three-dimensional imaging and Doppler ultrasound is refining preoperative planning, ensuring precise flap design and placement.³⁸ Moreover, regenerative techniques involving stem cells and bioengineered tissue (Figure 4: Role of Stem cell) hold promise in augmenting the flap's utility in complex cases.³⁹

Minimally invasive techniques, such as endoscopic-assisted harvesting, are being explored to reduce donor site morbidity and improve aesthetic outcomes.⁴⁰ These innovations, coupled with the flap's inherent benefits, are cementing their role as a mainstay in reconstructive surgery.⁴¹

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The Techniques for Zygomatic Implant : A Literature Review

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Received on: 06 March 2025; Accepted on: 21 March 2025; Published on : 19 April 2025

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Abstract

Zygomatic implants have emerged as a reliable solution for the rehabilitation of severely atrophic maxillae, especially in cases where conventional dental implants are not feasible without extensive bone grafting. This literature review aims to explore and critically evaluate the various surgical techniques employed in the placement of zygomatic implants, including the original Brånemark technique, the Zygoma Anatomy-Guided Approach (ZAGA), and other contemporary modifications. Emphasis is placed on surgical protocols, anatomical considerations, prosthetic implications, clinical outcomes. The review highlights the evolution of surgical strategies aimed at improving implant stability, reducing morbidity, and optimizing patient-specific treatment planning. The objective of the present chapter is to present a timeline of the zygomatic implant technique. A literature review was performed to find relevant studies and to put them in chronological order to obtain a general perspective of the advances and evolution of the technique. By synthesizing current evidence, this paper provides clinicians with a comprehensive understanding of zygomatic implant techniques and guides future directions for clinical practice and research.

Keywords : Zygomatic implants, maxillary atrophy, osseointegration, maxillofacial rehabilitation, dental implants, oncology, congenital defects, surgical techniques, bone grafting.

Introduction

In cases of significantly resorbed maxillary bone, maxillary rehabilitation with osseointegrated implants is more difficult due to the close proximity of the maxillary sinus, nasal cavity, and deficient bone volume. In 1965, the osseointegration principle applied to the edentulous patient. Bone graft taken from the proximal metaphysis of the tibia and inserted in the edentulous maxilla and mandible. Approximately 20% of the population over 18 years of age presents an absence of any posterior teeth in the maxilla. The frequency of edentulism is 35 times higher in the posterior maxilla than in the mandible.¹

Patients with severe maxillary atrophy in addition to maxillary sinus pneumatization usually require alveolar ridge height and thickness for endosseous implant placement. In the posterior maxilla, implant placement usually requires bone grafting in the maxillary sinus floor.

Placement of implant in posterior region of maxillary bone, becomes difficult because of inadequate visual access and surgical competence. The quality of the bone tissue that

will receive the implants is another crucial element for a successful rehabilitation with osseointegrated implants.²

The quality of the bone tissue that will receive the implants is another crucial element for a successful rehabilitation with osseointegrated implants. Conventional implant treatment difficult to performed in the edentulous maxilla because of inadequate amount of bone for the anchorage of implants. But alternative procedures such as zygomatic implants have been developed to overcome these challenges.

Thus, to pursue alternatives to grafting procedures as well as to avoid the need for sinus lift procedures in individuals with severe maxillary atrophy, zygomatic implants were introduced in 1988 by Prof. Brånemark.³

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<https://doi.org/10.5281/zenodo.15253778>

How to cite this article : Prabhale et al. - Heal Talk A Journal of Clinical Dentistry. (2025). The Techniques for Zygomatic Implant : A Literature Review. In Heal Talk A Journal of Clinical Dentistry (Vol. 17, Number 4, pp. 44-51). Zenodo. <https://doi.org/10.5281/zenodo.15253778>

Then, a new era in implant dentistry began, one in which patients who had lost all of their teeth may once again be able to chew, smile, and function in society without having to undergo drastic bone grafts that would have left them with severe morbidity and sequelae.

Methods

An electronic search was performed in the PubMed search engine, with articles until the year 2018 using the terms: zygomatic, zygomatic implants, intra-sinus technique, extra sinus and immediate loading, to identify follow-up studies, prospective and retrospective studies of placement of zygomatic implants. We excluded articles with follow-up of less than five months, and articles that presented only a case report without proper follow-up. After inclusion of the articles, these were placed in chronological order for a better understanding of the evolution of zygomatic implants.

Anatomy of Zygomatic Bone

The paired, irregular zygomatic bone (also called the zygoma) determines the anterior and lateral aspects of the face. The zygomatic complex is important in maintaining the shape of the cheek bones and face as well as the contents of the orbit. The orbit floor, the prominence of the cheeks, a section of the lateral wall, and parts of the temporal and infratemporal fossa are formed by the two irregularly diamond-shaped zygomatic bones that project laterally. The zygomatic bone can be divided into two or more sections by additional sutures, although it is normally a single bone limited by sutures that articulate with the frontal, maxilla, temporal, and sphenoid bones (Fig.1). The pressure of mastication and the transmission of reactionary forces from the maxilla can be tolerated by the zygomatic bone.²

The zygoma bone presents trabecular bone, useful for osseointegration and strong cortical bone useful for primary stabilization of zygomatic implant. The advantage of tilted implants is to reduce the length of prosthetic cantilevers, but that the stresses and strains will be larger with tilted implants than with straight implants. The specific benefit, therefore, of zygomatic implants is that the anchorage is not at the maxillary level but in the zygoma.³

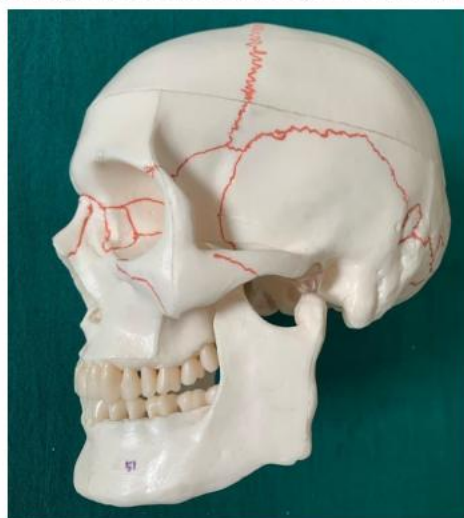


Fig. 1 : Lateral View of Skull - A. The Zygomatic Bone, B. Zygomatico-temporal Suture, C. Fronto-zygomatic Suture, D. Zygomatico-maxillary Suture.

Zones of maxilla

The maxillary bone can be split into three zones, according to Bedrossian et al.⁴ : Zone I, which is the premaxilla; Zone II, which is the premolar area; and Zone III, which is the molar area (Table 1).

The availability of bone in each of the three zones should be ascertained by the clinician. The amount of bone in these zones and the zygomatic arch can be measured in both horizontal and vertical dimensions using cone beam computed tomography. Further more, any pathology in the maxillary sinuses or these regions must be confirmed prior to surgery. When there is sufficient bone in zones I and II, the surgeon may think about using four to six conventional implants, tilting the farthest implant on each side to distribute the load evenly (Table 2).

Zones	Region
I.	Premaxilla
II.	Premolar
III.	Molar

Table 1. Zones of maxilla

Presence of bone	Surgical Approach
Zones I, II and III	Traditional (axial) implants
Zones I and II	Four traditional implants (tilted)
Zone I only	Zygomatic implants plus two or four traditional implants
Insufficient bone	Four zygomatic implants

Table 2. Treatment recommendations based on the presence of bone in the different zones of the maxilla

The zygomatic bone is nearly quadrangular in shape and each point of this quadrangular bone unites with particular facial bone. The zygomatic bone can be divided into multiple sections. Based on these points, a grid was formed and superimposed over the zygomatic bone, and the sections that contained a portion of the maxillary bone were labeled 1 to 13. Sections 5, 6, 8, and 9 were the sections with the best potential for implant placement (Fig. 2).⁵

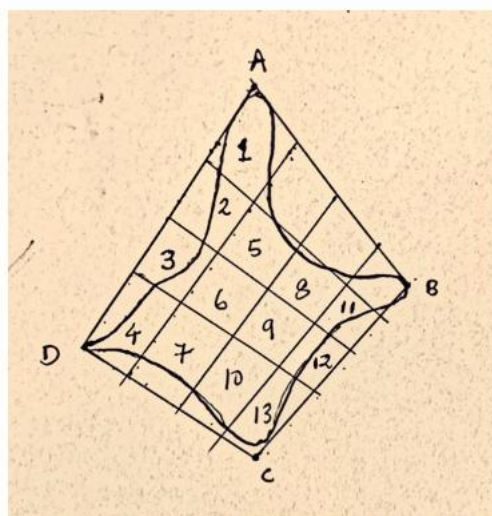


Fig. 2: Schematic representation of various sections of zygomatic bone. Point A articulates with the frontal zygomatic process. Point B articulates with the maxillary zygomatic process on its superior border. Point C articulates with the maxillary zygomatic process on its inferior border. Point D articulates with the temporal zygomatic process. Based on these points, a grid was formed and superimposed over the zygomatic bone, and the sections that contained a portion of the maxillary bone were labeled 1 to 13. Sections 5, 6, 8, and 9 were the sections with the best potential for implant placement.

Zygomatic Anatomy Guided Approach (Zaga)

The initial approach with an intra-sinus route causes excessive palatal emergence of the implant head in individuals with prominent buccal concavities on the lateral aspect of the maxillary sinus.

The zygomatic anatomy-guided approach (ZAGA), a variation on the original zygomatic implant technique that emphasizes inter-individual anatomic variability. Cone beam computed tomography is now used to guide the preparation of the implant site, and no initial window or slit is opened at the lateral wall of the maxillary sinus.⁶ The anterior maxillary wall is very flat. The first osteotomy is placed on the residual alveolar crest. The implant body reaches the zygoma bone following an intrasinus path (Fig. 3). The desire to place the implant head in the correct prosthetic site, together with the presence of a slightly concave anterior maxillary wall, caused the implant osteotomy to perforate the maxillary wall. Regardless, most of the implant body remained inside the maxillary boundaries (Fig. 4).

In the presence of a more concave maxillary wall, ideal placement of the implant head forced most of the implant body to be placed extra-sinusally. However, no space was left between the implant surface and the anterior maxillary bone (Fig. 5). As a result of a very concave maxilla, the first osteotomy performed from the palatal side of the alveolar crest went out buccally to the maxillary bone until it reached the zygoma in a more cranial position. The middle part of the implant does not touch the bone (Fig. 6). The atrophied maxilla presented both vertical and horizontal resorption. To place the implant head in an optimal location, while avoiding perforation of a very thin palate, the surgeon had to choose an extra-maxillary path (Fig. 7).⁷



Fig. 3 : ZAGA type 0



Fig. 4 : ZAGA type 1



Fig. 5 : ZAGA type 2

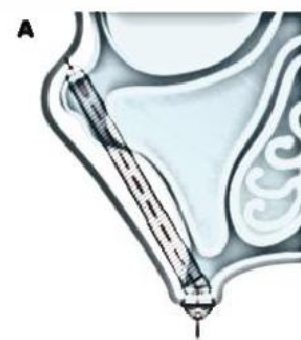


Fig. 6 : ZAGA type 3

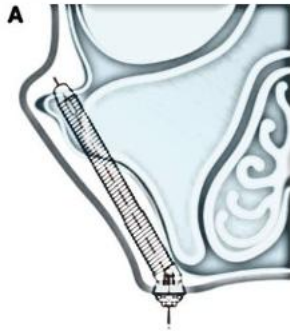


Fig. 6 : ZAGA type 4

Discussion

The initial approach presented forth by P.I. Branemark called for a vestibular incision that would resemble a Le-Fort I incision and involve periosteal detachment from the medial aspect of the zygomatic bone and zygomatic arch. Following that, two windows (antrotomies) were created in the maxillary sinus's lateral wall, and the Schneider membrane was detached along the implant insertion path, regardless of the membrane's integrity, to allow for the posterior placement of intra-sinus zygomatic implants.³

These implants were completely internal to the maxillary sinus and were anchored in the medial portion of the zygomatic bone. But the main issue with the Branemark procedure was the implant's palatal exit, which was positioned in an unsatisfactory three-dimensional position on the palate. This led to significant issues with phonetics, comfort, and cleanliness and negatively impacted the prosthesis's configuration going forward.

Due to these challenges, Stella and Warner⁴² modified the original procedure in 2000. Previously, the implant was completely inside the maxillary sinus; slots were created in the sinus's external wall, which helped to partially address the main issue of the implant head's positioning (prosthetic positioning). Nevertheless, two thirds of the implant remained inside the sinus, and

the remaining third was outside, closing the slot and inserting the implant into the zygomatic bone's medial wall. This improved prosthetic positioning compared to Branemark's technique, leaving the implant less palatally for future prosthesis placement.

Aparicio et al.²⁶ reported their 10-year follow-up clinical study in 2014. The study included 41 zygomatic fixations performed in two surgical stages (traditional loading) using the intrasinus technique⁸ (Table 3). A perimplant infection led to the removal of two zygomatic implants.

A 95.12% success rate was maintained by all patients with functional prosthesis. Utilizing the extrasinus technique since 2003, Miglioranca et al.³³ published the application of the extrasinus placement technique (Miglioranca Technique) in the literature for the first time in 2007 (Table 4). Better prosthetic alignment, less invasive surgery, better postoperative care, a shorter surgical time, the absence of an antrotomy, and improved surgical visualization were all made possible by the externalized approach in relation to the zygomatic fixations. The idea was to change the method that Stella & Warner had previously recommended.

In 2012, Miglioranca et al.³⁸ published a prospective cohort research with an eight-year follow-up in the literature (Table 4). Wherein the immediate loading of the provisional prosthesis was assessed in conjunction with the evaluation of 40 extrasinus zygomatic implants and 74 conventional implants. The success rate of metal reinforced prosthesis was 95.2%, while the success rate of extrasinus zygomatic implants was 97.5% (one implant was removed) and 95.9% for conventional anterior implants (three implants failed during the study period). The surgical approach is dictated by the maxillary bone volume availability and the prosthetic demands upon which the implant layout is chosen. Recently, the development of micro CT technology has allowed precise determination of the internal structure of bone. This method has been shown to be superior to conventional techniques in terms of factors that influence tissue and time. It is very useful for observing the 3-dimensional internal structure of bone.

Table 3. Studies Performed The Intrasinusual Technique

S. No	Author (Year)	Numbers of ZI	Follow-up	ZI success rate
1.	Bedrossian et al. (2002)8	44	34 months	100%
2.	Branemark et al. (2004)3	52	5 to 10 years	94%
3.	Hirsch et al. (2004)9	145	1 year	97.9%
4.	Malevez et al.(2004)10	103	6 to 48 months	100%
5.	Becktor et al. (2005)1	31	9 to 69 months	90.3%
6.	Penarrocha et al. (2005)11	10	12 to 18 months	100%
7.	Landes (2005)12	28	14 to 53 months	82%
8.	Aparicio et al. (2006)13	131	6 to 60 months	100%
9.	Kahnberg et al. (2007)14	145	3 years	96.3%
10.	Davo et al. (2007)15	36	6 to 29 months	100%
11.	Duarte et al. (2007)16	48	30 months	97.9%
12.	Mozzati et al. (2008)17	14	24 months	100%
13.	Davo et al. (2008)18	81	12 months	100%
14.	Balshi et al. (2009)19	110	9 to 60 months	96.37%
15.	Davo et al. (2009)20	45	60 months	97.4%
16.	Aparicio et al. (2010)21	47	2 to 5 years	100%
17.	Stievenart et al. (2010)22	80	6 to 40 months	96%
18.	Bedrossian (2010)23	74	7 years	97.3%
19.	Davo et al. (2013)24	81	60 months	98.5%
20.	Davo et al. (2013)25	68	36 months	100%
21.	Aparicio et al. (2014)26	41	10 months	95.12%
22.	Fernandez et al. (2014)27	244	6 to 48 months	99.6%
23.	Rodriguez-Chessa et al. (2014)28	67	10 to 40 months	79.1%
24.	Yates et al. (2014)29	43	5 to 10 years	86%
25.	Davo et al. (2015)30	68	60 months	100%
26.	Araujo et al. (2016)31	27	15 to 5 months	100%
27.	Araujo et al. (2017)32	129	12 months	98.44%

Table 4. Studies Performed The Extrasinus Technique

S. No	Author (Year)	Numbers of ZI	Follow-up	ZI success rate
1.	Miglioranca et al. (2007) ³³	152	48 months	98.68%
2.	Malo et al. (2008) ³⁴	67	6 to 18 months	98.5%
3.	Aparicio et al. (2010) ³⁵	36	36 to 48 months	100%
4.	Miglioranca et al. (2011) ³⁶	150	12 months	98.7%
5.	Malo et al. (2012) ³⁷	92	36 months	100%
6.	Miglioranca et al. (2012) ³⁸	40	8 years	97.5%
7.	Malo et al. (2014) ³⁹	92	60 months	98.8%
8.	Malo et al. (2015) ⁴⁰	747	6 months to 7 years	98.2%
9.	Coppede et al. (2017) ⁴¹	92	36 months	98.9%

Conclusion

Zygomatic implants represent a significant advancement in the management of severely resorbed maxilla and maxillofacial defects. By providing an alternative to extensive grafting procedures, zygomatic implants offer a more efficient and less invasive option for restoring function and aesthetics in affected patients.

Zygomatic implants represent a pivotal advancement in the rehabilitation of the atrophic maxilla, offering a graftless alternative with high success rates and patient satisfaction. The evolution of surgical techniques from the original Brånemark method to the more anatomically adaptive ZAGA approach reflects a growing emphasis on minimizing complications, enhancing prosthetic outcomes, and tailoring treatment to individual anatomical variations. While all techniques aim to achieve predictable osseointegration and functional restoration, each comes with its own set of indications, challenges, and risk profiles. Careful patient selection, thorough anatomical assessment, and adherence to a technique that aligns with the patient's specific needs are critical for long-term success. Continued research and clinical innovation are essential to refine existing protocols and further improve outcomes in zygomatic implantology.

