



DETERMINING THE SHEAR BOND STRENGTH OF RE-ATTACHED MAXILLARY PERMANENT CENTRAL INCISOR'S CROWN USING DIFFERENT TECHNIQUES: IN VITRO STUDY

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ABSTRACT

introduction-Tooth fragment reattachment offers a conservative ,esthetic and cost effective restorative option that has been shown to be an acceptable alternative to restoration of the fracture tooth with resin-based composite or full –coverage crown .Reattachment of a fragment to the fractured tooth can provide good and long – lasting esthetics the aim and objective of this search is to determining the best techniques [Bevel, Internal groove, Chamfer, Over contour] for crown fragments reattachment. Methodology used in research were Filtek Z 350 material used for reattachment procedures ,Sectioning of sound teeth, preparations of the sectioned teeth and fragments ,grouping of teeth on basis of name of techniques, Restoration of fractured teeth and determined the Fracture strength of restored teeth. Results The mean value of Maximal load for simple reattachment technique was highest for z-350 material. Conclusion Anterior teeth form most aesthetic part of the dentition. The trauma to these teeth is also common due to the proclination of maxillary central incisor and their anterior position Simple reattachment is an evolved technique with improvements in hydrophilic adhesives. The logic behind the technique is that if a fragment has a good fit then no preparation is required and the fragment can be directly cemented.

KEYWORDS : fracture strength, anterior teeth

INTRODUCTION-

Tooth fragment reattachment offers a conservative ,esthetic and cost effective restorative option that has been shown to be an acceptable alternative to restoration of the fracture tooth with resin-based composite or full –coverage crown . Reattachment of a fragment to the fractured tooth can provide good and long – lasting esthetics because the tooth's original anatomic form , color ,and surface texture are maintained, can restore function, can result in a positive psychological response , and is a reasonably simple procedure. In addition, tooth fragment reattachment allows restoration of the tooth with minimal sacrifice of the remaining tooth structure. Furthermore, this technique is less time –consuming and provides a more predictable long-term wear than when direct composite is used.

Many techniques have been proposed for re-attaching the fragment to remaining tooth i.e.

- Bevel
- Internal groove
- Chamfer
- Over contour.¹

In the past, fractured teeth were restored using acrylic resin or complex ceramic restorations associated with metals these restoration did not promote adequate long term esthetics and also required a significant tooth reduction during preparation. Because of difficulty in obtaining good retention, there were few attempts to re-attachment fragment. **Chosack and Eildeman** 1964, were the first to report it. The amputated anterior crown was cemented to a cast post. **Spasser** in 1977, used interlocking mini pins associated with light cured composites. With the acceptance of the acid –etch technique, reattachment of the tooth fragment became a more usual procedure because of the excellent retention obtained with the fluid resin on etched enamel.²Tooth fragment reattachment is a good alternative, since the fragment is adequately preserved in physiologic saline solution or saliva to prevent dehydration and discoloration. This procedure offers good aesthetic and functional result in short and medium term and also restores the patient's emotional balance.³

The advantages of tooth fragment reattachment are

- Regaining color and size of the original tooth.
- Being worn away in a similar proportion to adjacent tooth without trauma.
- Giving an emotionally and socially positive response due to the protection of natural tooth structure.

- Rapid and conservative nature of the treatment.
- Preservation of occlusal contact.
- Economical aspect of a one visit.⁴

A perfect reproduction of the natural color, optical properties such as translucency, opalescence, and fluorescence, shape and surface texture are a challenge and requires great skill and dexterity. When performing a direct composite restoration. Therefore, when a tooth fragment is viable and presents good adaptation to the remaining dental structure, it should be the first restorative option. Modification to both tooth and fragment prior to bonding has been proposed with an estimated recovery of fracture resistance up to 97%. Reattaching of both tooth and fragment is done by different techniques.

- Simple reattachment.
- Chamfer
- Over contour
- Internal groove.⁵

Hence the aim of this in vitro study were to evaluate and compare the shear bond strength of sound and restored maxillary central incisor teeth using different re-attachment techniques.

The aim of this in vitro study is to evaluate and compare the shear bond strength of re-attached maxillary permanent central incisor using different techniques:

1. Simple re-attachment
2. chamfer
3. Over contouring
4. Internal dentinal groove

OBJECTIVES:

To evaluate and compare various reattachment techniques .The main objective was to evaluate and compare the strength required to fracture re-attached fractured anterior teeth using four different techniques i.e.

