ejpmr, 2020,7(10), 555-560

SJIF Impact Factor 6.222

EUROPEAN JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH

www.ejpmr.com

Research Article

ISSN 2394-3211

EJPMR

FRACTURE RESISTANCE OF TEETH WITH UNCOMPLICATED CROWN FRACTURE, RESTORED WITH FRAGMENT REATTACHMENT TECHNIQUE AND RESIN COMPOSITE: AN IN VITRO STUDY

Dr. Abhisek Guria*[1] and Dr. Bharath M. J.[2]

[1]MDS, Department of Conservative Dentistry and Endodontics, Sri Hasanamba Dental College & Hospital, Hassan, Karnataka.

[2]Professor, Department of Conservative Dentistry and Endodontics Sri Hasanamba Dental College & Hospital, Hassan, Karnataka.

***Corresponding Author: Dr. Abhisek Guria**

MDS, Department of Conservative Dentistry and Endodontics, Sri Hasanamba Dental College & Hospital, Hassan, Karnataka.

Article Received on 01/08/2020 **Article Revised on 22/08/2020** **Article Accepted on 12/09/2020**

ABSTRACT

Aim: The aim of the study was to evaluate and compare fracture resistance of teeth restored with fracture fragment reattachment and composite resin restoration. **Materials and Methodology:** 24 Freshly extracted human maxillary central incisors with comparable dimensions were collected. The teeth were embedded in self-cure acrylic resin blocks till cemento enamel junction. Each sample were sectioned **2.5**mm from the incisal edge obliquely in labio-lingual direction. All samples were randomly divided into two groups (n= 12).**Group1 (fragment reattachment group):** A groove (1mm diameter, 1mm depth) was placed in dentin with a carbide bur on sectioned surface of both fragment and the tooth. Then fragments were reattached with micro hybrid flowable composite (Filtek Z250).**Group2 (composite restoration group): A** short bevel of 1mm width was placed on the sectioned tooth margin. They were restored with microhybrid composite resin (Filtek Z250) using incremental layering technique.Samples were subjected to fracture resistance test in a universal testing machine at a crosshead speed of 1mm/sec until fracture. Point of force application was at the center of the fragment or restoration. **Statistical analysis:** Data was collected and analyzed by unpaired t test. **Result:** Composite restoration (113.51±19.6N) had higher fracture resistance compared to fragment reattachment group (71.43 ±24.1N).(P <0.001).

KEYWORDS: Tooth Fracture, Traumatic Injury, Fragment Reattachment, Fracture Resistance, Composite Restoration, Internal Dentin Groove.

INTRODUCTION

Traumatic injuries to dentoalveolar structure are frequent in children and adolescent, especially within the age of 10-12 years.[1,2] When we look at the gender predilection, males are more affected than females. But due to increased involvement of females in sports the ratio is changed. Maxillary incisors are at more risk for this kind of fracture, almost 90%.[3] Most of the time injuries occurs at the crown level and usually asymptomatic, unless there is significant dentin involvement.[4] Currently following conservative treatment options are available for uncomplicated crown fractures

1. Fracture fragment reattachment
2. Restoration with composite resin
3. Ceramic veneers
4. CAD CAM fragment reattachment.[5]

Among these fragment reattachment is the most conservative approach, especially in case of children and uncooperative patients. Reattachment of fractured fragments can offer several advantages comprising (i) The patient's own incisal enamel appears more natural than any composite resin, particularly with regard to translucency. (ii) The incisal edge will wear in unison with the adjacent teeth, as a composite restoration tends to wear faster than enamel. (iii) Total chairside time for reattachment of incisal edge is less than constructing a composite resin incisal edge (iv) The most important feature of the method has been the preservation of pulpal vitality. (v) The method is much more economical.[6,7] In children it helps to preserve dental tissues during tooth development. Composite resin restorations also been used frequently for these treatment with excellent esthetic result and fracture resistance. The primary cause of failure of the reattached tooth fragment is new trauma or the use of the restored tooth with excessive masticatory forces.[8] So to improve the strength of reattached fragment various techniques have been suggested. Some of them showed that placement of internal dentin groove has better fracture resistance.

