

Biomechanical Resistance of a Treated Molar Tooth is Influenced by Dental Restoration Depth, Internal Cavity Angle, and Material Properties

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Abstract

A substantial community of viruses and a vast microbial flora inhabit the oral cavity. Although the majority of the oral microbiome is comprised of viruses that infect bacteria or bacteriophages, human-cell-infecting viruses make up a significant portion. Viral communities are also site-specific changes that can cause disease, just like bacteria. Indeed, the increased presence of lytic bacteriophages in periodontal disease subgingival plaque is one of the earliest associations of biofilm virome with human disease. The propensity of particular viruses to affect the oral cavity is well-known, despite the fact that evidence for oral virome and its contributions to oral health and disease is still emerging. Additionally, because the oropharynx and nasopharynx communicate directly, the highly vascularized oral tissues are more susceptible to respiratory or gastrointestinal viruses. As a result, numerous of these viruses have been linked to persistent oral mucosal lesions. The significance of salivary diagnostics for the detection, transmission, monitoring, and prognosis of severe acute respiratory syndrome coronavirus is also the subject of discussion in this chapter. Additionally, we discuss the potential for SARS-CoV-2 transmission in dental offices and preventative measures.

Keywords: SARS-CoV-2; Xerostomia; Microbiome of the mouth and lungs; Diagnostics using saliva; Dental clinic; Viral transmission

Introduction

Resin-based restorative materials have been widely used to restore function and appearance, particularly in cavities in the posterior teeth (molars and premolars) [1]. Clinicians face difficulties in finding effective solutions to the growing demand for aesthetic restorations. Certain design parameters, such as preparing optimized cavity geometries and using adequate composites for each clinical situation, can reduce a restored tooth's fracture susceptibility, particularly for large class II restorations. The mechanical mismatch between the tooth and the composites can result in an uneven stress concentration on both sides, which can weaken the tooth and the restoration structures. Successful and durable restorations may be achieved by striking a balance between enhancing the design of the cavity and preserving the tooth structure.

Only a small number of studies have examined how the internal cavity angles, cavity depth, and restorative material properties affect the durability of a restored tooth [2]. The stress and strain distributions were investigated in relation to the various margin angles of the class II MOD restoration [3]. The findings indicated that the restoration was susceptible to damage when the internal cavity angle for a MOD cavity was greater than 95 degrees. Similarly, comparing the sound tooth's stress distribution to the cavitated tooth's obtained stress distribution. They noticed that the sound tooth has a uniform stress distribution, while the treated teeth had more stress discontinuities.

Using FEA, a multi-factor study was carried out on an adhesive MOD restoration to investigate how the stress response of a Class II MOD restoration is affected by a number of variables, including the restorative material, adhesive layer modulus, adhesive layer thickness, and cavity dimension. They discovered that the primary factors influencing the stress values were the loading condition, cavity depth, and restoration modulus, respectively. For a Class II OD cavity restored with IPS Empress Direct, amalgam, and ionomer, the effect of line angles on the high-stress concentration fields was examined. The findings demonstrated that restored tooth structures can be strengthened by altering the internal cavity angle of the cavity.

In spite of the widespread acceptance of in-vitro testing in general dentistry, there are some drawbacks to this method. For instance, adding any additional setup to the test may necessitate more complex controls and additional equipment [4]. In-vitro testing also suffers from the inaccuracy of stress and strain measurements at various tooth locations, as well as the high cost and time involved in specimen fabrication and testing. Supporting in-vitro tests and hypotheses, as well as filling in the aforementioned gaps and limitations, require mathematical methods. Notwithstanding the limited component examination (FEA) opening up new possibilities to specialists and clinicians in displaying complex actual peculiarities utilizing mathematical methodologies, there stays a huge hole in our insight, particularly in setting up the class II OD reclamations. In this work, a Python script was utilized to program the FEA programming to direct a progression of 2D FEA reenactments, fully intent on researching the impact of occlusal pit profundity (OcD) and inner pit point on the mechanical execution of OD cavities, reestablished with dental composite, with the composite modulus (CM) going from 2 to 26 GPa. As one of the worst-case scenarios for a restored tooth failing, a semi-circular stone part was used to apply the contact loads at the tooth-restoration interface because the tooth-restoration interface is more susceptible to failure than the composite restoration itself [5].

Materials and Methods

Treating a molar tooth typically involves several materials and methods. Here's an overview of the common materials and methods used in treating a molar tooth. An anesthetic solution containing

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lidocaine or another numbing agent is used to numb the area around the molar tooth before any treatment is performed. A thin sheet of latex or non-latex material called a dental dam may be used to isolate the molar tooth during certain procedures, such as root canal treatment [6]. It helps to keep the tooth clean and dry, preventing contamination from saliva and other oral fluids.