Preference for one surgical technique over the other should take into consideration the concavity formed by the ridge crest, maxillary sinus, and region of implant insertion in the zygomatic bone. When the maxilla is severely resorbed, this concavity is small, and the original classical technique should be used. When maxillary resorption generates a large concavity, it would be better to exteriorize the ZI. The externalized technique could be considered one of the best surgical approaches, as has fewer surgical steps than the classical and sinus slot methods, is less invasive, and reduces surgical time.

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Nature's Remedy : The Role of Herbal Medicine in Modern Dentistry

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Received on: 23 February 2025; Accepted on: 26 February 2025; Published on : 19 April 2025

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Introduction

Medicinal plants have been utilized for centuries in both medical and dental fields and remain widely employed across the globe. Their anti-inflammatory, antibacterial, and antioxidant properties, coupled with their biocompatibility, contribute to the increasing interest in herbal medicine.²

Globally, over 90% of school-aged children and many adults suffer from dental caries, highlighting the necessity for improved diagnostic and treatment methods, particularly for pediatric patients³. Meanwhile, the misuse and overuse of antibiotics continue to rise, raising concerns about resistance and safety. Research on dental irrigants reveals limitations and side effects of synthetic agents. For instance, chlorhexidine (CHX) is known to cause tooth discoloration, an unpleasant burning sensation, and temporary loss of taste⁴. Sodium hypochlorite is associated with allergic reactions and tissue toxicity, while calcium hydroxide is ineffective at completely eliminating bacteria from dental tubules².

Additionally, access to synthetic medications is not universal, particularly in developing regions, prompting many to turn to herbal alternatives. In the United States, a 2007 study revealed that 12% of children used alternative medicine, with 5% specifically using plant-based treatments⁵. Given the diverse composition and effects of different plants, this review focuses on various medicinal plants commonly used in dentistry, particularly paediatric dentistry. It aims to explore their advantages and potential side effects, promoting the safe and effective use of herbal medicines in treating oral health conditions in children.

Materials and Method

A Literature Review were performed using the Medline, PubMed and Google Scholar databases and books published in

english with the following search keywords “medicinal plant”, “herb”, “phytotherapy”, “dentistry” and “pediatric”.

Overview of Plant-Based Applications in Dentistry

Plants have played a pivotal role in various aspects of dentistry, contributing to treatments and materials across multiple specialties. For instance:

- **Periodontics:** Aloe vera (medicinal aloe) helps reduce gingival bleeding and inflammation, while *Azadirachta indica* (neem) decreases plaque accumulation. *Pistacia atlantica* (mastic tree) exhibits antimicrobial properties against gingival microorganisms, and *Salvadora persica* (miswak) promotes improved gingival health^{6,7}.
- **Endodontics:** *Morinda citrifolia* (Indian mulberry)⁸, and propolis are employed as irrigants. Propolis is also useful for pulp capping⁹, while *Arctium lappa* (greater burdock)¹⁰ and *Curcuma longa* (turmeric) serve as intracanal medicaments. Turmeric, in particular, aids in endodontic retreatment by dissolving and softening gutta-percha¹¹.
- **Oral and Maxillofacial Surgery:** Products like Ankaferd Blood Stopper®, derived from *Glycyrrhiza glabra* (licorice), *Vitis vinifera* (grapevine), *Alpinia officinarum* (lesser galangal), *Thymus vulgaris* (thyme), and *Urtica dioica* (nettle), are used to manage bleeding. Similarly, aloe vera-based SaliCept patches help reduce the incidence of alveolar osteitis¹².
- **Management of Oral Lesions:** Various medicinal plants are studied for treating

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<https://doi.org/10.5281/zenodo.15253814>

How to cite this article : Mohit et al. - Heal Talk A Journal of Clinical Dentistry. (2025). Nature's Remedy : The Role of Herbal Medicine in Modern Dentistry. In Heal Talk A Journal of Clinical Dentistry (Vol. 17, Number 4, pp. 52–56). Zenodo. <https://doi.org/10.5281/zenodo.15253814>

oral conditions. *Melissa officinalis* (lemon balm) and *Mentha piperita* (peppermint) are effective against herpetic lesions, with the latter showing strong virucidal activity against HSV-1 and HSV-2²³⁻²⁴. *Candida albicans* infections can be treated with *Coriandrum sativum* (coriander)²⁵, while *aloe vera* and *Portulaca oleracea* (purslane) are beneficial for managing lichen planus²⁶.

Phytotherapy in Pediatric Dentistry

The use of medicinal plants in pediatric dentistry has gained popularity, driven by the perception that they are gentler alternatives to invasive procedures and synthetic medications, with fewer adverse effects. This growing preference has encouraged the exploration of various plant-based properties for treating children.

Preventing Dental Caries

The prevalence of dental caries, combined with the expense of treatment, underscores the importance of preventive measures. Antibacterial agents and fluoride-based products play a crucial role in this effort. Research indicates that certain plants, through their secondary metabolites, can enhance microbial sensitivity. Additionally, they can prevent dental caries by suppressing bacterial growth and acid production, inhibiting bacterial adhesion to tooth surfaces, and blocking the synthesis of exopolysaccharides. For example, some of these plants are mentioned below:

Allium sativum (Garlic) Garlic is known to boost the immune system, lower blood pressure, and reduce cholesterol production in the liver. It is commonly used to manage conditions such as asthma, arthritis, atherosclerosis, and various circulatory and digestive issues. Forms such as fresh garlic oil, raw cloves, and odourless extracts are utilized.²⁰ Research attributes its antibacterial properties to allicin, a key compound in garlic. It has been shown to inhibit the growth of *Streptococcus mutans*, reduce acid production, and stimulate saliva secretion, making it beneficial in the prevention and management of dental caries²⁹.

Azadirachta indica (Neem) Neem has been found to reduce the occurrence of early dental caries and can reverse its progression, showing effectiveness comparable to chlorhexidine by lowering *Streptococcus mutans* levels²¹. It possesses antibacterial properties and acts as a biocompatible antioxidant. Studies reveal that it inhibits the growth of *Streptococcus mutans*, *Streptococcus mitis*, *Streptococcus sanguinis*, and *Streptococcus salivarius*³².

Curcuma longa commonly known as turmeric, possesses antioxidant, anti-inflammatory, and antimutagenic properties. Its use as a mouthwash has been shown to provide quick pain relief. Applying turmeric directly to an aching tooth can alleviate discomfort, while a paste made with turmeric, mustard, and salt is beneficial for managing gingivitis and periodontitis³³. Turmeric also exhibits potent antibacterial activity against *Streptococcus mutans* biofilm, demonstrating efficacy comparable to chlorhexidine (CHX). This makes it a promising agent for preventing dental caries.

Mentha piperita, commonly known as peppermint, has historically been used to treat conditions affecting the stomach, intestines, and muscles, as well as to enhance blood circulation. Today,

it is also employed to address ailments such as colic, fever, nausea, and diarrhea. Its chemical constituents include menthol and methyl acetate. In dentistry, peppermint is used topically to alleviate dental pain and as a mouthwash to reduce gum inflammation³³. Another study found that peppermint oil exhibited local virucidal effects against herpes simplex viruses (HSV-1 and HSV-2)²⁴.

Pistacia atlantica, a member of the *Pistacia* genus, has various parts, such as its resin, leaves, fruit, and aerial components, utilized for medicinal purposes. In Iran, the resin, known as Saqqez, is commonly used as a mouth freshener, antiseptic, and gum tissue fortifier. It is also available as chewing gum to address gastrointestinal issues and motion sickness³⁵.

Storage Media for Avulsed Teeth

When a tooth is avulsed, it is crucial to store it in an appropriate medium to preserve its viability until replantation at a dental office. Common storage media include milk, saliva, and Hank's Balanced Salt Solution (HBSS)³⁸.

Camellia sinensis (Green Tea Extract)

- Green tea extract has proven to be as effective as Hank's Balanced Salt Solution (HBSS) in preserving the viability of periodontal ligament (PDL) cells⁴⁰.

Cocos nucifera (Coconut)

- Research indicates that skimmed and whole milk, natural coconut water, and HBSS are effective in maintaining the viability of PDL fibroblasts⁴¹.

Morus rubra (Red Mulberry)

- Studies show that red mulberry juice at concentrations of 2.5% and 4% outperforms HBSS in preserving PDL cells for 3, 6, and 12 hours. A 4% concentration has been found equally effective as HBSS for up to 24 hours, making it a suitable storage medium⁴².

Salvia officinalis (Garden Sage)

- Contains alpha and beta-thujone, camphor, cineole, rosmarinic acid, tannins, and flavonoids. Commonly used in modern European herbal medicine for treating sore throat and gum inflammation. Its antibacterial, antifungal, and antiviral properties make sage extract effective as a storage medium, particularly at a 2.5% concentration, for maintaining PDL viability⁴³.

Propolis

- In vitro studies on dogs demonstrate that propolis is as effective as milk for preserving PDL cell viability. It has been shown to maintain avulsed teeth for up to 6 hours as an appropriate storage medium⁴⁶.



Camellia Sinensis (Green Tea Extract)



Morus rubra (Red Mulberry)



Salvia Officinalis (Garden Sage)



Commiphora Myrrha



Curcuma longa



Pistacia atlantica

Endodontic Treatment in Primary Teeth

Maintaining primary teeth during the primary and mixed dentition stages is crucial for ensuring proper space maintenance. Additionally, preserving the health of primary teeth supports the development of permanent teeth⁴⁷. When other options are not viable, endodontic treatment serves as the final approach to retaining primary teeth. Various materials such as zinc oxide eugenol, iodoform-based pastes, and calcium hydroxide are commonly used for endodontic procedures in primary teeth⁴⁹. Medicaments such as formocresol, calcium hydroxide, glutaraldehyde, enriched collagen solution, ferric sulfate, and mineral trioxide aggregate are employed in pulpotomy⁵¹. In another study, propolis and mineral trioxide aggregate were found to be more biocompatible than formocresol and ferric sulfate⁵². For vital pulpotomy in primary molars, formocresol and Ankaferd Blood Stopper® have demonstrated success as pulp-dressing agents in follow-ups extending up to 12 months⁵³. Furthermore, it has been observed that *Allium sativum* (garlic) oil exhibits stronger effects compared to formocresol on the infected pulp of primary non-vital molars⁵⁴. Nonetheless, further research is required to solidify these findings.

Mouthwashes are an effective and convenient way to enhance oral hygiene. Plant-based compounds such as *Salvia officinalis* (sage), *Mentha piperita* (peppermint), menthol, *Matricaria chamomilla* (chamomile), *Commiphora myrrha* (myrrh), *Carum carvi* (caraway seed), *Syzygium aromaticum* (clove), and *Echinacea purpurea* (purple coneflower)⁵⁶ can be utilized in oral rinses to help lower the gingival index⁵⁵.

Adverse Effects

The side effects and toxicity of medicinal plants can be discussed both generally and specifically for each plant. These factors depend on elements such as their chemical composition, potential contaminants, and adulterants. Additionally, certain plants may exhibit synergistic effects when used together. Another critical consideration is the concentration of active compounds within a plant, which can fluctuate depending on the plant part used, the timing of harvest, and environmental factors such as soil and weather conditions. This variability makes the dosage of active compounds inconsistent and unpredictable, particularly in children. Children are especially sensitive due to their smaller body size and reduced detoxification capabilities. Their absorption, digestion, metabolism, and excretion processes differ from those of adults, and their developing liver impacts their ability to detoxify substances. Therefore, it is essential to carefully evaluate the potential side effects and toxicity of medicinal plants before using them in children⁵⁹.

Conclusion

The growing reliance on medicinal plants can be attributed to the side effects and limitations of synthetic drugs, as well as the affordability, accessibility, and biocompatibility of plant-based remedies. However, further research is needed to identify appropriate medicinal plants, their applications, and optimal dosages, particularly for children, to better understand their potential toxicity and side effects.

Acknowledgment

None.

Conflict of Interest

None.

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Magnetic Resonance Imaging (MRI)

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Received on: 24 March 2025; Accepted on: 27 March 2025; Published on: 19 April 2025

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Abstract

Over the past 30 years, Magnetic Resonance Imaging (MRI) has evolved from a promising technology to a cornerstone of diagnostic imaging. Initially confined to neuroimaging, its applications now encompass the entire body, significantly enhancing diagnostic accuracy across multiple medical specialties. With an expanding knowledge base, MRI is increasingly used either independently or in combination with other imaging modalities to improve diagnostic certainty. This article provides a concise historical overview of MRI, explores its fundamental principles, discusses its advantages and disadvantages, and highlights its broad clinical applications, emphasizing its critical role in modern medical diagnostics and patient care.

MRI

*“Things should be made as simple as possible
-but not simpler.”*

Albert Einstein

MRI has been hailed as one of the most significant advancements in medical diagnosis since the discovery of the x-ray a century ago. Now a cornerstone of radiology, it is applied to nearly every part of the body. Yet, despite its remarkable capabilities, many radiologists hesitate to delve into it. The reason? Physics. The complexities of MRI physics can be daunting, especially for those attempting to grasp its principles without a solid foundational understanding. Without mastering these basics, an MR clinician risks merely “going through the motions” rather than truly comprehending the physical mechanisms behind signal changes in the images. The origins of MRI can be traced back to the mid-20th century when physicists Edward Purcell and Felix Bloch independently discovered the phenomenon of nuclear magnetic resonance (NMR) in 1946. Their ground breaking work revealed the magnetic properties of atomic nuclei a discovery that would later become the foundation of modern medical imaging. In recognition of their contributions, Purcell and Bloch were awarded the Nobel Prize in Physics in 1952.¹

Principle

Magnetic resonance phenomena can be described using both classical and quantum mechanical approaches. Magnetic resonance imaging (MRI) is based on the principles of nuclear magnetic resonance (NMR). In an MRI scanner, the nuclear spins of hydrogen atoms in the patient are first aligned by a strong magnetic field. Radiofrequency pulses then excite these nuclei, causing them to precess in unison. Initially, the nuclei emit strong electromagnetic signals, but over time, small variations in local magnetic fields cause their spins to lose synchronization. This desynchronization leads to a gradual decay of the combined signal, a process known as relaxation.

To acquire an image, a gradient field is applied along a specific direction (X, Y, or Z) to select a slice of interest. Additional magnetic field gradients along three orthogonal directions are then used to spatially encode the signals. Finally, the acquired signals undergo Fourier transformation to reconstruct a two-dimensional or three-dimensional image.²

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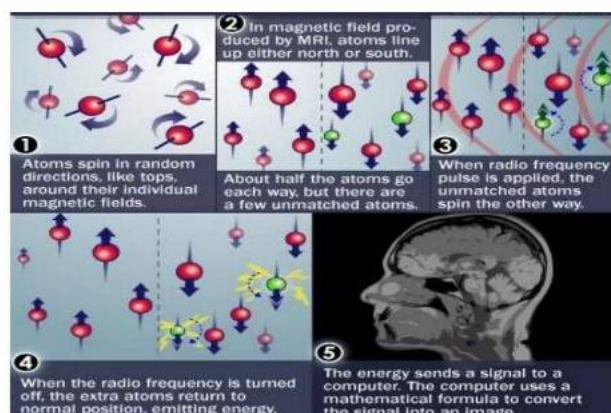
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<https://doi.org/10.5281/zenodo.15253842>

How to cite this article : Yadav et al. - Heal Talk A Journal of Clinical Dentistry. (2025). Magnetic Resonance Imaging (MRI). In Heal Talk A Journal of Clinical Dentistry (Vol. 17, Number 4, pp. 57-60). Zenodo. <https://doi.org/10.5281/zenodo.15253842>



Principle of MRI

MRI requires a magnetic field that is both strong and highly uniform, with variations limited to just a few parts per million across the scan volume. The field strength of an MRI magnet is measured in teslas (T). While most clinical MRI systems operate at 1.5 T, commercial systems range from 0.2 T to 7 T. 3T MRI systems, also known as 3 Tesla MRIs, have stronger magnets than 1.5T systems and are particularly advantageous for imaging organs and soft tissues. In research applications, whole-body MRI systems operate at even higher field strengths, such as 9.4 T, 10.5 T, and 11.7 T.³

Lower field strengths are also utilized in portable MRI scanners, including a system approved by the FDA in 2020. More recently, MRI has been demonstrated at ultra-low fields-ranging from the microtesla to millitesla scale-where sufficient signal quality is achieved through prepolarization (typically in the range of 10–100 mT) and the detection of Larmor precession fields around 100 microtesla using highly sensitive superconducting quantum interference devices (SQUIDS).^{4,5,6}

Indications

Neurological Disorders

Magnetic Resonance Imaging (MRI) plays a pivotal role in diagnosing neurological disorders, offering superior sensitivity and specificity compared to other imaging techniques. Its advanced capability to distinguish between gray and white matter allows for the precise identification of structural abnormalities and lesions, making it an essential tool for evaluating a wide range of neurological conditions.