The aim of this study was to evaluate and compare fracture resistance of teeth restored with composite resin restoration and fracture fragment reattachment with internal dentin groove.

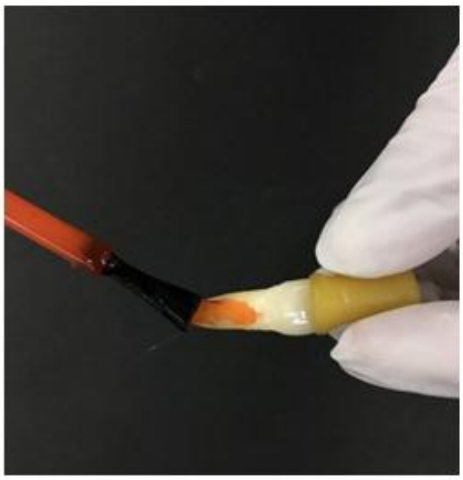


Figure 1: application of tray adhesive.

Figure 2: sectioning of incisal third.

MATERIALS AND METHODOLOGY

Sample collection and preparation

24 Freshly extracted human maxillary central incisors with comparable dimensions were collected and stored in saline until use. Tissue remnants were removed from the surface with an ultrasonic scaler and washed under water. For periodontal space simulation a thin layer of tray adhesive (Figure 1) and light body silicone material was applied on the root surface of each sample. The teeth were embedded in self-cure acrylic resin blocks (1cm x 1cm x 2.5cm) till cemento enamel junction.

Each sample was sectioned 2.5mm from the incisal edge obliquely in labio-lingual direction with a diamond disc under water coolant (Figure 4).[9] All specimens were washed under distilled water to remove debris and dried with blotting paper. Then they were randomly divided into two groups **(n=12).**

Group 1 (composite restoration group)

A short bevel of 1mm width was placed on the sectioned tooth margin. Acid eatching was done for both the sectioned surfaces with 37% phosphoric acid for 30sec followed by washing with distilled water. Then the samples were blot dried and a thin layer of bonding agent was applied and cured for 30 sec. Then they were restored with composite resin (Filtek™ Z350 XT universal restorative) using incremental layering technique till 2.5mm.(Figure 3).

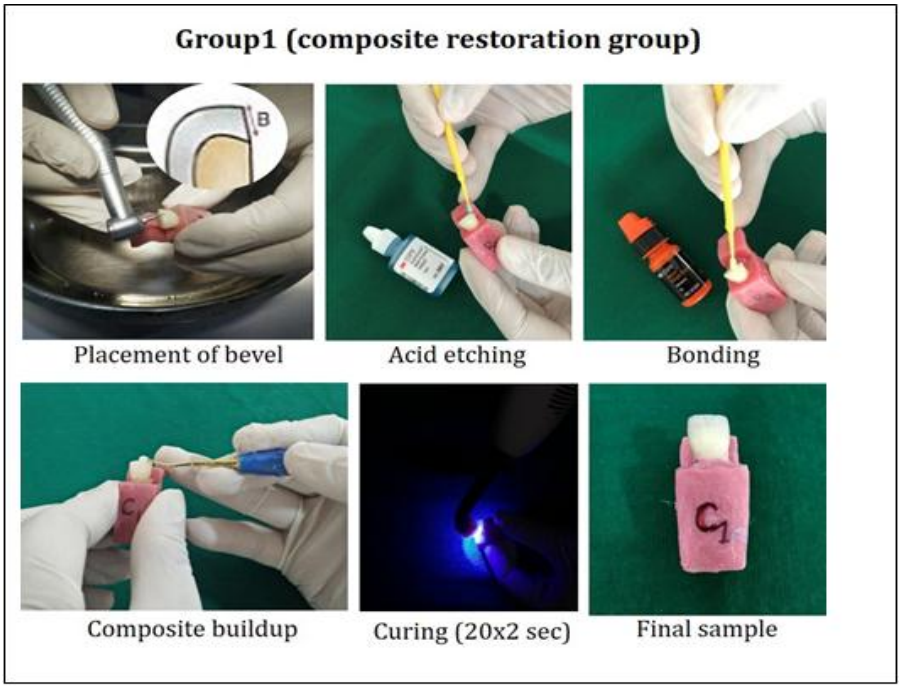


Figure 3: procedures for Group 1.

