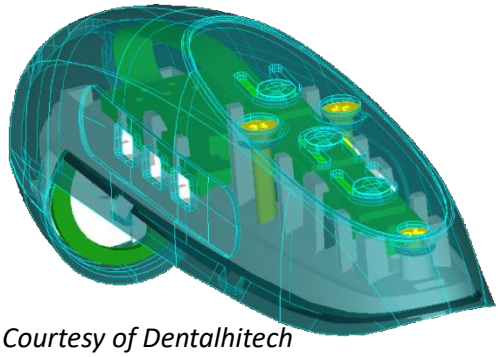
Case Study: Strengthening Innovation: How Oxybel Pinpointed the Root Cause of Random Fractures in a Dental Anesthesia Device

This case study showcases how Oxybel leveraged its expertise to solve a critical challenge faced by Dentalhitec, a leading company offering effective, innovative products that make life easier for dental care practitioners, while improving surgery success rate and patient comfort.



Courtesy of Dentalhitech

The Challenge:

Dentalhitec was experiencing a concerning trend – random fractures occurring in a key component of one of their innovative dental anesthesia devices. These fractures compromised device integrity, potentially hindering practitioners in their mission of improving dental care.

The device, aimed at both dental surgeons and dentists, offers significant advantages:

- **Enhanced Patient Comfort:** The device's design prioritized patient comfort during dental procedures.
- **Increased Surgeon Productivity:** The device's functionality aimed to streamline workflows and improve treatment efficiency for surgeons.

A Collaborative Effort to Identify Root Cause:

The unpredictable nature of the fractures presented a significant challenge for Dentalhitec. They recognized that extensive design modifications without a clear understanding of the root cause could be costly, time-consuming, and potentially ineffective. Therefore, they partnered with Oxybel to identify the specific factors contributing to the fractures.

A Holistic Life-Cycle Investigation:

Our team, with its extensive experience in Material and Structural Engineering, closely collaborated with Dentalhitec to deploy a comprehensive approach to map the entire life cycle of the device scrutinized components:

- **Material Analysis:** We conducted a thorough analysis of the fractured component, considering the interplay between the engineering plastic incurring fracture and the elastomeric component in contact with it. Advanced techniques like 3D visualization, finite element analysis, material property analysis, or life cycle analysis helped us identify any material properties that could contribute to fractures under the combined stresses experienced during operation.
- **Design Review:** We examined the design of both the fractured component and the elastomeric component that interacted with it. This review identified:
    - A local sub-optimal weak point in the design in the first component that made it susceptible to fractures under certain conditions.
    - A loosely controlled tolerance in the design of the elastomeric component, which could lead to excessive contact pressure being applied to the first component.
- **Finite Element Analysis (FEA):** We utilized FEA to create a digital mock-up of the components and system, incorporating the interaction between the engineering plastic component and the elastomeric component. By simulating real-world stress and strain on the components during device operation, we validated the findings from the design review and identified the specific stress concentrations that contributed to the fractures.
- **Manufacturing Process Review:** We collaborated with Dentalhitec to analyze their manufacturing process for both components, identifying any potential contributing factors.

Targeted Solution for Efficiency:

Through this meticulous investigation, Oxybel pinpointed the root cause of the fractures – a combination of 1) the sub-optimal design of the first component (made of engineering plastic) and 2) a loosely controlled tolerance in the design of the elastomeric component that was pressurizing the first component. Armed with this knowledge, we worked with Dentalhitec on a targeted solution that maximized efficiency and minimized unnecessary design changes:

- **Component Design Optimization:** We highlighted the weak point in the first component (made of engineering plastic) to address the sub-optimal design and enhance its resistance to stress. We also recommended tighter tolerances in the design of the elastomeric component to ensure consistent and controlled pressure on the first component.
- **Manufacturing Process Refinement:** Based on the findings from the manufacturing process review, we collaborated with Dentalhitec to implement minor adjustments to their manufacturing processes to ensure consistent production of both components according to the optimized designs.

The Impact:

The implemented solutions effectively addressed the random fractures. Dentalhitec successfully launched the improved device, ensuring patient safety and device reliability. This collaboration resulted in:

- **Unimpeded Innovation:** By resolving the fracture issue efficiently, Dentalhitec could focus on further developing their innovative device and its benefits for patient comfort and surgeon productivity.
- **A Cost-Effective Solution:** The targeted approach minimized the need for extensive design modifications, saving Dentalhitec time and resources.
- **A Stronger Position on the Market :** Successfully addressing this challenge consolidated Dentalhitec position as a reliable provider in the dental technology market.

Conclusion:

This case study demonstrates the value of a collaborative approach that prioritizes identifying the root cause of problems in the medical device industry. By partnering with Oxybel, Dentalhitec not only resolved a critical technical challenge but also ensured the continued success of their innovative product aimed at improving dental care.