- **Brain Tumors**

Over the years, numerous researchers in medical imaging and soft computing have conducted extensive studies on brain tumor segmentation. Various approaches, including both semiautomatic and fully automatic methods, have been proposed to enhance accuracy and efficiency in detecting and classifying tumor tissues. Brain tumor segmentation involves distinguishing various tumor tissues, including solid or active tumor, edema, and necrosis, from normal brain structures such as gray matter (GM), white matter (WM), and cerebrospinal fluid (CSF). In most brain tumor studies, the presence of abnormal tissues is often readily identifiable, facilitating the differentiation between healthy and pathological regions.⁷

- **Strokes**

Magnetic Resonance Imaging (MRI) is extensively utilized in stroke evaluation and is considered superior to computed tomography (CT) for detecting acute ischemia. This study aims to assess the available evidence on whether conventional MRI impacts clinical decision-making by doctors or improves patient outcomes in routine medical practice.⁸

- **Epilepsy**

MRI is the preferred imaging modality for the initial evaluation of patients with epilepsy. It offers superior sensitivity in diagnosing conditions such as hippocampal sclerosis, brain tumors, and cortical developmental malformations. Additionally, MRI plays a crucial role in neurosurgical planning by providing detailed anatomical insights that aid in precise surgical intervention.⁹

Musculoskeletal Conditions

MRI has emerged as the preferred imaging modality for addressing various diagnostic challenges in musculoskeletal radiology. As its role in diagnosing musculoskeletal conditions continues to expand, clinicians have shown growing interest in utilizing MRI for guiding musculoskeletal procedures. This interest stems from MRI's ability to provide high-resolution, real-time imaging without ionizing radiation, making it a valuable tool for both diagnosis and interventional applications in musculoskeletal medicine.¹⁰ Magnetic resonance imaging is useful to diagnose internal derangements of the support structures of the joints, occult fractures, bone marrow edema, infiltrative processes of the marrow space, and soft-tissue masses. Early studies have demonstrated the safety and feasibility of MR guidance for biopsies, spine procedures, cyst aspirations, therapeutic injections, and tumor ablation.¹¹

Oncological Imaging

MRI plays a vital role in the detection, staging, and monitoring of various cancers, including breast, prostate, and rectal malignancies. Its high-resolution imaging allows for precise tumor localization and characterization, offering valuable insights into tumor size, extent, and involvement of adjacent structures. By providing detailed and accurate imaging, MRI improves diagnostic confidence and facilitates personalized treatment planning, enabling clinicians to develop targeted therapeutic strategies for better patient outcomes. Breast MRI offers the highest sensitivity for detecting breast cancer among all current clinical imaging modalities, making it an essential tool in breast imaging. Its superior ability to detect malignancies, especially in high-risk patients and those with dense breast tissue, enhances early diagnosis and treatment planning. As a result, MRI has become indispensable in breast imaging practice, complementing mammography and ultrasound for comprehensive breast cancer evaluation.¹²

Cardiovascular Imaging

Cardiovascular magnetic resonance imaging (MRI) has transitioned from a powerful research tool to a clinically established, safe, and comprehensive imaging modality. It provides detailed anatomic and functional assessment of both acquired and congenital heart diseases, offering unparalleled precision in quantifying ventricular volumes, function, and mass. Due to its exceptional

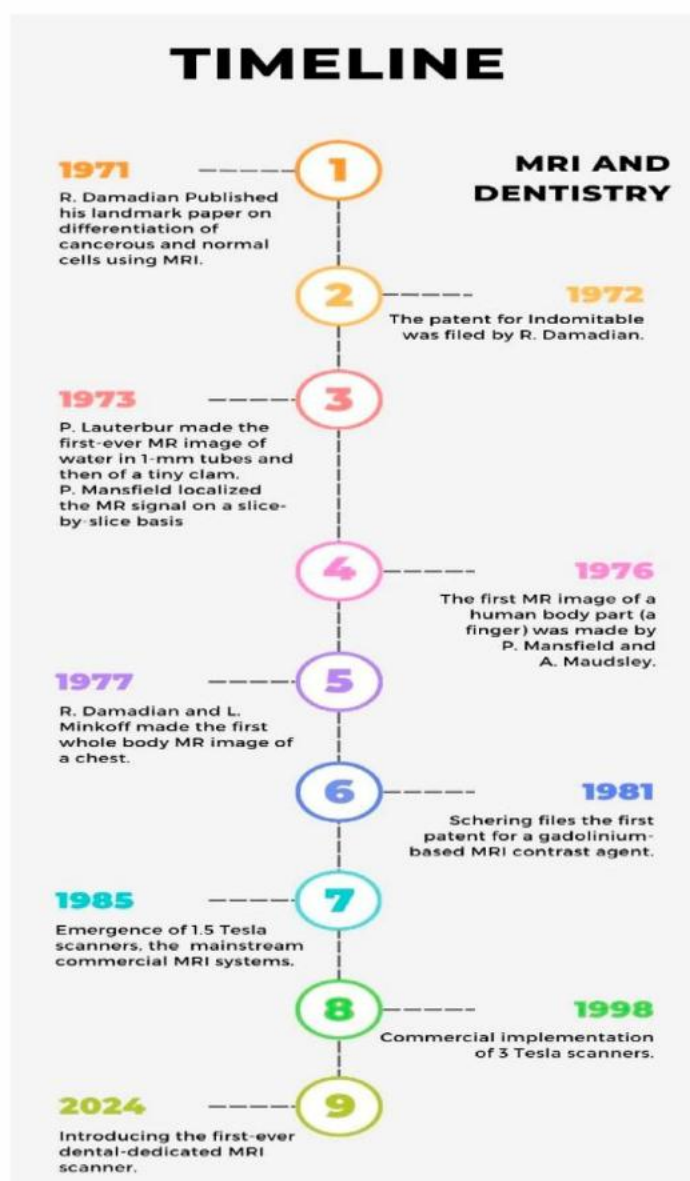
interstudy reproducibility, cardiovascular MRI is the preferred method for monitoring changes in ventricular parameters following therapeutic interventions, ensuring accurate evaluation of treatment efficacy and disease progression.¹³

Abdominal and Pelvic Imaging

MRI is a highly effective imaging modality for evaluating abdominal and pelvic organs, including the liver, pancreas, kidneys, and reproductive structures. It plays a critical role in accurately diagnosing conditions such as liver tumors, pancreatic lesions, and uterine abnormalities. Moreover, MRI is particularly beneficial for assessing pregnant patients with acute lower abdominal pain when an extra-uterine cause, such as appendicitis or ovarian torsion, is suspected. Its non-invasive nature and absence of ionizing radiation make it a safe and reliable tool for diagnosing complex abdominal and pelvic conditions, supporting precise treatment planning and improving patient outcomes.¹⁴

MRI in Dentistry

The applications of dental MRI are diverse, ranging from surgical interventions such as third molar extractions to advanced prosthodontic treatments. Its superior imaging capabilities allow for detailed visualization of temporomandibular joint structures, precise assessment of peri-implant tissues, and accurate guidance for implant placement, ultimately enhancing treatment precision and patient outcomes. Additionally, MRI enables the evaluation of muscle function during mastication, assisting in the development of tailored occlusal schemes to achieve optimal occlusion, which is crucial for maintaining long-term oral health, function, and overall patient well-being.¹⁵



Advantages & Disadvantages

Advantages	Disadvantages
Superior Soft Tissue Contrast: Provides exceptional differentiation between soft tissues.	Longer Scan Time: MRI procedures take longer than CT scans, limiting their use in emergencies.
No Ionizing Radiation: MRI does not use ionizing radiation, making it safer for repeated scans.	Claustrophobia and Noise: Enclosed machine design and loud noise can cause discomfort.
High-Resolution Imaging: Provides detailed visualization of internal structures without invasive procedures.	Magnetic Interference: Can be unsafe for patients with metal implants or pacemakers.
Multi-Plane Imaging Capability: Allows imaging in various planes without repositioning the patient.	High Cost: MRI is more expensive than other imaging modalities like CT and X-rays.
Functional Imaging Capabilities: Can assess blood flow and neural activity.	Patient Movement Sensitivity: Requires the patient to remain still for clear images.
Non-Invasive: No surgical intervention is required for diagnosis.	Not Suitable for people with severe claustrophobia
Versatility in Diagnosis: Effective for various medical conditions, including tumors, strokes, and injuries.	Potential for False Positives: MRI's high sensitivity can lead to unnecessary follow-ups.
Safe for Pregnant Women: MRI does not expose patients to harmful radiation.	Limited Availability in Emergencies: Due to long scan times, MRI is not ideal for urgent cases.

Conclusion

Magnetic Resonance Imaging (MRI) is a non-invasive medical imaging technique that provides highly detailed visualization of internal structures and functional aspects of the body. Unlike imaging methods that use ionizing radiation, MRI employs radiofrequency (RF) waves within precisely controlled magnetic fields to produce high-resolution cross-sectional images in multiple planes, ensuring patient safety without radiation exposure. As a cutting-edge diagnostic tool, MRI plays a crucial role in detecting, diagnosing, and monitoring a wide range of medical conditions. Its appropriate utilization enhances patient care, and ongoing advancements in 3D imaging and dynamic scanning continue to expand its clinical applications, improving diagnostic accuracy and treatment planning.¹⁶

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Importance of Middle Mesial Canal In Permanent Mandibular First Molar - 4 Case Report

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Received on: 06 March 2025; Accepted on: 21 March 2025; Published on : 19 April 2025

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Abstract

With better understanding of the morphology of root canals, the variation in root canal anatomy can be easily found. Careful clinical examination along with radiograph interpretation enables the clinician to successfully treat such cases. The pulp and/or necrotic tissue can be source for the persistence of Periapical lesion. This article reports 4 cases of middle mesial canal in the permanent mandibular molar. The middle mesial canal in all three cases were detected without aid of operating microscope. This case report shows that a careful clinical and radiographic examination is of utmost importance to treat the aberrant internal anatomy.

Keywords - Mandibular First Molar, Middle Mesial Canal,

Introduction

From early work by Hess and Zurcher (1) in 1925 through to more recent studies demonstrating the anatomical complexities of the root canal, roots with a conical channel and a single apical foramen have been known to be the exception rather than the rule. Although all teeth are anatomically complex, first lower molars are the first permanent posterior teeth to erupt and are those that most often suffer from caries, so they are highly likely to require endodontic treatment. These molars normally have two roots, one mesial and one distal, and their usual canal distribution is two in the mesial root and one or two in the distal root. Nonetheless, other possibilities exist.

The presence of an independent middle mesial canal with a separate orifice and a separate apical foramen was reported in 1974 by Vertucci and Williams (2) and Barker et al. (3). In addition, cases with three canals in the distal root and two in the mesial root (4), two canals in the mesial root and three canals in three distal roots (5), two canals in the distolingual root (6), two roots and one canal in each (7), Four canals in mesial root of mandibular molar (8), molar with seven canals: 2 mesiobuccal, 2 mesiolingual and 3 distal canals (9) were reported in the literature.

The presence of a third canal in the mesial root of mandibular first molars has been reported to have an incidence rate of 1 to 15%.

This additional canal may have a separate foramen, or join apically with either the mesiobuccal or mesiolingual canal⁽¹⁰⁾.

The purpose of this article is to report the successful treatment of four cases of a mandibular first molar with three mesial canals

Case Report 1

A 17-year old male patient presented with a non-contributory medical history, a chief complaint of pain in the lower left back tooth region. There was a history of periodic discomfort to biting on the tooth. Clinical exam revealed large occlusal caries in left mandibular first molar and delayed response to electric pulp test. Radiographic examination revealed involvement of pulp with no Periapical radiolucency. Root canal treatment was indicated. Access cavity was prepared with No 4 round bur (Mani). The coronal pulp tissue was removed and the chamber irrigated with 5% sodium hypochlorite solution. Three root canal orifices were detected, two mesial and large distal. Since the patient was of young age middle mesial canal was not ruled out. Exploring the fissure between the main mesial canals, with a sharp endodontic explorer, a "stick" was encountered. A small pre-curved file (size .08 Flexofile, Dentsply Maillefer, Germany) was inserted into the middle

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How to cite this article : Ainapur et al. - Heal Talk A Journal of Clinical Dentistry. (2025). Importance of Middle Mesial Canal In Permanent Mandibular First Molar - 4 Case Report. In Heal Talk A Journal of Clinical Dentistry (Vol. 17, Number 4, pp. 61-72). Zenodo. <https://doi.org/10.5281/zenodo.15253883>

mesial canal orifice. With clockwise and counterclockwise rotational movements, the instrument was advanced until working length was achieved. The working lengths were estimated using an apex locator (Root ZX, Morita, Tokyo, Japan) and then confirmed with a radiograph. Three separate mesial root canals were confirmed with a radiograph (Figure 3). During instrumentation, the middle mesial canal joined the mesiobuccal canal. All the mesial canals were instrumented with protaper rotary files and the distal canal was enlarged upto 45 k file size. All canals were dried and filled by cold lateral condensation of gutta-percha with a zinc-oxide eugenol sealer. (Figure 4).

Case Report 2

A 31-yr-old woman complained about high sensitivity to cold stimuli, and pain caused by chewing, located to the left mandibular region. Once the pain was elicited it persisted for several minutes. Tooth 36 had an distocclusal caries. The tooth was painful to percussion, and thermal tests gave exaggerated responses compared to proximal and contralateral teeth. The diagnosis of irreversible pulpitis was made and single visit endodontic treatment scheduled. After anaesthesia, an adequate access preparation was made. On removal of roof of pulp chamber bleeding was excessive. 3% sodium hypochlorite was used to dissolve the pulp. Two mesial and two distal canal orifices were found and pulp extirpated with .No 15 K-files. Slight bleeding was evident each time file was inserted into mesiobuccal canal. A first working length measurement radiograph was taken using digital radiography. The files in all canals were 0.5 mm short of apex. Since the bleeding didn't stop search was undertaken to see for the presence of middle mesial canal. Once the negotiation of the third canal was done, a second working length radiograph was taken. The radiograph confirmed the middle mesial canal and it was joining with the mesiobuccal canal (fig 5). The two distal canals presented as two separate orifices and two separate apical foramen. The three mesial canals were enlarged using protaper rotary files up to size of F1 and distal canal up to F2 using a crown-down approach. Master cone radiograph was taken to confirm the exactness of the preparation (fig 6). Irrigation was made using copious amounts of 1% sodium hypochlorite. The canals were finally washed with sterile saline and dried with sterile paper cones. The three canals were obturated using the lateral condensation technique and a AH Plus sealer. After removal of excess gutta-percha cones, the access closed with temporary cement. An angled radiograph was taken to confirm the quality of obturation (fig 7). The patient was recalled after two weeks. The patient was asymptomatic. The temporary restoration removed and restored with composite resin.

Case 3

A 27-year-old female patient was referred to the dental clinic for endodontic treatment of tooth #36. The patient's chief complaint was pain in his lower left back teeth region. Clinical examinations revealed that tooth had deep bucco-occlusal caries. The tooth was tender to vertical percussion but not to palpation and the periodontal condition of the tooth was normal and no pocketing was observed. On sensitivity tests, using heated gutta-percha, there was a severe, long-lasting painful response. The reason of his pain was diagnosed to be irreversible pulpitis in his mandib-

ular left first molar. The preoperative radiograph revealed presence of Radix Entomolarix. The left inferior alveolar nerve was anaesthetized using 2% Lidocaine with 1:80000 adrenaline (Daroupakhsh, Tehran, Iran). After an adequate access preparation was made, two mesial and two distal canal orifices were found. Examining the fissure connecting the two mesial canals carefully, the tip of a #08 file could be inserted into a spot located in the middle of the distance between the two mesial canals. The middle mesial canal originated as a separate orifice but joined to the mesiobuccal canal in the apical third of the canal (fig 8). The working length radiograph confirmed the presence of two distal root and single canal in each.. The root canals were cleaned and shaped using protaper rotary files using crown down approach. The root canals were copiously irrigated with 1% sodium hypochlorite solution. Before obturation, master points were seated to test their suitability to canals (fig 9). Then, the canals were dried with sterilized paper points and obturated with protaper gutta-percha and zinc oxide sealer (fig 10).

Case Report 4

A 25 year old male patient came to the dental clinic with complaint of pain on biting in the left mandibular region. On examination deep occlusal caries was noted in the mandibular left first molar. The tooth was tender on percussion and negative sign for mobility and sinus tract. The electric pulp testing gave a delayed response. The pre-operative radiograph revealed carious involvement of pulp with slight widening of periodontal ligament space (fig). A diagnosis of apical periodontitis was established. A two visit endodontic treatment was planned. Once anesthesia was achieved, access cavity was prepared under rubber dam. Considering the age of the patient, the floor of the pulp chamber was searched for the presence of three mesial canals. Probing the fissure between the two mesial canals, a stick was encountered. #10 file was introduced into canal. A total of five root canal orifices were located (fig) and working length radiograph was taken. The radiograph revealed the middle mesial canal joining the mesiolingual canal (fig). The preparation was carried out using step-down technique and apical area enlarged up to #30 k-file for the mesial canals. During the coronal flaring of the distal canal the partition between the two distal canal was removed and treated as single canal and was enlarged up to #45 k-file. An intracanal medicament of calcium hydroxide was placed and appointment was scheduled after one week. Patient returned with no symptoms and no tender on vertical percussion. The temporary restoration was removed and the canal was dry. Master cone was selected and confirmatory radiograph was taken (fig). The obturation of the root canal was carried out using AH Plus sealer and gutta-percha using lateral compaction technique (fig).

Discussion

Based on the literature and these clinical cases, it is evident that knowledge of the anatomical variations of the mandibular molars is extremely important for the success of endodontic treatment. According to Cohen and Burns (11), canals are often not treated because they are not located. At the same time clinician should keep in mind the aberrant anatomy and search for the extracanal at the time of canal detection and their negotiation. For this to accomplish, proper access cavity preparation and angled

radiograph are very much necessary.

There are many variations in the root canal morphology of mandibular molar. One among them is the middle mesial canal. It has also called by other names - intermediate canal⁽¹²⁾, mesio-centric canal⁽¹³⁾.

Many authors agree on the presence of three foramina in the mesial root but few report three independent canals, which presents itself as a rare anatomical variant^(14,15). Goel⁽¹⁶⁾ notes that the mesial root of permanent mandibular first molars presented two foramina in 60% of the specimens they examined, 6.7% had three and 3.3% even had four. According to Mortman⁽¹⁷⁾, the third mesial canal is not an extra canal but rather the sequelae of instrumenting the isthmus between the mesiobuccal and mesiolingual canals.

While a third canal in the mesial root of mandibular first molars may not be a very frequent discovery, a review of the literature indicates that its prevalence is 0-15% (Table 1).

The middle mesial canal must be sought along the line between the two mesial canals after deroofing of the pulp chamber and of any cervical stenosis in this zone that might cover the opening of the canals, using burs. A round bur or an ultrasonic tip can be used for removal of any protuberance from the mesial axial wall which would prevent direct access to the developmental groove between MB and ML orifices. This developmental groove should be carefully checked with the sharp tip of an endodontic explorer. If depression or orifices are located, the groove can be troughed with ultrasonic tips at its mesial aspect until a small file can negotiate this intermediate canal⁽¹⁸⁾.

The detection of additional root canals requires a careful clinical and radiographic inspection. Diagnostic tools such as multiple radiographs, careful examination of the pulpal floor with a sharp explorer, and better visualization using an operating microscope^(19, 20) are all important aids in the detection of additional root canals. Recently, various attempts have been made to use CT imaging for the confirmatory diagnosis of morphologic aberrations in the endodontic field⁽²¹⁾.