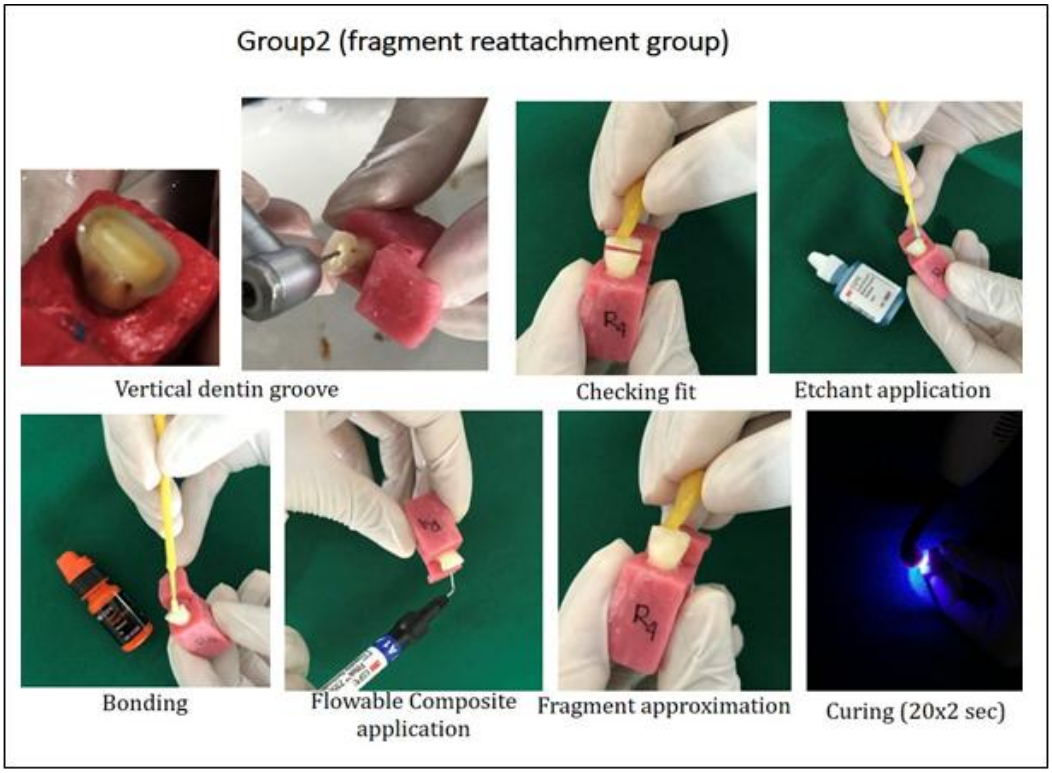


Figure 4: Procedures for Group 2.

Group 2 (fragment reattachment group)
A groove (1mm width, 1mm depth) was placed in dentin and a short bevel in enamel with a carbide bur on sectioned surface of both fragment and the tooth. Etching and bonding was performed as described for group 1. Then fracture fragments were reattached with flowable composite resin (Filtek^{TM} Z350 XT flowable restorative). Excess resin was removed with a teflon coated instrument and cured with LED light cure unit **(**1,000 mW/cm^2) from 1mm distance for 30sec each. Then polished with SHOFU polishing kit. (Figure 4 & 5)

Figure 5: Finishing & polishing

Testing procedure
All samples of group1 and group2 were incubated at 37^{0}C in fully saturated condition. Then subjected to fracture resistance test in a universal testing machine at a crosshead speed of 1mm/min until fracture. Force was applied on the labial surface in a perpendicular direction with a pointed metal tip of 1mm^2 diameter. Point of force application was at the center of the fragment or restoration. The load was increased progressively until the reattached tooth fragment separated. The force required to fracture the reattached fragment was recorded in Newton.

Statistical analysis
Unpaired t test was used to compare the fracture resistance of both the group.