- Simple re-attachment
- Chamfer
- over-contouring
- Internal dentinal groove

The teeth were reattached using material i.e. Filtek Z 350 .The resin system is slightly modified from original Filtek Z 250 universal restorative and filtek™ supreme universal restorative resin. The resin contains

- I. Bis-GMA
- II. UDMA
- III. TEGDMA
- IV. Bis-EMA Resins

To moderate the shrinkage, PEGDMA has been substituted for a portion of the TEGDMA resin in filtek supreme XT restorative. Step i-Sectioning of sound teeth Experimental specimens were sectioned at the mesial-incisal proximal edge 3 mm from the incisal edge in a labio-lingual direction at 25° inclination apically using a diamond disk. Fragments were matched and stored at room temperatures in sterile water. Step ii preparations of the sectioned teeth and fragments the specimens were divided into five groups, with the control group having 10 samples and other 4 groups having 15 samples each. The groups formed were: -

- Group I:** Control group – consisted of intact sound teeth which were not subjected to sectioning.
- Group II: Simple re-attachment** - no additional preparation was made. The sectioned fragments were re-attached.
- Group III: chamfer** - In this group a 1mm depth chamfer were placed circumferential of fracture line.
- Group IV: Over contouring** - Following re-attachment the teeth were prepared on the buccal surface by means of cylindrical diamond finishing bur-extending 2.5mm coronally and apically from fracture line at a depth of 0.3mm.
- Group V: Internal dentinal groove** - Internal groove of 1 mm deep and wide were placed within the fragment and tooth by means of # 2 round carbide bur with a high- speed hand piece.

Step iii **Restoration of fractured teeth by filtek z 350:** - additional step of etching was done by 37% phosphoric acid for 20 sec on sectioned teeth and fragments and rinsing for 10 sec. Then bonding agent was applied on cut and prepared surfaces of both sectioned teeth and fragments and later extra bonding agent was removed by air blow followed by light cure of the surfaces. Then the composite material was applied on cut and prepared surface and the fragment was attached on it. The light cure was done. The teeth were finished and polished with the flexible polishing disk. Stored in sterile water at room temperature.

GENERAL DESCRIPTION OF GROUPS (TABLE A)

GROUPS	TECHNIQUE	DESCRIPTION
I	Control	Intact teeth.
II	Simple Reattachment	Re-attachment of the fragment with no additional preparation.
III	Chamfer	Circumferential chamfer + Reattachment fragment with tooth.
IV	Over Contour	Superficial Preparation + Re-attachment of fragment.
V	Internal Dentinal Groove	Internal dentinal groove + Re-attachment of fragment

STATISTICAL ANALYSIS-

The data were collected and statically analyzed. The shear force will be summarized for all group in terms of mean as central tendency measure and standard deviation as the measure of dispersion. Then the variance among the groups will be determined by ANOVA if it follows the normal distribution or by K-W test in case of non-parametric distribution. Another measurement will be related to unit change in the dimensions (shearing strains) in reference with shearing force. This incremental/detrimental value will be plotted and compared through a regression method. The maximum permissible type-i error in all these analyses will be set on 0.5 and type ii error at.

K-W Test-Kruskal–Wallis test by ranks, Kruskal–Wallis *H* test (named after William Kruskal and W. Allen Wallis), or one-way ANOVA on ranks is a non-parametric method for testing whether samples originate from the same distribution. It is used for comparing two or more independent samples of equal or different sample sizes.. The parametric equivalent of the Kruskal–Wallis test is the one-way analysis of variance (ANOVA). A significant Kruskal–Wallis test indicates that at least one sample stochastically dominates one other sample. Since it is a non-parametric method, the Kruskal–Wallis test does not assume a normal distribution of the residuals, unlike the analogous one-way analysis of variance. If the researcher can make the less stringent assumptions of an identically shaped and scaled distribution for all groups, except for any difference in medians, then the null hypothesis is that the medians of all groups are equal, and the alternative hypothesis is that at least one population median of one group is different from the population median of at least one other group.

Review of literacher- Megha bhargava et al (2010) evaluated and compare the fracture strength of various restorative materials and design used in the reattachment of anterior teeth according to author a combination of nano-composite and chamfer preparation gave the high mean fracture strength values. **Farzaneh Shirani, Moh Reza ,Dane Tahririan conducted study 60 mandibular incisors (2011)**teeth were fractured on the incisal 1/3rd and were divided in to group of 12 to be stored in normal saline ,water , milk , saliva and dry environment for 24 hrs. All the fractured parts in each group were bonded to their relevant apical parts by an etch and rinse bonding system and a flowable composite resin. the fractured resistance was measured by a universal testing machine and result were analysed using one way ANOVA and turkey test. **Ranial Fernandes Peixoto,Kryсна Torres ,Julia Peixoto (2016)** Dento-alveolar traumas are one of the most frequent injuries to teeth, mainly affecting the upper incisors due to their exposed position in the dental arch. In such cases, esthetics, function and phonetics of anterior teeth may be compromised. Furthermore, when there is involvement of the biological width, there is often a poor prognosis. This case report describes the multidisciplinary approach to tooth fragment re-attachment in a fracture with biological width violation. The patient presented with an oblique crown fracture in the maxillary right lateral incisor, extending from the buccal to palatal side, as well as a biological width invasion. The re-establishment of the biological width was obtained by periodontal surgery to achieve clinical-crown lengthening and tooth fragment re-attachment with a glass fiber post to increase retention. After 3 years of follow -up, the rehabilitated lateral incisor remains in good condition, with satisfactory esthetic and periodontal health.