Conclusion

In conclusion, every attempt should be made to find and treat all root canals to ensure successful endodontic treatment. The importance of an accurate clinical evaluation of root canal number and morphology in mandibular molars cannot be overemphasized. Some points which may help in recognizing the presence of middle mesial canal are –

- The presence of bleeding in one of the mesial canal after pulp extirpation
- Pain didn't subside after the initial appointment. Other cause of pain should be ruled out.
- The mesiobuccal and mesiolingual canal are widely spaced
- Presence of pain during instrumentation of either mesiobuccal or mesiolingual canal
- The patient's age less than 30 should always be searched for middle mesial canal.
- Large occlusal table and wider faciolingually.

- Diagnostic radiographs are of limited use in identification of middle mesial canal. Only careful clinical evaluation with magnification can help to identify the extra canal.
- Always probe the fissure between the two mesial canals. A stick may be encountered if the middle mesial canal orifice is present.

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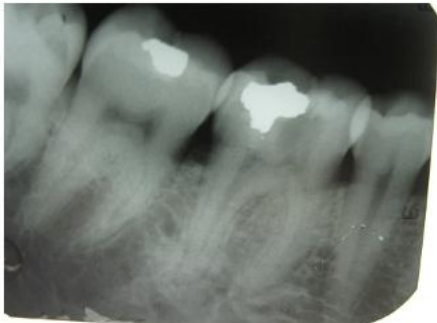
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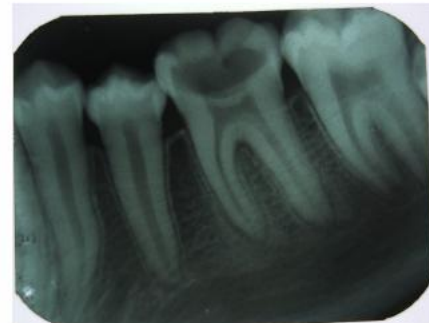
1a – Clinical Picture



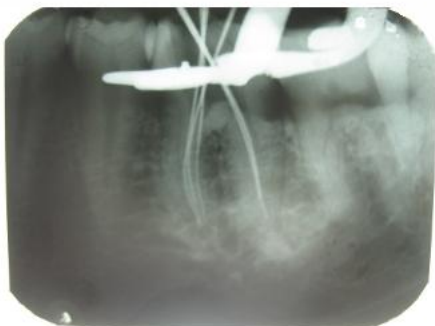
1e – Post Obturation Radiograph



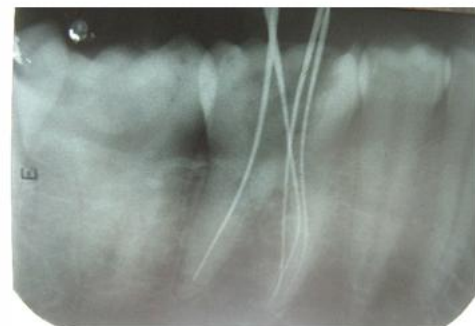
1b – Preop Radiograph



2a – Preop Radiograph



1c – Working Length Radiograph



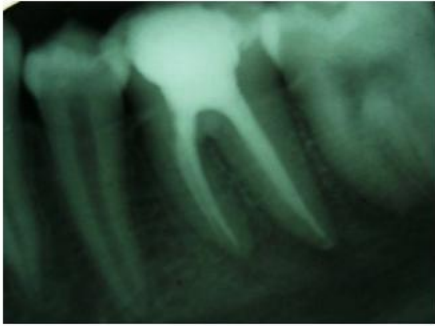
2b – Working Length Radiograph



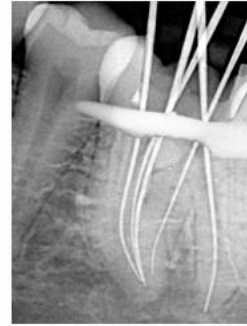
1d – Mastercone Radiograph



2c – Mastercone Radiograph



2d – Post Obturation Radiograph



4a – Working Length Radiograph



3a – Working Length Radiograph



4b – Master Cone Radiograph



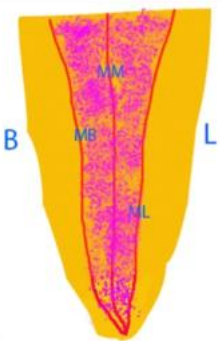
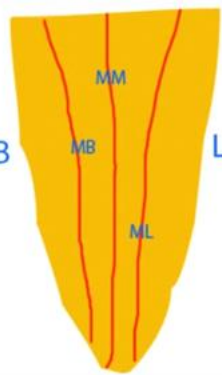
3b – Master Cone Radiograph



4c – Post Obturation Radiograph



3c – Post Obturation Radiograph

Author	Number of Clinical Case(s)	Materials And Methods	Number of canals and number of foramina (of both mesial and distal canals)	Type of canal preparation	Obturation	Type
Weine (7)(1982)	1	In vivo (PA radiograph)	Mesial root – 3 canals and 1 foramina Distal root – 1 canal and 1 foramina	Not mentioned	Lateral compaction technique with Wach's paste as sealer	
Mortman and Sunghee (8) (2003)	1	In vivo (PA radiograph)	Mesial root – 3 canals and 1 foramina Distal root – 2 canals and 1 foramina	Not mentioned	Lateral compaction technique with sealapex	
Min (9) (2004)	1	In vivo (PA radiograph)	Mesial root – 3 canals and 1 foramina Distal root – 2 canals and 1 foramina			
Martinez Berna and Badanelli (10) (1985)	2	In vivo (PA radiograph)	Mesial root – 3 canals and 3foramina Distal root – 3 canals and 1 foramina	Not mentioned	Lateral condensed guttapercha and AHPlus sealer	
Bond et al (11) (1988)	1	In vivo (PA radiograph)	Mesial root – 3 canals and 3 foramina Distal root – 2 canals and 2 foramina	Not mentioned	Laterally condensed guttapercha and Roth 801 Sealer	
Jacobsen (12) (1994)	1	In vivo (PA radiograph)	Mesial root – 3 canals and 3 foramina Distal root – 2 canals and 2 foramina	Not mentioned	Not mentioned	
Ricucci (13) (1997) (intermediate canal)	1	In vivo (PA radiograph)	Mesial root – 3 canals and 3 foramina Distal root – 2 canals and 1 foramina	Step down technique	Lateral compaction technique	
Holtzman (14) (1997)	1	In vivo (PA radiograph)	Mesial root – 3 canals and 3 foramina Distal root – 2 canals and 1 foramina			
Yesilsoy et al (15)(2009)	1	In vivo (PA radiograph)	Mesial root – 3 canals and 3 foramina			
La et al (16) (2010)	1	In vivo (PA radiograph)	Distal root (2) – 2 canals and 2 foramina			
Poorni et al (17)(2010)	1	In vivo (PA radiograph) & CBCT Images	Mesial root – 3 canals and 3 foramina Distal root (2) – 2 canals and 2 foramina	Protaper rotary instruments	Gutta-percha and AHPlus sealer	
		In vivo (PA radiograph)	Mesial root – 3 canals and 3 foramina Distal root – 2 canals and 1 foramina	Crown-down technique with protaper rotary files	Lateral compaction technique with zinc oxide eugenol sealer	

Fabra Campos (18) (1985)	3	In vivo (PA radiograph)	Mesial root – 3 canals and 2 foramina Distal root – 2 canals and 1 foramina		Lateral compaction technique	3-2 Middle mesial canal joining mesiobuccal canal
Fabra Campos (19) (1989)	13	In vivo (PA radiograph)	Mesial root – 3 canals and 2 foramina Distal root – 2 canals and 1 foramina			
Jacobsen et al (12)(1994)	1	In vivo (PA radiograph)	Mesial root – 3 canals and 2 foramina Distal root – 2 canals ; not mentioned about foramina	Not mentioned	Not mentioned	
Mortman and Sunghhee (8) (2003)	2	In vivo (PA radiograph)	Mesial root – 3 canals and 2 foramina Distal root – 2 canals and 1 foramina			
Baugh and Wallace (20) (2004)	1	In vivo (PA radiograph)	Mesial root – 3 canals and 2 foramina Distal root – 2 canals and 2 foramina		Laterally condensed gutta-percha and Roth 801 Sealer	
Fabra Campos (18) (1985) (intermediate canal)	1	In vivo (PA radiograph)	Mesial root – 3 canals and 2 foramina Distal root – 2 canals and 2 foramina		Lateral compaction technique	3-2 Middle mesial canal joining Mesiolingual canal
Fabro Campos (19) (1989)	6	In vivo (PA radiograph)	Mesial root – 3 canals and 2 foramina Distal root – 2 canals and 1 foramina			
Jacobsen et al (12) (1994) (mesio-centric canal)	1	In vivo (PA radiograph)	Mesial root – 3 canals and 2 foramina Distal root – 2 canals ; not mentioned about foramina	Not mentioned	Not mentioned	
DeGrood and Cunningham (21) (1997)	1	In vivo (PA radiograph)	Mesial root – 3 canals and 2 foramina Distal root – 2 canals and 2 foramina		Laterally condensed gutta-percha and Roth 801 Sealer	

Table 1 - Case Reports of A Third Canal In The Mesial Root of Mandibular First Molars

Authors	Year	No. of teeth	Method	Three canals(%)
Vertucci (22)	1974	100	Vitro	1
Pomeranz (23)	1981	100	Vivo	12
Martinez-Berna and Badanelli (24)	1983	1418	Vivo	1.5
Fabra-Campos (18)	1985	145	Vivo	2.1
Fabra-Campos (19)	1989	760	Vivo	2.6
Goel (25)	1991	60	Vivo	15
Caliskan et al. (26)	1995	100	Vitro	3.39%
Wasti et al (27)	2001	30	Vitro	3.3%
Sarkar S (28)	2002	10	Vitro	70%
Navarro LF (29)	2007	27	Vitro	14.81%
Shahriar Shahi (30)	2008	209	Vitro	0.95%
Chen G (31)	2009	183	Vitro	6%
A. A. Al-Qudah & L. A. Awawdeh (32)	2009	330	Vitro	6%

Table 2- Prevalence of A Third Canal tn the Mesial Root of Mandibular First Molars According to Different Authors

Author/year	Percentage of two distal root	Percentage of distal canals	Population
Taylor (1899) (33)	3.4	–	United kingdom
Tratman (1938) (34)	5.8	–	Chinese
Skidmore AE, Bjorndal AM (1971) (35)	2.2%	28.9%	Caucasians
Turner (1971) (36)	32%	-	American Indian
Curzon MEJ (1973) (37)	3.4%	-	United kingdom
Fabra-Campos (1985) (18)	Not mentioned	49.60%-2 canals	Not mentioned
Yones et al (1990) (38)	2.92	Not studied	Saudi people of Asiatic and Africa descendant
Loh (1990) (39)	7.2	Not studied	Singaporean Chinese
Goel NK, Gill KS, Taneja JR.(1991) (25)	1.7%	40% - 2 canals; 1.7% - 3 canals	Indian population
Ferraz JAB, Pécora JD (1992) (40)	11.4%		Japanese
Yew and Chan (1993) 41)	21.5%	31.5%-2 canals	Chinese
Caliskan et al.(1995) (26)	Not mentioned	1.69% - 3 canals 16.94%- 2 canals	Turkish population
Sperber GH, Moreau J (1998) (42)	3.12%	25% - 2 canals	Sengalese
Zaatar EI, al Anizi SA, al Duwairi Y.(1998) (43)	–	26.5% - 2 canals	Kuwaitis population
al-Nazhan S.1999 (44)	5.97%	57.76%-2 canals	Saudi arabian sub-population
Gulabivala K, Aung TH, Alavi A, Ng YL(2001) (45)	10%	38.4% - 2 canals	Burmese population
Wasti F, Shearer AC, Wilson NH. (2001) (27)	Not mentioned in the study	50%- 2 canals	South asian pakistanis population
Gulabivala K, Opananon A, Ng YL, Alavi A (2002) (46)	12.7%	30.5% - 2 canals 3.4% - 3 canals	Thai population
Ahmed HA, Abu-bakr NH, Yahia NA, Ibrahim YE. (2007) (47)	3%	59% - 2 canals	Sudanese population

Peiris R, Takahashi M, Sasaki K, Kanazawa E. (2007) (48)	3%	Most of them presented with 2 canals	Srilankan population
Ruwan Duminda Jayasinghe, Thomas Ka-Lun Li (2007) (49)	22%	Not mentioned	Hong Kong
Pattanshetti N, Gaidhane M, Al Kandari AM. (2008) (50)	4%	49%-2 distal canals	Kuwait population
Shahriar Shahi (2008) (30)	1.44	34.43% - 2 distal canals	Iraninan
Al-Qudah AA, Awawdeh LA.(2009) (32)	4%	46% - 2 distal canals 1%- 3 distal canals	Jordian population
Chen G, Yao H, Tong C. (2009) (31)	20%	46% - 2 canals	Taiwan population
Rwenyonyi CM, Kutesa A, Muwazi LM, Buwembo W (2009) (51)		23.2% – 2 canals	Uganda population
Song JS, Kim SO, Choi BJ, Choi HJ, Son HK, Lee JH.(2009) (52)	33.1%	Not studied	Korean children
Edgar Schäfer, Dominik Breuer, and Sabine Janzen. (2009) (53)	1.35%	Not studied	German
Chen YC, Lee YY, Pai SF, Yang SF. (2009) (54)	9.9%	Not studied	Taiwanese population
Tu et al (2009) (55)	33.33%	Not mentioned	Taiwanese population
Huang CC, Chang YC, Chuang MC, Lai TM, Lai JY, Lee BS, Lin CP (2010) (56)	25.3%	40.5%-2 canals	Taiwanese individual
Song JS, Choi HJ, Jung IY, Jung HS, Kim SO. (2010) (57)	24.5%		
Garg et al (2010) (58)	5.95%	Not mentioned	Indian

Table 3- Prevalence of Three Rooted Mandibular First Molars- Survey of Available Studies

Author	Year	No of Distal Root	No of Distal Canals
Stroner WF, Remeikis NA, Carr GB (59)	1984	2	DB-2 DL-1
Beatty RG, Interian CM (60)	1985	2	DB-2 DL-1
Quackenbush LE (61)	1986	2	DB-2 DL-1
Friedman S, Moshonov J, Stabholz A (62)	1986	3	DB-1 Distal centre-1 DL-1
Reeh ES. (63)	1998	1	DB-1 Distal center - 1 DL-1
Kimura Y, Matsumoto K (64)	2000	2	DB-2 DL-1
Segura-Egea JJ (65)	2002		DB-1 DL-1
Se Yeh and HL Huang (66)	2003		DB- 1 DL-2
De Moor RJG, Deroose CAJG, Calberson FLG (67) (4 case reports)	2004	2	DB-1 DL-1
Lee et al (68)	2006	3	DB-1 Distal centre-1 DL-1
Ghoddusi J, Naghavi N, Zarei M, Rohani E (69)	2007	2	DB-2 Distal centre-1 DL-1
Barletta et al (70)	2007	2	DB-1 DL-2
Calberson et al. (71) (2 case reports)	2007	2	
Ming-Gene Tu (72)	2009		DB-1 DL-1
Parolia A (1)	2009		DB-1 DL-1
Chandra et al (73)	2009	1	DB-1 Distal center - 1 DL-1
Pragati Mirikar, Arvind Shenoy, and Goud K Mallikarjun (74)	2009	1	DB-1 DL-1

Table 4 - Previous Reports Concerning Radix Entomolaris and Number of Distal Canals

Author	Year
Barnett F (75)	1986
R. TedRice and Buford O.Gilbert Jr (76)	1987
Bolger and Schindler (77)	1988

Table 6 - Case Reports of C-shape Canal in Mandibular Molar

Author	Year	Population	Prevalence	Method of study
Keene (78)	1966	Americians of European origin	2.8% - hypotaurodontism 0.4%- mesotaurodontism	Biometric study
Blumberg et al (79)	1971	Negros and white American patients	2.5%	Biometric study
Shifman A. (80)	1978	Israelians	5.6%	Periapical and bitewing radiographs
Jorgenson et al. (81)	1982	African American children	4.37%	Panoramic radiographs
Ruprecht et al. (82)	1987	Saudi Arabians	11.3%	Panoramic radiographs
Mac Donald –Jankowski and Li (83)	1993	Chinese	46.4%	Panoramic radiographs
Sarr et al. (84)	2000	Senegalese	48%	Panoramic radiographs
Park et al. (85)	2006	Korean	3.9%	Clinical and radiographic examination

Table - Studies Done on Taurodontism of Mandibular Molars

Author	Year	Highlight of the Study
Hamner JE et al. (86)	1964	Hypertaurodontism involving the permanent dentition of a 13-year-old American Caucasian girl
Cesar A. Mena (87)	1971	Familial trait in afro-american children
Goldstein E and Gottlieb MA (88)	1973	Demonstrated familial tendencies for taurodontism
A. Shifman and A. Buchner (89)	1976	Taurodontism a more common entity than previous thought. Explained clinical aspects regarding endodontic and periodontic therapy
Sathyanarayan R (90)	2001	
Tiku et al (91)	2003	
Ashwin R and Arathi R.(92)	2006	Presented a case of taurodontism involving deciduous lower second molars and all permanent first molar .

Table – Case Reports on Taurodontism

Implant Abutments Enhancing the Foundation of Dental Implants : A Review

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Received on: 06 March 2025; Accepted on: 21 March 2025; Published on : 19 April 2025

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Abstract

Implant abutments are a fundamental component in dental implant restorations, serving as the interface between the implant fixture and the prosthesis. The growing variety of abutment designs, materials, and connection mechanisms presents challenges in clinical decision-making. This review provides an overview of implant abutment types, their biomechanical and aesthetic considerations, and their impact on long-term treatment success. By examining factors such as abutment fit, connection stability, and tissue response, clinicians can make informed choices that optimize implant function and aesthetics. A thorough understanding of abutment selection is critical for ensuring the longevity and success of single or multiple-unit implant restorations, ultimately improving patient outcomes and satisfaction.

Keywords : Implant dentistry, abutment connection, prosthetic interface, tissue integration, implant stability.