RESULTS

In the present study mean load in reattachment group was 71.43 ±24.1 and in composite group it was 113.51±19.6. maximum fracture resistance in reattachment group was 121.6N and for composite restoration group was 140.1N. There was a statistically significant difference in mean load between two group i.e, p<0.001.

Table 1: mean fracture load of group 1 and group 2.

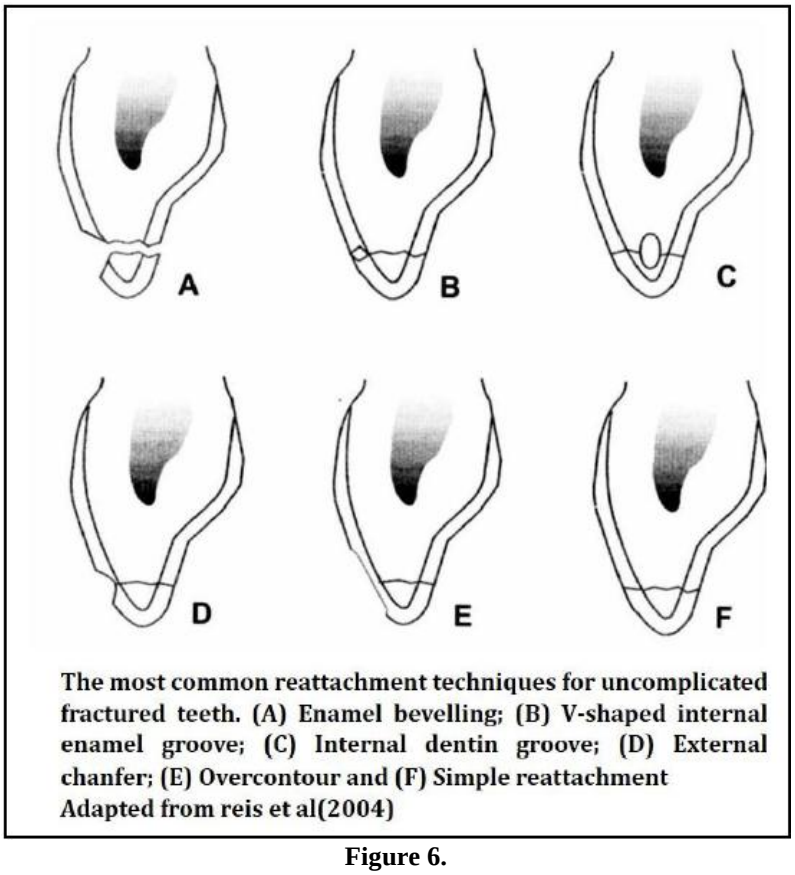
Unpaired t test						
Group	**N**	**Mean load (N)**	**Std. Deviation**	**t**	**df**	**p**
Composite Group 1	**10**	**113.51**	**19.64**	**4.35**	**19**	**<0.001**
RE-Attachment Group 2	**11**	**71.43**	**24.11**			

DISCUSSIOIN

In this study fracture resistance of teeth restored by fragment reattachment and composite resin were compared. Result showed that composite restoration (group 1) showed higher fracture resistance (113.51+19.6N) than reattachment group (group2, 71.43 +24.1N). This can be attributed to number of interfaces present between the restorations. In case of composite restoration there is only one interface between composite and tooth surface. But in reattachment group there are two interfaces, one between fragment and the composite and second one between composite and remaining tooth structure.

Studies showed that fracture resistance can be affected by different types of bonding agent, types of composite materials (microfilled, nanofilled or nanohybrid) and area of bonding surface available.[10,11,12] Fracture resistance can also be affected by age of the tooth, amount of dehydration of the fragment, extraoral time after fracture.

