A Novel Approach to Improve Repair Bond Strength of Repaired Acrylic Resin: An in-Vitro Study on the Shear Bond Strength

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Introduction

Denture bases are subjected to fracture if dropped or stressed beyond their fracture strength. Therefore, denture repair is needed sometimes. Many mechanical and chemical factors affect the repair strength. The aim of the study was to introduce a new approach that increases the bond strength at denture base resin/repair resin interface. This study evaluated the effect of mechanical surface treatments with intermediate material applications (alumina blasting + silane coupling agent [SCA] or methyl methacrylate [MMA]) on the shear bond strength (SBS) of repaired denture base material. It also evaluated the combined effect of nano-ZrO2 and surface treatments on the SBS of repaired acrylic denture base and compared the values with those of unreinforced PMMA resin. In addition, the treated surfaces were characterized by means of scanning electron microscope (SEM).

Materials & Methods

Heat-polymerized acrylic resin was used to fabricate 130 cylindrical blocks 15 mm in diameter. Specimens were divided into different groups according to surface treatment and NZ concentration (Figure 1). Repair resin was mixed and applied to the bonding area and polymerized at 37°C for 10 minutes. SBS (MPa) testing was performed using universal testing machine (Figure 2). Scanning electron microscopy (SEM) was used. Statistical analysis was done using ANOVA and Tukey post-hoc test at \( \alpha = 0.05 \).

Results

The mean bond strength value of repair resin to alumina blasted denture base specimens with application of intermediate agents was significantly higher in comparison to control group (\( P<0.05 \)). For surface treatment, alumina blasting followed by SCA application, showed the highest SBS values (15.42±1.98 MPa). Nano-ZrO2 addition resulted in statistically significant increase (\( p<0.05 \)) except for AB, and AB+MA repaired with 5% and 7.5% nano-ZrO2 (\( P>0.05 \)) (Figure 3). SEM showed that alumina blasting produced rougher and porous surface, while SCA and MA application reduced the irregularities and deep pits (Figure 4).

Conclusions

Within the limitations of the study, following conclusions were drawn:

• Mechanical surface treatment using alumina abrasive air-particles improved the shear bond strength.
• SCA and Methyl methacrylate based composite bonding agent application to mechanically treated repair surfaces improved the repair bond strength and could be used as a new adhesive technique for denture repair.
• Application of SCA in combination with Nano-ZrO2 reinforced repair material enhanced the repair bond strength.

References

Prevalence of distal caries in mandibular second molar related to impacted third molars in RAKCDS

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Introduction
Failure of normal tooth eruption, due to various factors, is referred to as impaction. The most common impacted teeth are mandibular third molars. It is difficult to treat and it is indicated to be removed without delay to avoid caries development in the neighboring second molar and loss of both teeth. Extraction of the third molar results in less complications and better dental health, improved gum health in the area adjacent to the second molar.

Aim:
The aim of this study was to evaluate the prevalence of distal caries in second molar teeth due to impacted third molar teeth in RAKCDS and their relation to gender and age.

Materials and methods:
A total of 100 Orthopantomograms (OPGs) of patients reporting to RAKCDS over a period of three years were screened and randomly selected according to inclusion and exclusion criteria. The data was collected and cross checked for any discrepancies and entered into excel spread sheet. Descriptive analysis of the data was done and results were displayed as graphs.

Results:
According to this study, 20% cases show distal caries on mandibular second molars and 80% cases show healthy second molars. There was no relation between gender and impaction, but when studied independently, it showed that mesial impaction was more common in males, and horizontal impaction was more common in females. Age wise, there was no relation between age and cavity existence.

Conclusion:
A total of 80% of the patients with impacted third molars had no distal caries on mandibular second molar. It was found that there is no relation between gender and impaction, and that there are equal chances of caries existence regardless of age or gender.

REFERENCES
Determining Stages Of Non-Cavitated Fissure Caries Using Optical Coherence Tomography (OCT)

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The objective of study was to assess the performance of OCT in determining stages of NCFC using OCT backscatter intensity profile (A-scan).

INTRODUCTION

Staging of non-cavitated fissure caries (NCFC) lesions is essential as these lesions are preventable and can potentially be reversed or arrested by risk adjusted and non-invasive strategies \cite{1}. Visual inspection is the most ubiquitous method used in the staging of fissure caries lesions clinically. Visual detection system such as the International Caries Detection and Assessment System (ICDAS) has been proven to have good accuracy and reproducibility \cite{2}. However, such systems require training and calibration with a reference examiner \cite{2} and can be time consuming \cite{3}. It also falls short of true quantification as it uses qualitative assessment. Optical Coherence Tomography (OCT) is a non-invasive, non-radiative, high resolution cross sectional imaging modality that utilizes near-infrared light operating at 1310-nm.

MATERIALS AND METHODS

90 investigation sites (ISs) from 46 extracted permanent human premolars were initially scored using ICDAS 1 and 2. 3-dimensional (3D) scans of 3mm x 3mm x 3mm were performed using a Swept-source (OCT OCS1300S, Thorlabs Inc.). The ISs were sectioned perpendicular to fissure for Polarized Light Microscopy (PLM) to thickness of <200µm and imaged under 4x magnification after imbibition in water using Nikon E 90i microscope. An overall mean A-scan for each Ek code was computed. Total Area-under-the-curve (AUC) between physical depths of 0-150µm subsurface (blue dotted lines) was computed for each Ek code.

Data extraction and analysis

Mean A-scan was generated from 50 A-scans (red arrow) at each ISs using Matlab. Post hoc Dunnet T3 test comparing for Ek code 1 and 2 SN, SP, AUROC values for differentiating Ek code 1 and 2 Sensitivity (SN), Specificity (SP), Area under Receiver operating characteristics (AUROC).

CONCLUSION

OCT has potential to differentiate NCFC using OCT backscatter intensity profile (A-scan). Such quantitative measurements can be useful for monitoring the state of early lesions and enable timely remineralization.

References:


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