Introduction

The use of dental implants to replace natural teeth has become a standard procedure in modern restorative and surgical dentistry^[1]. In contemporary practice, dental implants play a crucial role in replacing missing teeth, offering superior support for both fixed and removable prostheses. Compared to traditional complete and partial dentures, implants enhance functionality and restore aesthetics more effectively^[2]. Prosthodontic rehabilitation using osseointegrated implants has emerged as the preferred treatment option for partially or completely edentulous patients^[3]. The success of implants is a key factor that significantly impacts clinical practice and encourages patients to opt for implant-supported prostheses^[4].

Implant-supported restorations have become a widely preferred treatment option for rehabilitating partially edentulous patients. The increasing adoption of dental implants has led clinicians to explore various implant materials and treatment protocols, further broadening their application. This advancement has contributed to the development of “restoration-driven” implant dentistry^[5]. In this regard, a thorough understanding of implant abutments and their design principles plays a crucial role in successful implantation.

An abutment is a component of the implant system that connects to a prepared tooth and is designed to be screwed into the implant body. It serves as the key element providing retention for the prosthesis. The abutment consists of three main parts: the base, which fits into the internal structure of the implant; the head, which extends outward and functions as a prosthetic retainer; and the collar, which sits at the gingival level, linking the base and head. Abutments can be categorized into one-piece or two-piece types, depending on their design^[6].

Classification of Implant Abutments

Several types of implant abutments have been documented in the literature for use in anterior implant-supported restorations. These abutments can be categorized based on various factors, including their connection method to the restoration, the material used for fabrication, the manufacturing process, the type of connection to the implant, and their color^[7].

Implant abutments can be classified based on several key factors, including their connection method to the restoration, type of

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How to cite this article : Rathee et al. - Heal Talk - A Journal of Clinical Dentistry. (2025). Implant Abutments Enhancing the Foundation of Dental Implants : A Review. In Heal Talk A Journal of Clinical Dentistry (Vol. 17, Number 4, pp. 73–77). Zenodo. <https://doi.org/10.5281/zenodo.15253927>

implant connection, material composition, fabrication method, and color.

1. Method of Connection to Restoration:
 - Screw-retained abutment-crown complex
 - Two-piece design with a screw-retained crown over the abutment
 - Two-piece design with a cemented crown over the abutment
2. Abutment Connection to Implant:
 - External connection
 - Internal connection
3. Material Composition:
 - Titanium (including cast metal options such as noble, high noble, or base-metal alloy)
 - Cast metal with porcelain fused at the base
 - Alumina
 - Full zirconia
 - Zirconia with a titanium base (zirconia-titanium hybrid abutment)
4. Fabrication Method:
 - Prefabricated (unaltered or modified)
 - Custom cast abutment
 - Custom copy milled abutment
 - Custom CAD-CAM abutment
5. Color Variations:
 - Gold
 - Silver (metallic finish)
 - Pure white
 - Custom white
 - Custom pink/gingival shade at the cervical region

Additionally, implant abutments come in various designs, including standard abutments, estheticone abutments, angulated abutments, ceraone abutments, and overdenture abutments.

Types of Abutments

Standard Abutments

Standard abutments have a cylindrical design and come in various heights, accompanied by corresponding titanium abutment screws. Their base features a hexagonal shape that securely fits into the implant fixture. These abutments are commonly used in the fabrication of fixed bone-anchored bridges for edentulous patients. To facilitate oral hygiene, the junction between the abutment and the restoration is positioned 2mm above the oral mucosa^[8].

There are two primary impression techniques used with standard abutments:

- A. Pick-up (Open Tray) Impression Technique
- B. Transfer (Closed Tray) Impression Technique^[9]

One technique utilizes a tapered impression coping, which is screwed into the internal screw channel of the abutment. The impression is taken without removing the coping. Afterward, the coping is detached, connected to an analog, placed into the impression, and then used to pour the cast.

The other technique involves a square impression coping with undercuts that lock into the impression material. After taking the impression, the guide pins are unscrewed and removed. This method is considered more accurate. The base of the impression coping is round, and an anti-rotation feature is not required for multiple implant restorations.

For the final restoration, a gold alloy cylinder is placed over the standard abutment and incorporated into the final prosthesis after casting. Gold screws secure the gold cylinder to the abutment, ensuring stability. The final restoration is fixed in place using these gold screws, which are tightened to 10 N.cm^[10].

Angulated Abutments

Angulated abutments are designed with either a 30-degree or 17-degree angulation to address challenges related to implant positioning. Their base features a twelve-sided configuration, allowing for precise alignment. These abutments are primarily used in multiple implant restorations to correct implant angulation issues^[11].

Estheticone Abutments

Estheticone abutments are crafted from pure titanium and feature a hexagonal base with a tapered design. They are available in three sizes-corresponding to collar heights of one, two, and three millimeters. These abutments are specifically designed for aesthetic restorations, multiple implant-supported screw-retained prostheses, as well as ceramic-metal and cast-metal restorations^[12].

The restorations are positioned 2-3 mm subgingivally to create a natural appearance. The technique used for esthetic abutments is similar to that employed for standard abutments.

Ceraone Abutments

Ceraone abutments are made of pure titanium and are designed for cement-retained, single-tooth restorations. They come in various collar heights, ranging from 1 mm to 5 mm, and feature a hexagonal base. The abutment is secured to the implant using a gold alloy screw, tightened with a force of 32 Ncm.

Plastic impression copings attach to the abutment through frictional resistance and are removed along with the impression. Once the impression is taken, an analog is placed, and the cast is poured. Healing caps are used to preserve soft tissue support.

For all ceramic single-tooth restorations, porcelain is applied to ceramic caps. The final prosthesis can be cemented temporarily or permanently, with careful removal of excess cement being crucial to prevent complications^[13].

Overdenture Abutments

Abutments used for overdenture ball attachments are similar to standard abutments. The male component consists of a ball head on the abutment screw, while the female component is a plastic cap within the denture base. This plastic cap incorporates rubber O-rings that fit over the abutment screw, providing retention for the denture^[14].

Laboratory analogs are available, allowing for the option to incorporate the attachments either clinically or in the laboratory. This approach is both simple and time-saving.

Abutment Types for Anterior and Posterior Implants

Standard Abutments

Standard abutments are pre-made and typically made of titanium. They consist of two parts: the abutment itself and the abutment screw. These abutments come in various heights and feature smooth collars extending from the implant head to the crown margin. For example, the Nobel Biocare Ceraone implant has a flat top and a raised hexagon that provides an anti-rotation mechanism for the abutment. The abutment is secured to the implant using a gold screw.

Some implants, like Astratech, Frialit, and Straumann, use a conical-headed abutment with a matched conical fit surface, along with an anti-rotational element. In single-tooth restorations, the coronal part of the abutment must provide adequate retention and resistance to secure the crown to the abutment using cement. Other designs, such as the Astratech single-tooth abutment, allow space between the abutment and the crown to facilitate cement release^[15].

Although the margins of these abutments do not always follow the gingival contour and may not be suitable for labially placed cases, they are easy to use, require minimal chairside time, and offer reliable retention and crown fit.

Prep-able Abutments

Preparable abutments feature a retentive element made from a block of metal, which is customized to fit an ideal preparation. The abutment is shaped extraorally using a high-speed drill. The gingival margin follows the natural gingival contour, positioned subgingivally on the labial side and supragingivally on the proximal and palatal sides. The metal surface that contacts the crown is left coarse to enhance retention, while the surface that contacts the tissue is smoothed^[16].

There are two methods for preparing prep-able abutments:

- 1. Single-Stage Preparation :** The abutment and final crown are produced in one stage, typically when the soft tissue is healthy. This method provides a good marginal fit, but there is a risk of poor long-term retention.
- 2. Two-Stage Preparation :** The abutment and provisional crown are prepared in the first stage. An impression is taken with the abutment in place, and the final crown is made in the second stage. This method offers more predictable results, especially when the soft tissue profile or emergence needs modification.

The two-stage approach is versatile, accommodating angulation changes, soft tissue remodeling, and providing a good emergence profile. However, it requires a more complex laboratory process, a second intraoral impression, and can result in a less predictable fit between the abutment and the final crown.

Fully Customized Abutments

Fully customized abutments are particularly beneficial in cases where the implant positioning is compromised. To create these abutments, an impression of the implant head is taken, and the abutment is positioned on the model. The shape of the abutment is then waxed onto the pattern before being cast in precious metal. This technique allows for adjustments to the long axis of the final restoration, providing more flexibility in aligning the

restoration correctly^[17].

CAD/CAM Abutments

CAD/CAM abutments are created using specialized software that allows for the design and visualization of the ideal abutment shape in 3D. First, an impression of the implant head is taken, and the working model is placed in a scanner. The software captures the implant position and angulation. The gingival margin position can be superimposed onto the digital image, which is then sent to a center where the abutment is fabricated in titanium. This method offers precise customization and enhances the accuracy of the final abutment design^[18].

Ceramic Abutments

Ceramic abutments are made from dense porcelain and are known for their high aesthetic quality, offering success rates. The final crown is typically fabricated from all-ceramic material and cemented using a tooth-colored luting agent. However, ceramic abutments are not ideal for situations that require significant changes in angulation^[19].

Abutments for Screw-Retained Crown

Abutments designed for bridges, such as the Estheticone by Nobel Biocare and Octa by Straumann, are used for screw-retained crowns. These abutments require a gold cylinder with an internal facet that engages the abutment to ensure secure attachment^[20].

Abutments for Cement-Retained Crown

One-piece abutments do not feature anti-rotational mechanisms and are typically used for multiple splinted implants. Their advantages include eliminating the need for a torque wrench, offering greater strength, preventing screw loosening, being more cost-effective, and allowing for easier seating. However, they are limited to multiple abutments and cannot be used with angled abutments.

Two-piece abutments, which engage anti-rotational features on the implant body, are secured using an abutment screw. These are used for single-tooth implants, indirect prosthesis fabrication, and angled abutment situations. While they offer anti-rotational resistance under shear forces, screw loosening can still occur, and they require torque and counter-torque devices for proper fixation^[21].

Abutment Designs

Abutments can be classified into three main categories: threaded (straight, prefabricated angled, custom), frictional (press fit, cold-welded), and non-threaded (cementable).

I. Threaded Abutments

- a. Straight :** These abutments are used when the axial inclination and parallelism of the implants are favorable. Some straight abutments include collars (e.g., Integral), while others, like those from Nobelpharma and IMZ, require separate trans-epithelial collars. Abutments such as Calcitek, Hexlock, and SteriOSS feature an anti-rotation design.
- b. Pre-fabricated Angled :** Not all manufacturers offer pre-fabricated angled abutments, but some implant systems, including Integral, SteriOSS, and Sustain, supply them.

Implant Innovations offers 15-30 degree angled, one-piece collared abutments. Steri-Oss provides a two-piece system featuring a hexagonal vertical component and a 15-25 degree angled post.

- c. **Custom Abutments (Angled & Straight)** : Custom abutments are created by taking impressions or by using direct resin patterns. The internal threading of the implants is captured using a special transfer post, after which the impressions are removed, and the analog is attached before pouring the cast. Angulations greater than 25 degrees may result in excessive force on the implant^[22].

II. Frictional / Press-Fit Abutments

- Frictional or press-fit abutments are supplied by brands such as Stryker and Miter Blades. These abutments come in both straight and angled variants, with angles typically around 15 degrees. To insert these abutments, the head must be oriented correctly and then tapped firmly into place with a mallet. Once tapped in, the abutment cannot be removed, making it a secure and permanent attachment^[23].

III. Non-Threaded, Cementable Abutments

- The Core-Vent design system utilizes non-threaded, cementable abutments. In this system, abutment selection is typically made after the second stage of surgery.

Attachment of Abutment to Implants

- Modern systems primarily use retaining screws to attach abutments to implants. For implants with flat surfaces, one-piece attachments are typically used, but these are limited to multiple splinted implants and lack anti-rotation features. In contrast, abutments designed with anti-rotation features prevent unwanted movement. Current attachment systems include external hex, internal hex, spline, and morse-taper designs^[24].

Abutment Selection

- For optimal results, the labial margin should extend at least 1 mm subgingivally; however, if it extends more than 3 mm, seating the abutment and removing excess cement becomes challenging. In such cases, a preable abutment may be used to address any discrepancies. A vertical space of 3 mm typically ensures a favorable emergence profile. When the additional flare is needed within a limited vertical space, a wide-diameter preable abutment is appropriate. For slight labial angulation, a standard abutment is suitable, and similarly, standard abutments work well in interocclusal spaces of 6–7 mm, while a preable abutment is preferable when space is limited.
- Screw-retained abutments are easier to retrieve compared to cementable ones, which can be more challenging to remove. Additionally, in cases with heightened aesthetic requirements, porcelain abutments may be chosen. Final restorations on either metal or porcelain abutments must be fabricated with sufficient thickness to prevent any display of metal.

Conclusion

Dental implants have become the foremost treatment option for restoring patients with partial or complete tooth loss. The connection between the implant and abutment is crucial, as it ensures both lateral and rotational stability, which ultimately supports the overall stability of the implant-supported prosthesis.

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Engineering the Face: Biomaterials for Patient-Specific Maxillofacial Implants

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Received on: 06 March 2025; Accepted on: 21 March 2025; Published on : 19 April 2025

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Abstract

Maxillofacial defects, arising from trauma, oncological resection, or congenital deformities, present significant functional and aesthetic challenges. Patient-specific implants (PSIs), designed and fabricated to precisely match the individual patient's anatomy, have emerged as a transformative approach in reconstructing these complex defects. This article provides a comprehensive review of PSIs in maxillofacial reconstruction, encompassing their design principles, manufacturing techniques, and the diverse range of biomaterials employed. We delve into the advantages of PSIs, including improved surgical accuracy, reduced operative time, enhanced functional outcomes, and superior aesthetic results. Furthermore, we critically evaluate the various materials utilized for PSI fabrication, including metals (titanium and its alloys, cobalt-chromium alloys), polymers (polyether ether ketone, polymethylmethacrylate, polycaprolactone), and ceramics (hydroxyapatite), highlighting their respective advantages and disadvantages based on existing literature. This review culminates in a detailed table summarizing the properties, benefits, and limitations of each material, along with relevant author and year of publication, providing a valuable resource for clinicians and researchers in the field. The integration of advanced imaging, computer-aided design/computer-aided manufacturing (CAD/CAM), and biocompatible materials has positioned PSIs at the forefront of personalized and precise maxillofacial reconstruction, ultimately improving patient quality of life.

Keywords : Patient-specific implant, maxillofacial defect, reconstruction, biomaterials, CAD/CAM, titanium, polyether ether ketone, hydroxyapatite.

Introduction

The maxillofacial region, encompassing the complex bony and soft tissue structures of the head and neck, plays a crucial role in essential functions such as mastication, speech, respiration, and facial expression. Defects in this region, resulting from a variety of etiologies including trauma, ablative surgery for benign or malignant tumors, congenital anomalies, and infections, can lead to significant functional impairment, aesthetic disfigurement, and psychological distress for patients¹. Major abnormalities in this area can be caused by a variety of factors, including traumatic avulsion, osteoradionecrosis (ORN), bisphosphonate-related osteonecrosis of the jaw (BRONJ), removal of benign and malignant tumors, cysts, etc² The intricate three-dimensional anatomy of the maxillofacial skeleton and the critical functional and aesthetic demands necessitate precise

and individualized reconstructive strategies. Traditional methods of maxillofacial reconstruction often involve the use of standard prefabricated implants or autogenous grafts harvested from other parts of the patient's body (e.g., iliac crest, rib, fibula)³. While autogenous grafts offer excellent biocompatibility and the potential for osseointegration, they are associated with donor site morbidity, increased operative time, and potential resorption. Prefabricated implants, on the other hand, may not always perfectly conform to the complex and unique contours of the defect, leading to suboptimal functional and aesthetic outcomes, as well as potential complications such as implant instability and soft tissue irritation. The advent of

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<https://doi.org/10.5281/zenodo.15253967>

How to cite this article : Bhardwaj et al. - Heal Talk - A Journal of Clinical Dentistry. (2025). Engineering the Face: Biomaterials for Patient-Specific Maxillofacial Implants. In Heal Talk A Journal of Clinical Dentistry (Vol. 17, Number 4, pp. 78-86). Zenodo. <https://doi.org/10.5281/zenodo.15253967>

advanced medical imaging techniques, such as computed tomography (CT) and magnetic resonance imaging (MRI), coupled with sophisticated computer-aided design (CAD) and computer-aided manufacturing (CAM) technologies, has revolutionized the field of maxillofacial reconstruction⁴. This synergy has paved the way for the development and application of patient-specific implants (PSIs). PSIs are custom-designed and fabricated implants that precisely match the individual patient's anatomical defect, as determined from their preoperative imaging data. This personalized approach offers numerous potential advantages over traditional methods, including improved surgical accuracy, reduced operative time, enhanced functional rehabilitation, superior aesthetic outcomes, and potentially lower complication rates⁵. A diverse range of materials, including metals, polymers, and ceramics, have been explored and utilized for PSI fabrication in the maxillofacial region. Each material possesses unique characteristics that influence its suitability for different clinical scenarios. This article aims to provide a comprehensive overview of the current state of patient-specific implants in maxillofacial defect reconstruction⁶. We will discuss the design and manufacturing process of PSIs, delve into the various biomaterials employed, and critically evaluate their advantages and disadvantages based on existing literature. A detailed table summarizing the key properties and clinical outcomes associated with each material will be presented to provide a valuable resource for clinicians and researchers in this rapidly evolving field.

Aim

The aim of this article is to review and analyze the various materials used in the fabrication of patient-specific implants (PSIs) for maxillofacial reconstruction, based on literature published up to the year 2022, with a focus on their mechanical properties, biocompatibility, clinical applications, advantages, and limitations.