There are various techniques for reattachment of fragments like – simple beveling of enamel margin, ‘’v’’ shaped internal enamel groove, internal dentin groove, external chamfer, overcontoured and simple reattachment technique (Figure 6).[13] In a study by Reis et al compared the percentage of strength restored after fragment reattachment with 4 techniques (simple reattachment, labial chamfer, over contour and internal groove). Result showed that internal groove restored highest (90.5%) percentage of fracture strength.[10] So in this study internal groove (figure 6 C) technique was used.[14]



The most common reattachment techniques for uncomplicated fractured teeth. (A) Enamel bevelling; (B) V-shaped internal enamel groove; (C) Internal dentin groove; (D) External chanfer; (E) Overcontour and (F) Simple reattachment Adapted from reis et al(2004)

Figure 6.

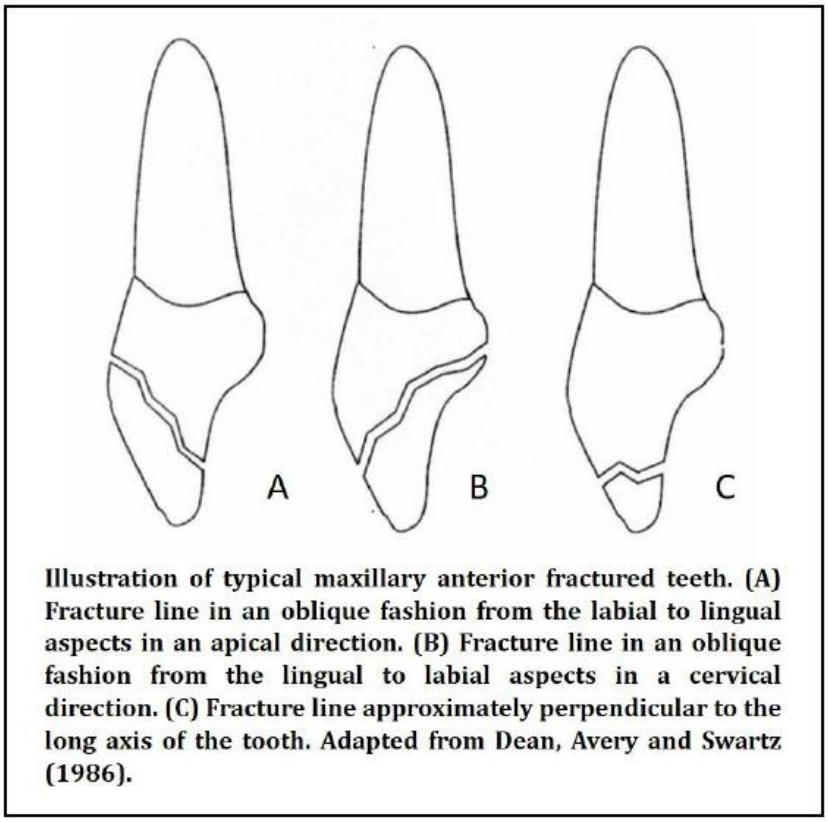


Illustration of typical maxillary anterior fractured teeth. (A) Fracture line in an oblique fashion from the labial to lingual aspects in an apical direction. (B) Fracture line in an oblique fashion from the lingual to labial aspects in a cervical direction. (C) Fracture line approximately perpendicular to the long axis of the tooth. Adapted from Dean, Avery and Swartz (1986).

Figure 7.

As area of bonding surface also affects the fracture strength, in this study teeth with comparable dimension were selected. Length and width of the incisal edge was measure with a Vernier caliper. Sectioning of the sample was done obliquely towards labio-lingual direction to simulate natural pattern of fracture. In a study by Murchison & Worthington showed that 80% of the tooth fractures happen in oblique fashion from the labial to lingual aspects in an apical direction (Figure 7).[15,16] Normally fracture pattern follows direction of enamel prism and there is no smear layer production.in case of sectioning there is production of smear layer. In this study sectioning with diamond disk was done as it has an advantage of sectioned fragment establishes standardized and repeatable condition.

Extent of dehydration decides the success of reattachment. Longer the fragment remains dehydrated poorer the tooth's strength will be. The dehydration of dentin causes collagen fibers to collapse and obstructs the proper penetration of resin monomers, leading to poor adhesion between dentin and composite material.[17] Farik et al. showed that Improvement of tooth's resistance can be achieved by fragment rehydration.[18] Although in this study fragments were stored in natural saline and reattached within short period of time.