RESULTS

Table1 - Cross Tabulation Of Dental Adhesives Tested In Reference With Restoration Techniques

	Chamfer	Internal Groove	Over contour	Simple reattachment	Control
Mean	22.642	28.82	23.812	26.69	32.468
Std deviation	4.868318	2.485528	6.947706	10.39568	4.67966
KW satistic=8.41(df=4,n=25),p=0.077					

This study used 70 anterior teeth in the study out of which 10 teeth were sound while 60 teeth were sectioned by diamond disk. The teeth included in the study as were essentially non carious, Non attrited and were only with periodontal involvement in order to avoid any structural confounders .

The table shown which gives the visual description of distribution of maximum loads associated with various techniques in a matrix. This graph gives information about the median value, 25 percentile, 75 percentile and minimum/maximum value attained through the respective technique.

The mean value and standard deviation of maximal load for various techniques on Filtek Z-350.

Techniques	Z350	Summary Ranking
Chamfer	4	3.33
Internal Groove	1	1.66
Over contour	3	1.66
Simple reattachment	2	3.33

The mean value of Maximal load was highest for internal groove technique and minimal for overcontour technique. The null hypothesis states that the point estimates for these groups are all equal and if there are any differences, they are because of random variations. Because the p-value is more than the significance level of 0.05, we cannot reject the null hypothesis. Thus for z350 material, all the four techniques may perform equally on maximal load. **Table Summary measures for techniques under study**

DISCUSSION-

Anterior teeth form most aesthetic part of the dentition. The trauma to these teeth is also common due to the proclination of maxillary central incisor and their anterior position. Many techniques are available for restoration of fractured tooth however with the advance of adhesive system in dentistry, the functional esthetic and biological restoration of fractured teeth is desired. When an intact fragment is available, the incisal edge reattachment offers the best functional and aesthetic treatment. Filtek Z350 is a nano-composite dental restorative material discovered to meet the functional needs of posterior class I and class II restoration as well as to satisfy the aesthetic requirements for anterior restoration. Nano-composites by default have an improved mechanical property in terms of better compressive strengths, diametrical tensile strength and fracture/bear resistance. This enhanced strength may be attributed to its manipulative ability in nascent structure for providing improvement in mechanical property.

Internal groove technique utilizes the space offered by internal dentine groove; it may accommodate more dental material as well as it gives more opportunity for structural resistance. However this technique is reported to compromise aesthetics as the groove itself and the internal resin composite may modify the shade of teeth.

Over contour technique is utilized in order to hide the junction of fragment by preparing the enamel at apical and coronal position which gives structural strength, however a long term aesthetic deficit is possible because of composite deterioration.

Chamfer technique theoretically have the advantage of placement of a chamfer which precludes the requirement of enamel and dentine preparation thus correct positioning of fragment is more possible.

Simple reattachment is an evolved technique with improvements in hydrophilic adhesives. The logic behind the technique is that if a fragment has a good fit then no preparation is required and the fragment can be directly cemented.

The choice of technique may depend on several factors. The literature has reported that the primary cause of fragment loss is either dental trauma or the non physiological use of restored teeth; therefore the primary concern behind all reattachment techniques is logically their fracture strength. Therefore, this study was attempted to search for techniques that offer fracture strength similar to offered by sound teeth. However these kind of studies may suffer from a number of methodological confounding factors like the nature of mechanical test, the method use for tooth fragmentation, the visible fracture pattern, the subjective opinion of differences and whether the sound tooth is really without any underlying

pathology. All these confounding factors or methodological limitation in cohesion makes it difficult to comment conclusively on any technique or dental adhesive materials. De santis Et al tried to compare simple reattachment to the placement of chamfer and concluded that chamfer technique attain higher fracture resistance. In the same manner reis et al reported that internal groove and over contour technique had nearly achieved intact tooth fracture strength . These finding are similar to our study in which both the technique showed their superiority at statistical plane.

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