Method

A comprehensive literature search was conducted to evaluate the application and outcomes of Patient-Specific Implants (PSIs) in the management of maxillofacial defects. Electronic databases including PubMed, Scopus, ScienceDirect, and Google Scholar were systematically searched for relevant articles published up to December 2022. The search strategy utilized a combination of keywords and Medical Subject Headings (MeSH) terms such as “patient-specific implants,” “custom implants,” “maxillofacial reconstruction,” “3D printing,” “craniofacial defects,” and “virtual surgical planning.” Inclusion criteria encompassed original research articles, clinical trials, case series, and review articles that specifically discussed the use of PSIs in maxillofacial surgery for traumatic, congenital, oncologic, or reconstructive purposes. Studies not available in English, animal studies, and reports lacking clinical application of PSIs were excluded. A total of [insert number] articles were shortlisted after title and abstract screening, out of which [insert number] were included for full-text review and analysis. Data were extracted on implant materials, indications, surgical outcomes, complications, and advantages of PSIs. The methodological quality of the included studies was assessed where applicable, and relevant findings were synthesized to provide a comprehensive overview of the role of PSIs in

maxillofacial defect management

Discussion

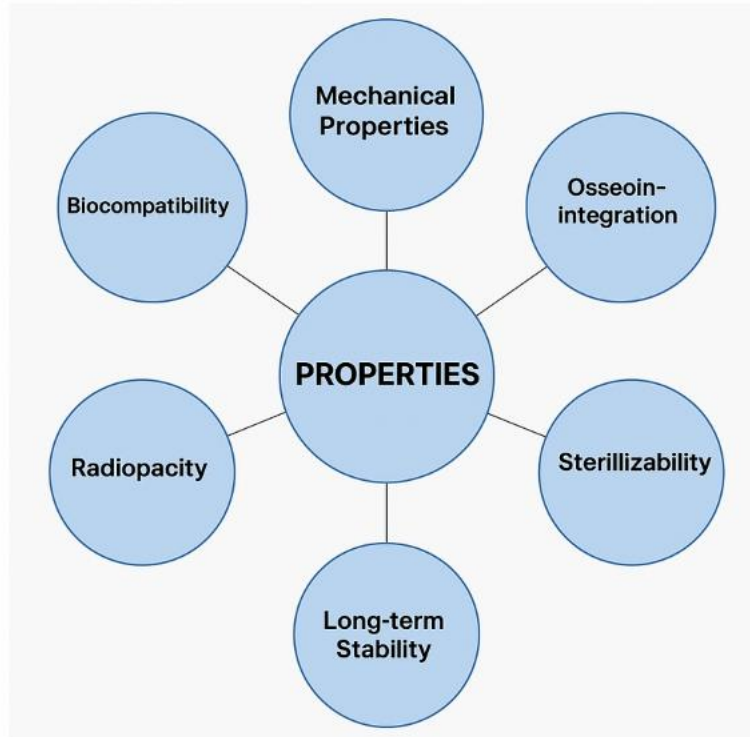
The selection of materials for patient-specific implants (PSIs) in maxillofacial reconstruction requires careful consideration of several key properties. An ideal biomaterial should exhibit excellent biocompatibility to prevent immune reactions and ensure tissue integration. It must have sufficient mechanical strength and stiffness to withstand masticatory forces, while maintaining a modulus of elasticity close to that of bone to minimize stress shielding⁸. Additional desirable features include corrosion resistance, ease of fabrication using CAD/CAM or 3D printing technologies, radiopacity or radiolucency (depending on clinical need), and resistance to bacterial adhesion to reduce postoperative complications. A wide variety of materials have been explored for the fabrication of patient-specific implants (PSIs) in maxillofacial reconstruction, each with distinct advantages and limitations. Titanium and its alloys, such as Ti-6Al-4V, are the most commonly used metals due to their excellent biocompatibility, which is largely attributed to a stable oxide layer.

These materials exhibit a high strength-to-weight ratio, good corrosion resistance, and favorable osseointegration properties¹⁰. Additionally, they are radiopaque and compatible with advanced manufacturing techniques like CNC machining, selective laser melting (SLM), and electron beam melting (EBM). However, titanium implants are relatively expensive, and their high elastic modulus can lead to stress shielding. There is also a potential risk of titanium particle release and rare hypersensitivity reactions, particularly due to trace elements like nickel or vanadium. Cobalt Chromium-Molybdenum (Co-Cr-Mo) alloys offer high strength and stiffness, making them suitable for load-bearing applications. They also provide excellent wear and corrosion resistance and are radiopaque. Despite these benefits, Co-Cr alloys have comparatively lower biocompatibility, carry a risk of metal ion release and allergic reactions, and pose challenges in additive manufacturing due to their hardness. Like titanium, their high stiffness can contribute to stress shielding. Among polymers, Polyether Ether Ketone (PEEK)²² is gaining popularity in PSI fabrication due to its biocompatibility, bone-mimicking mechanical properties, radiolucency, and chemical stability. It can be easily shaped using CNC or additive manufacturing methods and even made bioactive. However, it has lower mechanical strength compared to metals, may allow bacterial adhesion, and its radiolucency can interfere with postoperative imaging unless radiopaque markers are incorporated. Polymethylmethacrylate (PMMA) is another polymer used in craniofacial reconstruction. It is inexpensive, radiolucent, and can be modified intraoperatively. Some forms are biocompatible, but PMMA has limitations such as low mechanical strength, heat generation during setting, risk of infection, and limited long-term durability. Polycaprolactone (PCL)²⁸, a biodegradable and biocompatible polymer, is useful for temporary scaffolds and promoting tissue regeneration. It is easily 3D printed, but its mechanical strength and stiffness are very low. Additionally, the degradation rate of PCL can be unpredictable, making it unsuitable for permanent or load-bearing implants. In the category of ceramics, Hydroxyapatite (HA) is highly biocompatible and has excellent osteoconductive

properties. It bonds well with bone and is commonly used as a coating material or in porous scaffolds. However, it is mechanically weak and brittle, making it unsuitable for load-bearing applications. Its use is therefore largely limited to non-structural or surface-level roles in implant design.

The selection of an appropriate biomaterial is a critical step in the design and fabrication of patientspecific implants for maxillofacial reconstruction. The ideal material should possess a combination of properties, including:

Property of materials used for Patient-Specific Implants in Maxillofacial Reconstruction



Based on these criteria, several classes of biomaterials have been utilized for the fabrication of patient-specific implants in maxillofacial reconstruction:

Table 1: Materials Used In Patient Specific Implants

MaterialType	Material	Advantages	Disadvantages
Metals ⁷	Titanium & Alloys (Ti, Ti-6Al-4V)	<ul style="list-style-type: none"> • Excellent biocompatibility (oxide layer) • High strength-to-weight ratio • Corrosion resistance • Good osseointegration • Radiopaque • Compatible with CNC, SLM, EBM 	<ul style="list-style-type: none"> • High cost • Stress shielding (high modulus) • Possible titanium particle release • Rare hypersensitivity (to nickel/vanadium)
Metals ^{8,9}	Cobalt-Chromium Alloys (Co-Cr-Mo)	<ul style="list-style-type: none"> • High strength and stiffness • Excellent wear and corrosion resistance • Suitable for load bearing • Radiopaque 	<ul style="list-style-type: none"> • Lower biocompatibility • Metal ion release and allergy risk • Harder to process with AM • Stress shielding due to stiffness
Polymers ^{9,10}	Polyether Ether Ketone (PEEK)	<ul style="list-style-type: none"> • Biocompatible • Bone-like mechanical properties • Radiolucent • Chemically stable • Easily processed with CNC / AM • Can be bioactive 	<ul style="list-style-type: none"> • Lower strength than metals • Bacterial adhesion risk • Radiolucency may hinder imaging • unless radiopaque markers are added
Polymers ¹¹	Polymethylmethacrylate (PMMA)	<ul style="list-style-type: none"> • Low cost • Easy to modify intraoperatively • Radiolucent • Biocompatible (some forms) 	<ul style="list-style-type: none"> • Low mechanical strength and wear resistance • Heat release during setting • Infection risk • Poor long-term durability
Polymers ¹²	Polycaprolactone (PCL)	<ul style="list-style-type: none"> • Biodegradable and biocompatible • Encourages tissue regeneration • Easily 3D printed 	<ul style="list-style-type: none"> • Very low strength and stiffness • Unpredictable degradation rate • Not for permanent or load-bearing applications
Ceramics ¹³	Hydroxyapatite (HA)	<ul style="list-style-type: none"> • High biocompatibility • Excellent osteoconductivity • Bonds well with bone • Used as coatings or porous scaffolds 	<ul style="list-style-type: none"> • Brittle and weak mechanically • Not suitable for load-bearing applications • Mostly used in coatings or nonstructural parts

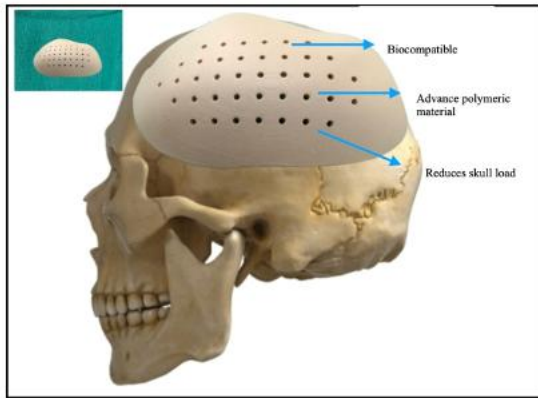


Fig 2: PEKK Implant for Parietal Defects PEKK (Polyetherketoneketone)

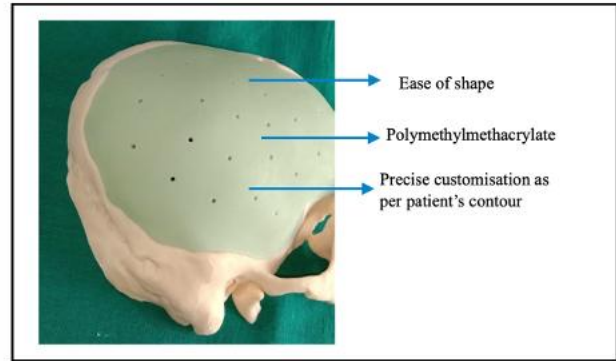


Fig 3: PMMA Implant



Fig 4: Customised Orbital Titanium Mesh for Orbital Floor Reconstruction

Author&Year	Objective	Methodology	Results	Conclusion
Rubin LR, Robertson GW, Shapiro RN (1948)¹	Investigated the use of Polyethylene for maxillofacial reconstruction.	Used chin, forehead, and ear implants with Polyethylene.	Polyethylene was found to be chemically inert, flexible, and biocompatible.	Recommended for reconstructive surgeries due to its adaptability.
Laub DR, Spohn W, Lash H et al. (1970)²	Studied prefabricated silastic implants for peri-orbital reconstruction.	Used silicone inlay method in 25 cases.	Implants were effective with fewer complications when immobile and secured to bone.	Further modifications needed for technique optimization.
Davis PKB, Jones SM (1971)³	Reviewed 137 cases using Silastic implants.	Examined complications and implant loss rates.	1 in 10 nasal implants failed, but success was noted in facial contour and breast reconstruction.	Careful fixation is essential, particularly in nasal bridge applications.
Chalian VA, Habal MB, McCutcheon RL (1974)⁴	Investigated prefabricated silicone implants for facial reconstruction.	Study on 34 patients with a 4- year follow-up.	Silicone implants were biocompatible and effective for facial contouring.	Custom implants offer better fit and stability than commercial ones. Prefabricated implants are a viable option for facial reconstruction.
Mohler LR, Porterfield HW, Ferraro JW (1976)⁵	Evaluated customized silicone implants for craniofacial defects.	Used Dow Corning Medical Grade Elastomer 382 in 34 cases.	33 out of 34 cases had satisfactory results, but risks of extrusion existed.	Simple technique with reduced operative time, but long-term effects need further research.
Lash H, Apfelberg DB, Lavey EB et al. (1978)⁶	Studied custom fabricated silicone implants for contour restoration.	Placed 87 implants in 83 patients (chin, nose, forehead, cheek, mandible, etc.).	Reported complications included extrusion, movement, hematoma, and infection.	Silicone met criteria for ideal soft tissue replacement but requires careful handling.
Epstein LI (1979)⁷	Evaluated Proplast (Teflon and Carbon) implants for facial deformities.	Used 38 implants for various maxillofacial corrections over 3.5 years.	Majority of cases had good outcomes; only 3 implants failed.	Autoclaving and blood saturation before implantation improved success.
Epker BN, Stella JP (1989)⁸	Investigated prefabricated silicone rubber implants for frontal and nasofrontal reconstruction.	15 custom silicone rubber implants placed over 8 years.	Silicone rubber implants were inert, non-carcinogenic, and stable.	Effective for frontal augmentation with minimal complications.
Wellisz T, Dougherty W, Gross J (1992)⁹	Evaluated Medpor porous polyethylene Flexblock implant for craniofacial applications.	Used for cranial contour correction in small-to-medium defects.	Found to be a viable alternative to existing methods.	Recommended thicker custom implants for larger defects.
Whear NM, Cousley RRJ, Liew C et al. (1993)¹⁰	Assessed postoperative infection of Proplast facial implants.	Retrospective analysis of 88 Proplast implants over 9 years.	Infection rate was 16%, higher in males (2:1 ratio).	Higher infection risk with osteotomies; further studies needed.
Rubin JP, Yaremchuk MJ (1997)¹¹	Studied complications of implantable biomaterials in facial reconstruction.	Used expanded polytetrafluoroethylene implants in multiple facial areas.	Highest complications in nose and ear, lowest in chin and malar regions.	Biocompatibility influenced by material type, surgical technique, and host response.
Yaremchuk MJ (2003)¹²	Evaluated porous polyethylene implants for facial reconstruction.	370 implants placed in 162 patients.	16 patients required reoperation due to infection or displeasing contour.	Porous polyethylene is biocompatible and effective for skeletal reconstruction.

Scolozzi P, Martinez A, Jaques B (2007)¹³	Assessed PEEK (polyetheretherke tone) PSIs for complex orbito-frontotemporal reconstruction.	Conducted cranioplasty with PSI.	PEEK implants showed excellent cosmetic and psychological outcomes.	PEEK is biocompatible, resistant to corrosion, and MRI-compatible.
Bell BR, arkiewicz MR (2009)¹⁴	Investigated computer-assisted planning for orbital reconstruction.	Used preoperative 3D modeling and intraoperative navigation.	Improved accuracy in complex orbital injury reconstruction.	Computer-assisted planning enhances PSI accuracy.
Kim MM, Boahene KD, Byrne PJ (2009)¹⁵	Evaluated PEEK implants for maxillofacial reconstruction.	Used PEEK PSI in 4 patients with excellent results.	No complications; high mechanical stability and durability.	PEEK is an ideal material for maxillofacial reconstruction.
Tarsitano et al. (2016)¹⁶	Assessed CAD/ CAM-designed PSIs in mandibular reconstruction.	Retrospective analysis of PSI-assisted reconstructions.	PSIs improved anatomical fit, reduced surgical time, and enhanced function.	CAD/CAM PSIs enhance precision and predictability.
Schouman et al. (2018)¹⁷	Analyzed 3D-printed titanium PSIs in midface reconstruction.	Clinical study on orbital and zygomatic defects.	Titanium PSIs improved stability, aesthetics, and biocompatibility.	3D-printed PSIs provide superior reconstruction.
Ciocca et al. (2019)¹⁸	Reviewed the use of PEEK PSIs in cranioplasty and maxillofacial surgery.	Literature review and clinical observations.	PEEK implants were biocompatible, lightweight, and mechanically stable.	PEEK is a promising alternative to titanium for aesthetic cases.
Goh et al. (2020)¹⁹	Examined 3D printing in PSI fabrication for facial bone defects.	Systematic review of PSI manufacturing techniques.	3D printing provides high-accuracy, personalized solutions.	3D printing optimizes PSI design and surgical outcomes.
Lethaus et al. (2021)²⁰	Investigated complications of PSI use in maxillofacial surgery.	Longitudinal study on PSI-related infections and reoperations.	Implant exposure and infection mainly due to poor soft tissue coverage.	Careful surgical planning is crucial for PSI success.
Choi et al. (2022)²¹	Assessed functional and aesthetic outcomes of PSIs in post-trauma reconstructions.	Clinical evaluation of PSI-assisted reconstructions.	Significant improvement in masticatory function, speech, and symmetry.	PSIs offer reliable solutions for post-traumatic defects.

Table 2 : Review of Studies

Conclusion

The selection of an optimal material for patient-specific implants (PSIs) in maxillofacial reconstruction is critical for long-term success. While various materials offer unique advantages, titanium and its alloys have consistently demonstrated a favorable balance of properties. Their excellent biocompatibility, high strength, and proven osseointegration capabilities make them a reliable choice for load-bearing applications.

The evolution of additive manufacturing has further enhanced the use of titanium, allowing for the creation of complex, patient-tailored designs with enhanced precision. Although newer materials like PEEK and certain bioceramics show promise, more extensive long-term clinical data is needed to fully establish their superiority over titanium in diverse maxillofacial reconstruction scenarios.

Ultimately, the best material may vary depending on the specific clinical case, but titanium remains a cornerstone in PSI fabrication.

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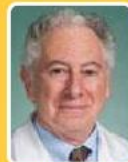
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Campus Talk

About all Campus

WORLD CANCER DAY

I.T.S Dental College, Ghaziabad



World Cancer Day held every 4 February is the global uniting initiative led by the Union for International Cancer Control (UICC). Each year, World Cancer Day adopts a specific theme, focusing on different aspects of cancer care. The theme for World Cancer Day 2025-2027, "United by Unique", highlights the significance of personalized cancer care. This year's theme underscores the need for treatments and interventions tailored to the individual needs of each patient, acknowledging that cancer is not one-size-fits-all.