CONCLUSION

With the limitations of the study it can be concluded that if proper adhesive protocol is followed, composite restoration of uncomplicated tooth fracture has increased fracture resistance compared to fragment reattachment. But clinical scenario should be taken into consideration while deciding treatment protocol.

REFERENCES

1. Levin L, Samorodnitsky GR, Schwartz Arad D, Geiger SB. Dental and oral trauma during childhood and adolescence in Israel occurrence, causes and outcome. Dent Traumatol, 2007; 23(6): 356-9.
2. Wilson S, Smith GA, Preisch J,Casamassimo PS. Epidemiology of dental trauma treated in an urban pediatric emergency department. Pediat Emerg Care, 1997; 19(1): 12-15.
3. Rajab LD. Traumatic dental injuries in children presenting for treatment at the Department of Pediatric Dentistry. Faculty of Dentistry, University of Jordan. Dental Traumatol, 2003; 19(1): 6-11.
4. Andreasen FM. A retrospective evaluation of crown fractured permanent teeth treated in a paediatric dentistry clinic. Dental Traumatol, 2007; 23(6): 389-90.
5. Sinhori, B. S., Monteiro, S., Bernardon, J. K., & Baratieri, L. N. CAD/CAM ceramic fragments in anterior teeth: A clinical report. Journal of Esthetic and Restorative Dentistry, 2017; 30(2): 96–100.
6. Maia EA, Baratieri LN, de Andrada MA, Monteiro S Jr, de Arau´ jo EM Jr. Tooth fragment reattachment: fundamentals of the technique and two case reports. Quintessence Int., 2003; 34: 99–107.
7. Sengun, A., Ozer, F., Unlu, N. and Ozturk, B. Shear bond strengths of tooth fragments reattached or restored. Journal of Oral Rehabilitation, 2003; 30: 82-86.

8. Andreasen FM, Nore´n JG, Andreasen JO, Engelhardtsen S, Lindh-Stro¨ mberg U. Long-term survival of fragment bonding in the treatment of fractured crowns: a multicenter clinical study. Quintessence Int., 1995; 26: 669–81.
9. Singhal R, Pathak A. Comparison of the fracture resistance of reattached incisor tooth fragments using 4 different materials. J Indian Soc Pedod Prev Dent, 2012; 30: 310-6.
10. Esin Pusman, Zafer C. Cehreli, Nil Altay, Bahtiyar Unver, Osman Saracbasi, Gungor Ozgun. Fracture resistance of tooth fragment reattachment: effects of different preparation techniques and adhesive materials. Dental Traumatology, 2010; 26: 9–15
11. Reis A, Kraul A, Francci C, Assis TRG, Crivelli DD, Oda M & Loguercio AD. Re-attachment of anterior fractured teeth: Fracture strength using different materials Operative Dentistry 2002; 27(6): 621-27.
12. Pagliarini A, Rubini R, Rea M & Campese M Crown fractures: Effectiveness of current enamel-dentin adhesives in reattachment of fractured fragments Quintessence International, 2000; 31(2): 133-36.
13. Reis A, Francci C, Loguercio AD, Carrilho MRO, Rodrigues Filho LE. Re-attachment of anterior fractured teeth: fracture strength using different techniques. Oper Dent, 2001; 26(3):287-294.
14. Reis A, Loguercio AD, Kraul A, Matson E. Reattachment of fractured teeth: A review of literature regarding techniques and materials. Operative dentistry, 2004; 29: 226-33.
15. Worthington RB, Murchison DF & Vandewalle KS. Incisal edge reattachment: The effect of preparation utilization and design Quintessence International, 1999; 30(9): 637-643.
16. Dean JA, Avery DR & Swartz ML. Attachment of anterior tooth fragments Pediatric Dentistry, 1986; 8(3): 139-143
17. Perdigão J, Lopes M. Dentinbonding-State of the art 1999.CompContin Educ Dent, 1999; 20: 1151-62.
18. Farik B, et al. Drying andrewetting anterior crown fragment priorto bonding. Endod Dent Traumatol, 1999; 15: 113-16.