Various hand instruments, such as dental mirrors, probes, excavators, and scalers, are used to examine, clean, and prepare the tooth during the treatment process. Depending on the specific treatment, different dental restorative materials may be used, such as dental amalgam (silver fillings), composite resin (tooth-colored fillings), or dental ceramics (crowns or inlays/onlays). Dental cement is used to bond restorations, such as crowns or inlays/onlays, to the molar tooth structure [7]. Gutta-percha is a rubber-like material used in root canal treatment. It is placed inside the cleaned and shaped root canal to seal it and prevent further infection.

Dental bonding agents are used to enhance the adhesion between the tooth structure and restorative materials, such as composite resin fillings. The dentist will visually examine the molar tooth and may take X-rays or use other diagnostic tools to assess the condition and determine the appropriate treatment. Local anesthesia is administered to numb the area around the molar tooth, ensuring a pain-free treatment experience.

Depending on the treatment, the dentist may remove decayed or damaged tooth structure using hand instruments, dental drills, or lasers. This process creates space for the placement of restorative materials. After the tooth is prepared, the appropriate restorative material is placed in the cavity or on the tooth surface. The material is shaped and contoured to resemble the natural tooth structure. If the molar tooth has infected or damaged pulp, a root canal treatment may be necessary [8]. This involves removing the infected pulp, cleaning and shaping the root canals, and filling them with gutta-percha.

The dentist ensures that the restoration fits properly, adjusts the bite if necessary, and polishes the tooth for a smooth finish. The patient is given post-treatment instructions, such as oral hygiene recommendations, dietary restrictions, and follow-up appointments.

It's important to note that specific materials and methods may vary depending on the individual case and the dentist's preferences. Additionally, advancements in dental technology and materials may lead to new techniques and materials being used in the future.

Results and Discussions

When discussing the results and implications of a treated molar tooth, several factors come into play. Here are some potential aspects to consider. The first point of evaluation is the integrity and quality of the restoration placed on the molar tooth. This includes assessing factors such as the fit, contour, and color match of the dental restoration (filling, crown, etc.) with the natural tooth structure [9]. A well-executed restoration should blend seamlessly with the surrounding teeth, ensuring both functional and aesthetic outcomes.

The treated molar tooth's role in the overall occlusion (how the upper and lower teeth come together) is crucial. The restoration should be evaluated for proper alignment and bite distribution to avoid any occlusal interferences or premature contacts. A balanced bite ensures proper chewing function and reduces the risk of complications like temporomandibular joint (TMJ) disorders.

Sensitivity and discomfort are common concerns following dental

treatment. The patient's feedback regarding any lingering sensitivity or discomfort in the treated molar tooth should be discussed. If persistent issues are present, further investigation may be required to identify the cause and determine appropriate solutions. The success of the treatment can be evaluated by assessing the patient's ability to chew and function properly with the treated molar tooth. A well-performed treatment should restore the tooth's functionality, allowing the patient to bite and chew comfortably without limitations.

The longevity of the treatment is a significant factor in evaluating its success. Depending on the specific restoration and materials used, the treated molar tooth should be assessed for its durability and resistance to wear over time [10]. Long-term success is crucial to avoid complications or the need for additional interventions in the future. The patient's oral hygiene practices and their compliance with post-treatment instructions play a significant role in the long-term success of the treated molar tooth. The discussion should include the importance of regular dental check-ups, professional cleanings, and proper oral hygiene practices, such as brushing and flossing. Finally, it is essential to consider the patient's satisfaction with the treatment outcome and the impact it has on their overall quality of life. Patient feedback and their perception of the restored molar tooth, including functional, aesthetic, and psychological aspects, should be discussed to ensure their expectations have been met.

It's worth noting that the specific results and discussions will vary depending on the type of treatment performed, the individual patient's circumstances, and any unique factors involved in the case [11]. The dentist's expertise, the patient's oral health status, and their compliance with post-treatment care all contribute to the overall outcome and success of the treated molar tooth.

Conclusion

In conclusion, treating a molar tooth involves a combination of materials and methods aimed at restoring its functionality and aesthetics. The success of the treatment depends on various factors, including the integrity of the restoration, occlusion and bite alignment, absence of sensitivity and discomfort, functional chewing ability, longevity and durability of the treatment, oral health maintenance, patient satisfaction, and overall quality of life. A well-executed treatment should result in a restoration that seamlessly blends with the natural tooth structure, providing proper alignment and distribution of forces during biting and chewing. The absence of sensitivity or discomfort is essential for the patient's comfort and overall satisfaction. Long-term success relies on the durability of the restoration, which should resist wear over time. Proper oral hygiene practices and regular dental check-ups are crucial for maintaining the treated molar tooth's health.

Ultimately, the success of a treated molar tooth is measured by the patient's satisfaction and improved quality of life. By addressing the dental issues and restoring the tooth's functionality, the treatment aims to enhance the patient's ability to chew comfortably and maintain oral health.

It's important to note that each case is unique, and the results and conclusions may vary depending on individual circumstances and factors specific to the treatment performed. Regular follow-up appointments and ongoing communication with the dentist are recommended to monitor the treated molar tooth's long-term success and address any concerns that may arise.

Acknowledgement

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Conflict of Interest

None

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