A series of events were organized at the adopted village, Sultanpur, Old Age Home Duhai, at the camp venue (Mathurapur village and Kasba Muradnagar) and OPD of I.T.S-Center for Dental Studies and Research, Muradnagar including Micro-Group awareness. Health educational pamphlets regarding oral cancer were distributed at the camp venue and to the patients visiting the OPD of ITS-CDSR. Health talk regarding early signs and symptoms of Oral Cancer, adverse habits related to oral cancer, and individuals were motivated to quit habits to avoid the disease. Tobacco Cessation counseling was emphasized to all patients who were in a habit of smoking or chewing tobacco at the camp venue and the Tobacco Cessation Center of ITS – CDSR, Muradnagar. Oral cancer screening was done at the adopted village,

Old Age Home Duhai, camp venue (Mathurapur village and Kasba Muradnagar) and at I.T.S – CDSR, Muradnagar. There was a demonstration of "Self Examination" to all patients to check their oral cavity regularly and to make them aware of early changes so that they can visit a doctor as soon as possible. Stake-holders like village pradhans, and health care workers of villages were identified and sensitized regarding this deadly disease and were made aware of the prevention, diagnosis, and treatment of cancer. Shop-keepers at Kasba Muradnagar selling tobacco products were sensitised and motivated to strictly adhere to the COTPA Act 2003 and not to sell tobacco products to people under 18 years of age. The pledge was taken by all the patients, staff, students, and stakeholders to combat this disease. An interactive Health Education session was done for all patients and their queries were answered. Also, the patients were referred to I.T.S Dental College for further comprehensive treatment.

Our sincere thanks to our Chairman, Dr. R.P. Chadha sir, and Vice Chairman, Mr. Arpit Chadha sir who were the driving force behind the program and gave us the opportunity to celebrate this day.

CONS- ENDO DAY

I.T.S Centre for Dental Studies & Research, Ghaziabad



The Indian Association of Conservative Dentistry and Endodontics has earmarked 5th March as "Cons-Endo" Day which is celebrated throughout India to raise awareness amongst the general population about the speciality. The Department of Conservative Dentistry & Endodontics, I.T.S. Dental College, Muradnagar under the aegis of IACDE and the guidance of our beloved Chairman Dr. R.P. Chadha, Vice chairman Shri. Arpit Chadha, Director-Principal Dr. Devi Charan Shetty celebrated this occasion as a part of Cons-Endo Week from 5th to 8th March 2025, with joy and delight. The scientific

extravaganza was enjoyed and attended by all undergraduates, postgraduates, and senior faculty members from all the specialities making it a roaring success.

Under the leadership of Dr. Sonali Taneja, Professor and Head, Department of Conservative Dentistry and Endodontics, The CONS-ENDO week extravaganza was celebrated with great

enthusiasm and received overwhelming response and participation from the post graduate as well as undergraduate students. The first day of celebrations started off with exciting events like "Reel making", "Mandala Art" & "Short Video" Competition. Events like "Slogan writing competition", "Debate", Interdisciplinary Poster/ Collage Making Competition", "Rubber dam Rapid Fire" and "Memes" were held on the second day of the celebrations and saw a splendid display of talent and skill from the participants. Day three was replete with vibrant designs seen during the "Rangoli Competition" and magnificent display of talent during the Nukkad Natak by the interns & final year students. The celebration concluded with the Valedictory ceremony. The event was graced by the presence of Respected Director-Principal, Dr. Devi Charan Shetty Sir, Deans, Head of the Departments, senior faculty members, postgraduate students and interns

This Program provided the opportunity to learn, sensitize & inspired undergraduate students to conservative dentistry. The students were educated & motivated about maintaining good oral hygiene & its importance. The curtain was drawn with prize distribution to our victorious students by Director- Principal Dr. Devi Charan. The Department Of Conservative Dentistry and Endodontics wishes to thank our esteemed Chairman Sir Dr. R.P. Chadha, Vice-Chairman Sir Shri. Arpit Chadha, who have been the torch bearers for innovation and have laid the strong foundation for the institution's constant accomplishments. They have been the guiding light behind the programme and were the motivation for making the event a massive success.



ORAL & MAXILLOFACIAL SURGERY DAY

I.T.S Dental College, Ghaziabad

The Department of Oral & Maxillofacial Surgery at ITS Dental College, Ghaziabad, proudly celebrated Intern-ational Oral and Maxillofacial Surgery Day. The event witnessed the enthusiastic participation of over 250 BDS and MDS students, along with the Heads of Departments (HODs) and esteemed faculty members from all dental departments of the institute. This significant day highlights the specialty while honoring the inspiring role of Oral and Maxillofacial Surgeons across the globe. The event commenced with the ceremonial lighting of the lamp before the revered Goddess Saraswati, symbolizing the pursuit of knowledge and enlightenment.

The inaugural ceremony was graced by the presence of distinguished dignitaries, including the keynote speaker and chief guest **Dr. Shubham Garg**, alongside the Institute's Director-Principal **Dr. Devi Charan Shetty**, **HOD-Dr. Arun Kumar KV**, Professor **Dr. Amit Gupta**, and other HODs from various dental departments. **Dr. Devi Charan Shetty**, Director-Principal of the institute, expressed heartfelt gratitude to all participants for their involvement in the program. Following this, **HOD-Dr. Arun Kumar KV** addressed the gathering, elaborating on the significance of the event and its purpose. The keynote speaker and chief guest, **Dr. Shubham Garg**, who currently serves as Director and Senior Consultant at Dharamshila Narayana Super speciality Hospital, Delhi, delivered an insightful session. He provided detailed knowledge on cancers of the neck and oral cavity, enriching the audience's understanding of these critical health issues.





Campus Talk

About all Campus

BLENDING BEAUTY AND PRECISION : PROSTHODONTIST DAY WORKSHOP ON AESTHETICS, OCCLUSION, AND RESTORATIVE EXCELLENCE

Santosh Dental College, Ghaziabad



tise and commitment to advancing prosthodontics have been instrumental in shaping the department's reputation as a center of excellence.

The workshop delved into two critical aspects of prosthodontics: the seamless integration of aesthetics and the pivotal role of occlusion in restorative treatments. **Dr. Rohit Shetty's** enlightening lecture captivated the audience as he shared his expertise on achieving the perfect balance between beauty and functionality in dental restorations. His session covered advanced techniques in composite veneers, emphasizing shade matching, tooth contours, proportions, and smile design.

A highlight of the workshop was the hands-on session, where individual postgraduate students (PGS) had the opportunity to work directly with composite veneers. Under **Dr. Shetty's** guidance, participants learned the art of using Edelweiss veneers, while ensuring optimal occlusal function. This practical experience empowered attendees to refine their skills and apply these advanced techniques in their clinical practice.

The event was further enriched by the presence of **Dr. Rajiv Aluwalia**, the Dean of Student Welfare, **Dr. Sumita Giri**, the Deputy Dean of Dental Sciences, and **Dr. Natasha Gambhir**, the Assistant Dean, and faculty members whose support and insights added immense value to the occasion.

The event included a ceremonial cake-cutting, symbolizing the celebration of Prosthodontist Day and the spirit of collaboration. This was followed by a delightful lunch, where participants and faculty mingled, sharing ideas and experiences in a relaxed and festive atmosphere.

The workshop not only celebrated the art and science of prosthodontics but also reinforced the commitment of Santosh Dental College to fostering innovation and excellence in dental education. By equipping participants with advanced knowledge and hands-on experience, the event set a new benchmark in prosthodontic training, ensuring long-term patient satisfaction and clinical success.

Santosh Deemed To Be University On 22 January 2025, Santosh Dental College marked Prosthodontist Day with workshop titled "Refashioning Aesthetic, Revamping Occlusion," led by the esteemed **Dr. Rohit Shetty** (Prof. & HOD, Department of Prosthodontics, KLE, Society's Institute of Dental Sciences, Bangalore), a globally renowned prosthodontist and master of advanced restorative techniques and occlusion management. The event was a resounding success, blending cutting-edge education with celebration, and brought together some of the brightest minds in dentistry.

The workshop was inaugurated under the distinguished leadership of Prof. VN Mahalaxmi, the visionary Vice Chancellor of Santosh Deemed to be University, whose unwavering dedication to academic excellence continues to inspire the institution. The event was further graced by the presence of **Dr. Akshay Bhargava**, the dynamic Dean of Dental Sciences, whose leadership has propelled Santosh Dental College to the forefront of dental education and innovation.

The Department of Prosthodontics and Crown & Bridge, under the able guidance of its Head of Department, **Dr. Rajiv Kumar Gupta**, played a pivotal role in organizing this transformative event. His exper-





NATIONAL DENTIST DAY 2025 : CELEBRATING THE UNSUNG HEROES OF ORAL HEALTH

I.T.S Centre For Dental Sciences & Research, Murad Nagar



National Dentist Day, observed each year on March 6th, is a significant occasion dedicated to recognizing the commitment, skill, and contributions of dental professionals nationwide. This day also serves as an important reminder for individuals to maintain regular dental visits and uphold good oral hygiene practices. Simple actions such as brushing, flossing, and scheduling annual check-ups can contribute to a lifetime of healthy smiles.

In alignment with the celebration of this notable day, the I.T.S Centre for Dental Studies & Research in Ghaziabad organized various activities to promote awareness among the community. Events took place at several locations, including Radhey Shyam Colony, Muradnagar, the adopted village of Sultanpur, and the college's outpatient department. Attendees were informed about the vital role dental professionals play as the first line of defense against oral health issues, including cavities, gum disease, and oral cancer. Through regular check-ups, cleanings, and advanced treatments, dentists help

ensure that smiles remain bright and healthy throughout life.

Additionally, a drawing competition was held for students at the adopted school, with certificates awarded to the winners. At the college, a Reels competition highlighting the importance of dentists and oral hygiene was conducted, and prizes were given to the top participants.

Our sincere thanks to our Chairman, Dr. R.P. Chadha sir, Vice-Chairman, Mr. Arpit Chadha sir, who were the driving force behind the programme and had given us opportunity to celebrate this day.



CONS AND ENDO DAY

Shree Bankey Bihari Dental College & Research Centre, Ghaziabad

The IACDE commemorates 5th March as the 'National Cons Endo day'. We, the department of Conservative Dentistry and Endodontics at Shree Bankey Bihari Dental College and Research Centre, Ghaziabad celebrated this day with Great enthusiasm to celebrate our budding endodontists and our endodontic community.

Customised T-shirts with department logo were adorned by the whole department (faculties and postgraduates) to make this day special. Post graduates and undergraduates also made a beautiful Rangoli in the department, depicting the various aspects of endodontics. There was a cake cutting ceremony in the department, with cake printed with department logo.

To make this day memorable, various fun activities and games like quiz competition, cavity preparation competition, treasure hunt, lemon race, 100M race, find the prop game etc were organised among the students and faculties to emphasise the importance of endodontics and unity in the endodontic community. The winners were awarded with various prizes like endodontic sealer, hand files, MTA, Tokuyama composites etc

The day ended in a splendid way with lunch and 'Lucky Draw' in which the grand prize was endodontic hand files among various other prizes were given.





Campus Talk

About all Campus

NATIONAL PERIODONTIST DAY

Kalka Dental College, Meerut

Meerut, 28th February 2025 – The Department of Periodontology and Oral Implantology, Kalka Dental College, Meerut, in association with the Indian Society of Periodontology, celebrated National Periodontist Day with great enthusiasm. A series of events were organized to mark the occasion, aiming to raise awareness about the significance of maintaining good oral health.

The event commenced with a Lamp Lighting Ceremony, graced by the esteemed presence of the Principal, Vice-Principal, and Heads of Departments. This was followed by the much-awaited Prize Distribution Ceremony, where winners of the Gum Health Poster Design Competition and Selfie Competition were honored. Additionally, two non-teaching staff members were recognized and awarded for maintaining the Best Oral Hygiene.

Certificates and prizes were distributed to all the winners, and the event concluded on a high note, reaffirming the collective commitment to fostering a healthier oral hygiene culture. The celebration stood as a step forward in building a community that is not only orally healthier but also mentally and physically well.



NATIONAL ORAL PATHOLOGIST DAY

Kalka Dental College, Meerut

National Oral Pathologist Day on 25th February The Department of Oral Pathology at Kalka Dental College, Meerut proudly celebrated National Oral Pathologist Day on 25th February to honor the invaluable contributions of oral pathologists in diagnosing and preventing oral diseases, including oral cancer. The event aimed to highlight the significant role of oral pathologists in diagnosing and managing oral diseases, with a special focus on oral cancer awareness and prevention.

The celebration commenced with a formal inauguration ceremony, graced by the esteemed presence of Dr. Kanika Bhalla, who emphasized the crucial role of oral pathologists in ensuring early detection and diagnosis of life-threatening oral conditions. The Head of the Department, Dr. Lalita Yadav welcomed the gathering and shared insights into the department's achievements and ongoing research efforts.

The celebration featured a series of academic and awareness activities, including guest lectures by Dr Kanika Bhalla on recent advancements in oral cancer detection, and a poster presentation by students. A special tribute was paid to Dr. H.M. Dholakia, the pioneer of oral pathology in India, whose birth anniversary is commemorated as National Oral Pathologist Day. Speaking on the occasion, Dr Lalita Yadav Head of Department, emphasized the significance of oral pathology

in early disease detection and encouraged students to contribute to the field through research and clinical expertise.

The department organized an Oral Cancer Screening Camp in collaboration with local healthcare providers. An interactive quiz competition on oral pathology concepts saw enthusiastic participation from undergraduate and postgraduate students. Winners were awarded certificates and prizes. The celebration witnessed enthusiastic participation from faculty members, students, and healthcare professionals, reinforcing the importance of oral pathology in modern dentistry and public health.

In his closing remarks, Dr. Rakesh Krishan Gupta Principal of Kalka Dental College appreciated the department's efforts in raising awareness and enhancing academic excellence through such events. The celebration concluded with a vote of thanks delivered by Dr. Jyoti Ravi, who expressed gratitude to the faculty, students, and staff for their dedication and teamwork in making the event successful.

The event was widely appreciated by attendees for its informative sessions, community outreach, and interactive learning experiences, reinforcing the pivotal role of oral pathologists in health-care. This Department remains committed to promoting excellence in oral pathology education and service, furthering its mission to improve oral health outcomes through early diagnosis and prevention.



NATIONAL ORAL PATHOLOGY DAY

D J College of Dental Sciences & Research, Modinagar



National Oral Pathology Day was celebrated in The Department of Oral Pathology at D J College of Dent-al Sciences & Research, Modinagar. National Oral Pathology Day is celebrated on 25th February on the occasion of birth anniversary of Dr H M Dholakia. (First Oral Pathologist of India.) The occasion started with creativity and enthusiasm by the students showcasing their artistic talents, making the event a grand success!

Rangoli Making and Vegetable/Fruit Carving Competitions were organized and winners were awarded with certificates and trophies. The Department of Oral Pathology is thankful to Dr Smiti Jassar Klaire, CEO, Mr Rhitik Jassar, COO and Dr Pradeep Shukla, Principal & Dean for their immense support for making the event successful.



PROSTHODONTIST DAY

Subharti Dental College & Hospital, Meerut

On the occasion of Prosthodontist Day, the Department of Prosthodontics and Crown & Bridge, Subharti Dental College & Hospital, Meerut, organized a series of events to mark the significance of this special day and promote awareness about the field of Prosthodontics. The Department hosted a e-poster competition and a quiz competi-tion, both aimed at engaging undergraduates, interns and postgradu-ates. These events provided a platform for participants to showcase their knowledge and creativity.

The department also demonstrated its commi-tment to patient care and welfare. As part of the celebrations, denture insertions were done along with free mouth gels and denture cleansing kit were distributed to patients, emphasizing the importance of oral hygiene and prosthetic care. This initiative reflected the department's dedication to community service and patient well-being.





Campus Talk

About all Campus

CONS AND ENDO DAY

Institute of Dental Studies & Technologies, Modinagar



The department of Conservative Dentistry & Endodontics at Institute of Dental studies & Technologies, Modinagar celebrated Cons And Endo Day on 5th March 2025. The main objective of this event was to give insights pertaining to the importance of restorative dentistry and endodontics with emphasis on futuristic aspects in aesthetic dentistry.

The department organized various groups of events & competitions such as tooth preparation, Quiz Competition and debate competition for both under-graduates and post-graduates students. A well-organised event was hosted by Professor and Head Dr. Rishi Manan.

The program was graced by the secretary DMET Dr. Vikram Gandhi, principal Dr. Nidhi Agarwal, The Director PG Studies Dr. Gaurav Mittal and the vice-principal Dr. Achint Juneja and Dr. Manish khatri.

The programme was concluded by distribution of prizes for the various activities followed by a lunch organised by Department of Conservative Dentistry & Endodontics.

IMPORTANCE OF EARLY DETECTION AND PREVENTION IN ORAL CANCER

Institute of Dental Studies & Technologies, Modinagar

We had Fruit carving, Reel making, Just a Minute competitions

The day started with an Orientation lecture for BDS 3rd yr students on "Importance of Early Detection and Prevention in Oral Cancer"

You can pls make a small write up with this.

Dr Nutan Tyagi : Prof and Head

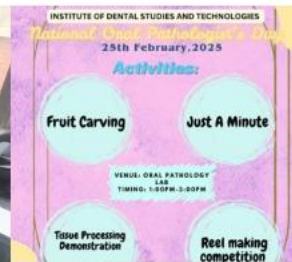
Dr Akansha Misra : Professor

Dr Nazifa Javaid : Senior Lecturer

Dr Priyanka Samanta : BDS lecturer

Tissue processing demonstration with histopathological technician Mr Vichitra Kumar.

The program was conducted under the patronage of Dr Vikram Gandhi (Secretary DMET), Principal Dr Nidhi Agarwal, Vice Principal (Admin) Dr Manish Khatri and Vice Principal (Academics) Dr Achint Juneja.



WORLD ORAL HEALTH DAY

Kalka Dental College, Meerut



Department of Periodontology and Oral Implantology, Kalka Dental College, Meerut in association with Indian Society of Periodontology celebrated, World Oral Health Day on 20th March, 2025, with the theme "A Happy Mouth is a Happy Mind," focusing on the link between oral and mental well-being, through various activities and community outreach programs.

The program started with an introductory speech by Dr. Geetanjali Gupta, Post Graduate 2nd Year, Department of Periodontology and Oral Implantology, followed by our traditional Lamp Lightning Ceremony. The Gathering was addressed and Glorified by Prize giving ceremony for Photographic Props Competition, Bulletin Board Decor Competition and Slogan Competition and it was seen that students participated with full zeal and enthusiasm. The day ended with a high hope of creating a orally and mentally healthier community.

ROMOTING HEALTH, PERFECTING SMILE - THE PERIODONTIST WAY

Santosh Dental College, Ghaziabad

National Periodontist Day Celebration (17-23 Feb 2025)

On February 21, 2025, the Department of Periodontics and Oral Implantology, Santosh Dental College (Santosh Deemed to be University) celebrated National Periodontist Day, with the aim to raise awareness about the significance of oral health and the crucial role periodontal health plays in overall well-being. The event commenced with the soulful Saraswati Vandana and a traditional lamp-lighting ceremony, by the esteemed dignitaries, Vice Chancellor, V.N Mahalaxmi, Dean Dental, Dr. Akshay Bhargava and Dr. Shivaani Sharma, HOD Periodontology, in the presence of an august gathering of Dental fraternity and Dental students.

In honor of National Periodontist Day, the Department of Periodontics organized dental camps on February 17th and 20th, 2025, at Vijay Nagar Thana and Champs World School, Vijay Nagar. These camps offered free dental check-ups and distributed complimentary toothpaste samples to attendees. Additionally, Postgraduates and Interns performed a Nukkad Natak (street play) to raise awareness about periodontal health and dispel common myths surrounding periodontal treatments.

A key highlight of the event was the enlightening lecture delivered by Dr. Amit Bhardwaj, Guest Speaker, Director, PHD Programs, SGT University, which left a lasting impact on the attendees. The Department also organized an engaging quiz contest to further involve participants in the celebration. The event concluded with a certificate distribution ceremony, where the quiz winners and all participants were recognized and celebrated for their enthusiasm and active involvement.

Overall, the celebration was a perfect blend of education, community outreach, and lively participation, making it a memorable occasion for all involved.



CONS AND ENDO DAY

Kalka Dental College, Meerut



Celebrating Cons Endo Week at Kalka Dental College: A Tribute to Excellence in Conservative Dentistry and Endodontics

This year's Cons Endo Week at Kalka Dental College, Meerut, proved to be a resounding success, showcasing the vibrant spirit and unwavering dedication of our students and faculty in the field of conservative dentistry and endodontics. Spanning over an unforgettable week, the celebration was a whirlwind of creativity, knowledge, and community service, designed not only to engage and educate but also to foster a sense of camaraderie among all participants.

Cons Endo Week Celebration 2025 was not just A Showcase of Skill, Knowledge, and Fun but also with a Social Message : Save Paper Save Teeth : Go Digital In Dentistry

The week kicked off with an exhilarating series of activities that invited students to express their artistic flair through glass painting. This was not merely an artistic endeavor; it served as a therapeutic outlet, allowing participants to explore the delicate fusion of art and dentistry, vividly illustrating the importance of aesthetics in dental care.

This year's Cons Endo Week was a resounding success, bringing together dental students, faculty, and professionals for an exciting series of events that celebrated the essence of conservative dentistry and endodontics. From thrilling competitions to insightful presentations, the week was filled with activities that showcased talent and fostered camaraderie across departments.

Kicking off the festivities was the highly anticipated Cavity Preparation Competition. Students from 2nd year BDS showcased their technical skills by meticulously preparing cavities on typodont models. Participants had to demonstrate precision, knowledge of dental anatomy, and proper technique in a timed environment. The atmosphere was electric as judges

watched closely, assessing each contestant's performance. This competition not only tested students' abilities but also emphasized the importance of mastering foundational skills in conservative dentistry.

In a unique twist this year, postgraduate students from different departments teamed up for engaging case presentations. This collaboration promoted interdisciplinary learning as participants shared complex cases, treatment plans, and outcomes from their respective practices. The audience was captivated by the diverse approaches and innovative solutions presented, fostering a rich learning environment. Feedback from faculty and peers encouraged constructive discussions, emphasizing the importance of collaboration among dental professionals.

The highlight of the week was undoubtedly the thrilling quiz competition, "KaunJitega Endopati?" This lively and interactive event brought students together for a test of their dental knowledge, covering topics from endodontics to general dental practices. Teams cheered and strategized as they faced off in a series of rounds filled with challenging questions and rapid-fire answers. The atmosphere was spirited, with participants and spectators alike rallying behind their teams. The excitement peaked as the leading teams battled it out for the coveted title of Endopati Champions.

The quiz not only fostered friendly competition but also served as an innovative way to reinforce students' knowledge and engage them in a fun, interactive manner. Prizes were awarded to the winners, adding a competitive edge that encouraged participation.

Overall, the Cons Endo Week succeeded in creating an engaging blend of education, competition, and community. Each event emphasized the dedication of students and faculty to excellence in dentistry while



fostering a collaborative atmosphere. As participants left with new skills, insights, and memories, the spirit of camaraderie was palpable.

A significant highlight of the week was the dental camp in collaboration with the Department of Public Health Dentistry headed by Dr. Meetika Pahuja where students, alongside faculty, extended their skills to the community. Providing free dental check-ups and education to local residents reflected our college's commitment to public health and the importance of preventive care. This initiative not only benefited the community but also instilled a sense of responsibility and empathy in our students.

In tandem with the creative celebrations, academic presentations by final year BDS formed the backbone of the week, allowing students to delve into various topics within conservative dentistry and endodontics. This platform not only sharpened their knowledge but also honed their skills in public speaking and critical thinking, essential competencies for their future endeavors.

As the days unfolded, the spotlight shifted to performances that illuminated the talents of our students. Skits and theatrical presentations provided a moment of levity while cleverly embedding educational messages regarding dental health and practices. These performances were both entertaining and enlightening, fostering engagement and collaboration among peers.

The excitement reached a peak with the production of engaging reels that captured the essence of daily activities, showcasing the joy, dedication, and innovation of all participants. Their remarkable storytelling skills shone through, making educational content accessible and enjoyable.

The culmination of Cons Endo Week was marked by an electrifying finale, where participants gathered for a prize distribution ceremony. Acknowledging the hard work, creativity, and knowledge demonstrated

throughout the week, eco friendly awards and e- certificates were presented, celebrating achievements and encouraging further growth and fostering sustainable practices.

The success of this year's celebrations And the Eco friendly theme sets a high bar for next year, with hopes of expanding participation and introducing even more exciting events. Cons Endo Week not only highlighted the importance of conservative dentistry but also celebrated the vibrant community dedicated to advancing the field.

As we reflect on the success of this week-long celebration, we extend our heartfelt thanks to the KGI management Mr. Anil Mehrotra sir, Mr. Anubhav Mehrotra sir and Mr. Sahil Mehrotra sir for supporting us in all the the endeavours. Utmost gratitude to Dr. Purushottam Jha sir Dean KGI and Dr. Paranjali Singh sir VP Pharma for always being the pillar of support and for believing in us and Thank you to Dr. Rakesh Kishan Gupta Principal and Dr. Amit Siwach VP KDC for their encouragement.

Their commitment to fostering an enriching educational environment made all of this possible and exemplified the values we hold dear in our institution. Together, we have set a benchmark for excellence in dental education and community service, paving the way for future endeavors.

In conclusion, Cons Endo Week was not just a celebration; it was a testament to the unity, creativity, and dedication that encapsulates Kalka Dental College. We look forward to next year's festivities with renewed enthusiasm, eager to continue making strides in the field of dentistry, both academically and collaboratively.

Best wishes :

Dr. Panna Mangat

Prof & HOD

Kalka Dental College

On behalf of Team Endo





Strong, Sassy & Still Under Paid : The Reality of WOMANHOOD

Celebrating Women Empowerment Department of Conservative Dentistry & Endodontics Kalka Dental College, Meerut

Welcome to the rollercoaster ride of womanhood, where the ticket is free, but the emotional baggage is extra! Every day, women navigate corporate jungles, domestic minefields, and unsolicited life advice from men named Ramu who still live with their mothers. From boardrooms to bedrooms, from breaking barriers to breaking heels, women have been juggling careers, families, expectations, and unsolicited opinions with the grace of a Cirque du Soleil performer minus the applause.

So, let's raise a toast (preferably a large glass of wine) to the unapologetic, unstoppable, and underappreciated force that is Women.

The Corporate Conundrum "Lean In, But Not Too Much"

Ah, the workplace! Where women are encouraged to "speak up" but not "too aggressively", to "be confident" but not "intimidating", and to "take initiative" but not "act bossy." It's a world where, the gender pay gap is real, but so is the expectation to "smile more." A man is called "ambitious" for voicing an idea; a woman is called "pushy." Men get promoted based on potential; women get promoted after proving themselves. Twice. And let's not forget mansplaining, the art of a man explaining something to a woman that she already knows often better than him.

The Domestic Drama "What's for Dinner?" (And Other Daily Disasters)

While men are applauded for babysitting their own kids, women are expected to master the fine art of running a household—often after a full day at work. It's a never-ending cycle of, Cooking meals while answering work emails, Folding laundry while mentally composing a resignation letter, Smiling through family gatherings while resisting the urge to scream into a pillow.

And the best part? If a woman dares to ask her partner for help, he responds with:

"Just tell me what to do!" Because apparently, basic survival instincts are lost on men when it comes to house chores.

Domestic Violence Love Shouldn't Leave Bruises

While the world showers women with pink-themed Women's Day campaigns, many women are trapped in relationships that feel more like battlefields than safe havens.

Domestic violence isn't just physical—it's also emotional, financial, and psychological warfare. Many women stay, not out of choice, but out of fear, financial dependence, or societal pressure. And let's be real: The system that's supposed to protect women? It often gaslights them instead. If a woman speaks up, she's asked: "But what did you do to provoke him?" How about this? Existing shouldn't be a provocation.

The Great Double Standards "Be a Lady, But Not Too Much"

Society has a user manual for women—one that's rewritten every time they get too comfortable. Wear makeup, but not too much, or you'll look "fake." Don't wear makeup, or you'll look "tired." Be strong, but not too independent, or you'll intimidate men. Be a mother, but don't forget to stay fit, be sexy, and have a career.

Meanwhile, a man just has to shower, put on deodorant, and he's considered a catch.

The Unsung Warriors Women in Prostitution

Let's talk about the oldest profession in the world—and the oldest hypocrisy that comes with it. Women in prostitution are blamed, shamed, and criminalized. But the men who pay for it? Mysteriously left out of the conversation. Society wants to "rescue" these women, but won't give them jobs, legal rights, or even basic respect. Women don't choose prostitution. Circumstances choose it for them—poverty, abuse, trafficking. Yet, they are treated as villains instead of victims.

How Men Treat Women A Crash Course in Everyday Sexism

For many men, women are either goddesses or doormats with no in-between. If she's single? "When are you getting married?" If she's married? "When are you having kids?" If she has kids? "When are you quitting your job?"

From catcalling to casual sexism, from mansplaining to moral policing, women are constantly reminded of their place—and spoiler alert: it's always a step behind men.

The Power of Women: Resilient, Relentless, Revolutionary

And yet—despite all of this—women thrive, fight, and refuse to back down.

They are CEOs, scientists, athletes, activists, changemakers, mothers, daughters, sisters, friends, and warriors. They carry trauma in their bones and still show up with a smile. Women have rewritten history, led revolutions, and broken chains—and they're not done yet.

This Women's Day, Do More Than Just Post a Quote

Women don't need flowers, pink cupcakes, or generic Women's Day wishes.

- They need equal pay.
- They need safe workplaces and homes.
- They need laws that actually protect them.

They need respect—not just on Women's Day, but every single day.

So, let's stop celebrating women once a year and start fighting for them every day. Because the world isn't just better when women are empowered—it's stronger, smarter, and a hell of a lot more interesting.

Happy Women's Day to the fighters, the dreamers, the rule-breakers, and the ones who refuse to be silenced.



Empowered women empower the world.



JiTalk

Heal Talk

Save The Girl Child

"Girls are Diamonds. Shape them for the Betterment of the Generation" - Afzal A. Zaidi

I'm Vidya Iyer, a third-year oral and maxillofacial surgery postgraduate student, and I want to share a bit about my journey as a woman in surgery, along with my other passion-caring for community animals. Balancing the demands of a surgical career and my work with stray dogs might seem like juggling two full-time jobs, but for me, both are parts of who I am. I'm 29, and in a world that often expects a woman to follow a more "traditional" path-get married, settle down, perhaps choose a career that allows for more family time-I'm here to tell you that it's possible to carve out a path that's uniquely my own.

From a young age, I was encouraged to dream big. I was lucky to be born in a family where my ambitions were nurtured and celebrated. My mother, for example, is not only a loving parent but also a high-ranking executive in a tech company. Watching her navigate boardroom meetings and manage a household with such finesse showed me that women are indeed multifaceted multitaskers. This belief-that I could achieve anything-was instilled in me early on and has been my guiding light ever since.

The field of surgery comes with high expectations, long hours, and a level of stress that can be overwhelming. Society often expects women to choose a field that allows for a break when it comes to family and childcare. Yet, here I am, in a demanding specialty that doesn't offer many breaks, late-night duties, or opportunities to clock out early when life demands balance. I've seen how society and sometimes even family members raise eyebrows at my choice, expecting that by now I should have chosen a "safer" path. But I believe we need to break these

stereotypes. I've often heard that women are not cut out for the rigors of surgical work, that our brains are better suited to less intensive roles. However, every time I scrub in for surgery, every time I stand over a patient in the operating room, I know that I'm here not just for me but for every woman who dares to dream beyond what society has boxed in.

At 29, I often find myself at a crossroads where family expectations and societal norms intersect with my professional ambitions. Relatives sometimes question why I haven't "settled down" yet, why I haven't taken a break from such an intense field. They suggest that I should choose a career that accommodates family life more easily. But I've always believed that choosing your path is deeply personal. The passion I have for surgery-and for my work with community animals-fuels me every day. I've also established a group of like-minded individuals dedicated to the care of community animals. This initiative isn't just about rescuing dogs in need of treatment or running sterilization drives; it's about creating a support network that includes a friends and family fund to cover treatments, drives, and food. It's a small community of compassion that mirrors the strength and diversity we bring as women in every sphere of life. Balancing this alongside my postgraduate work isn't always easy, but it reminds me that my skills extend far beyond the confines of the hospital.

One of the strongest pillars in my journey has been the support from my family. I was raised in an environment where ambition wasn't discouraged; rather, it was celebrated. My parents taught me that the limits of what I could achieve were bound only by the

size of my dreams. They always made it clear that I could be anything I wanted to be. For many women out there, having a supportive family can make all the difference in overcoming the obstacles that society places in our path. This support is crucial, especially when dealing with the additional pressures of societal expectations. Our world is changing, and so are the roles we can play. We are no longer confined to narrow definitions of success and duty. Women can excel in highly demanding fields while also nurturing personal passions and contributing to society in diverse ways.

As a postgraduate student witnessing the demanding nature of surgical training firsthand, I am all too aware of the security challenges that we face—challenges that have been underscored by recent events. Incidents such as the recent RG Kar case have shed light on the critical importance of robust safety measures in our work environments. These events remind us that the need for security isn't an abstract concept; it's a pressing, real-world requirement that institutions must address. A safe environment is not a big ask—it's the bare minimum we deserve. It's imperative that governing bodies and institutions take immediate action to ensure that women in high-pressure fields like surgery can work without fear for their physical or emotional well-being.

My journey as a woman in surgery, at an age where societal expectations often push me toward a different path, is not just my own—it represents the growing movement of women who refuse to be boxed into traditional roles. I am proud to be a surgeon and an advocate for community animals. I stand as a reminder that with the right support, the courage to defy expectations, and the determination to create a safe and inclusive work environment, we can achieve anything. To every woman reading this: may you find the support and strength you need to chase your dreams. Let's continue to break down stereotypes, demand safe working conditions, and redefine what it means to be a successful, multifaceted woman in today's world. We are capable, we are strong, and we deserve every opportunity to excel—both in our careers and in our personal passions.

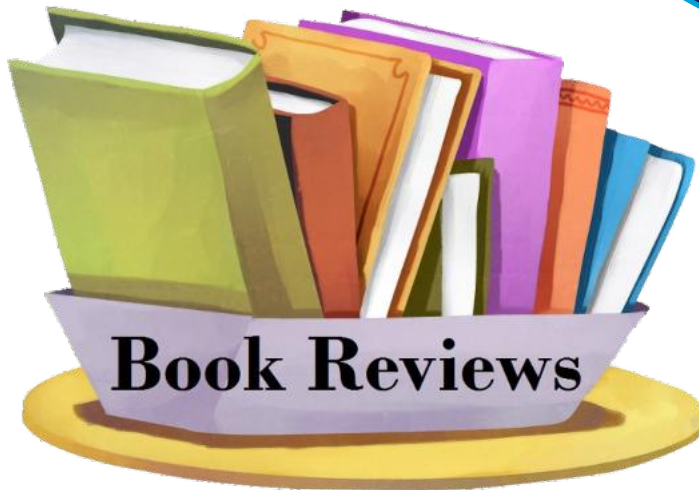
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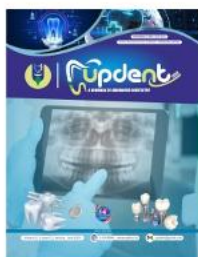
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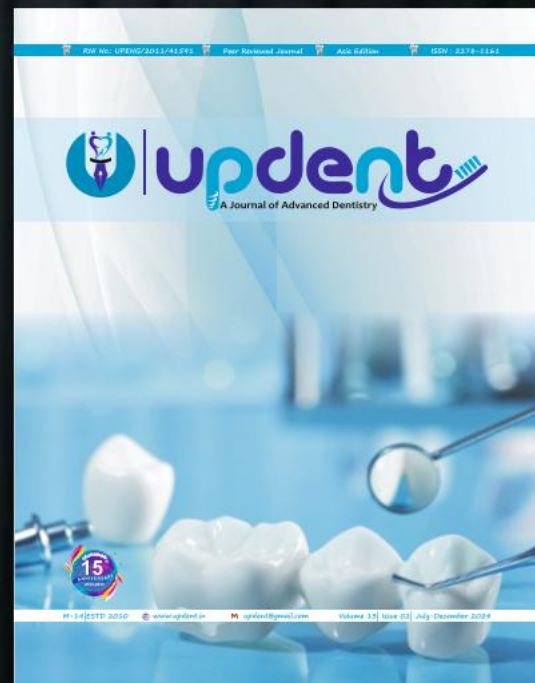
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