

Effect of Duration of Fragment in storage media and different types of storage media on the Bond Strength of the Reattached Tooth Fragment- A Novel Approach¹Dr. Dhiraj wagh, PG student, Department of Pedodontics, JMF's ACPM Dental College, Dhule²Dr. Sudha Patil, Professor, Department of Pedodontics, JMF's ACPM Dental College, Dhule³Dr. Prashant Bondarde, Professor and Head of Department of Pedodontics, JMF's ACPM Dental College, Dhule⁴Dr. Shoeb Mujawar, Reader, Department of Pedodontics, JMF's ACPM Dental College, Dhule⁵Dr. Aruna Vishwakarma, Senior lecturer, Department of Pedodontics, JMF's ACPM Dental College, Dhule⁶Dr. Akshay Kothari, PG student, Department of Pedodontics, JMF's ACPM Dental College, Dhule**Corresponding Author:** Dr. Dhiraj wagh, PG student, Department of Pedodontics, JMF's ACPM Dental College, Dhule**Citation of this Article:** Dr. Dhiraj wagh, Dr. Sudha Patil, Dr. Prashant Bondarde, Dr. Shoeb Mujawar, Dr. Aruna Vishwakarma, Dr. Akshay Kothari, "Effect of Duration of Fragment in storage media and different types of storage media on the Bond Strength of the Reattached Tooth Fragment- A Novel Approach", IJDSIR- September - 2020, Vol. – 3, Issue - 5, P. No. 130 – 136.**Copyright:** © 2020, Dr. Dhiraj wagh, et al. This is an open access journal and article distributed under the terms of the creative commons attribution noncommercial License. Which allows others to remix, tweak, and build upon the work non commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.**Type of Publication:** Original Research Article**Conflicts of Interest:** Nil**Abstract****Aim:** The aim of this study was to evaluate the effect of easily available novel storage media which have variable remineralizing potential on the fracture resistance of reattached fragments.**Material and methods:** 40 sound human maxillary incisors were divided into four groups, the teeth were then sectioned and the fragments were kept in Tooth Mousse (Group A), 3M Clinpro (Group B) SHY NM (Group C) and in Normal Saline for 24 hours. The fragments were then reattached using simple reattachment technique with flowable composite resin. These teeth were then subjected to the universal strength testing machine and the fracture resistance of these reattached fragments were recorded.**Results:** Group B (3M Clinpro) recorded the highest mean fracture resistance followed by Group A (Tooth Mousse) and Group C (SHY NM).**Conclusions:** Fragments stored in 3MClinpro showed greater fracture resistance than those kept in Tooth mousse, SHY NM group.**Keywords:** 3M Clinpro, SHY NM, Tooth Mousse, Storage media, reattached fragments.**Introduction**

The uncomplicated crown fracture of anterior teeth is the most common traumatic injury of permanent dentition. The upper central incisors are the teeth most frequently affected by this type of dental injury (80%), and this high incidence can be related to the anterior anatomical position and to the protrusion caused by eruptive process.

The traumatic events involving maxillary central incisors could also be related to malocclusion in which there is a more buccal positioning of these teeth. Depending on different clinical situations, anterior teeth with enamel-dentin fractures can be treated using various techniques and materials. Direct or indirect restorations can be used when the fractured fragment is not available.⁶ When the fractured portion is intact, with adequate and correctly preserved margins, the adhesive reattachment to the residual tooth structure represents the first choice treatment. The reattachment technique is also appropriate in dental fractures where the detached fragment does not match completely with the remaining tooth structure.⁷ In this case it is crucial to perform a pre-operative analysis of the margins in order to choose the best technique required to fill the gap between the tooth and the fragment thus improving the adhesion. The incisal edge reattachment technique compared with the traditional restorative procedures offers the possibility to re-establish the contour, the architecture and the original brightness of tooth easily, and with a positive emotional response and greater acceptance from the patient.² Various studies have been carried out using different materials and tooth preparation designs employed for the union of fractured segments. One of the factors that play an important role in the success of fragment reattachment is the type of storage of the fragment following trauma. Most of the case reports have highlighted the importance of hydrating the fractured segments. So, successful fragment reattachment depends on the intact retrieval of the fragment at the time of injury and adequate hydration of the fragment outside the mouth. Hydration maintains the vitality and original esthetic appearance of the tooth. The hydrophilic characteristic of adhesive systems also means that hydration acts to ensure adequate bond strength.³ The reattachment time can affect the bond strength of these reattached fragments because

dentin moisture is also essential for achieving the high bond strength between the fragments and composite resin.¹ Very few studies have been reported on the kinds of environments like saliva, water, or normal saline, in which patients may store fractured parts of teeth, like what should be done in case of avulsed teeth. The focus of the study was to examine the influence of different unprecedented storage media and duration of the fragment in the media on the bond strength of the reattached fragment of teeth.

Material And Methods

In this experimental study, 40 extracted permanent maxillary central incisors were selected. All the extracted teeth were cleaned with ultrasonic scaler and samples were randomly and equally divided into four groups of 10 teeth each. Groups were further divided into eight groups of 05 teeth each and were marked 3 mm apical to the incisal edge.

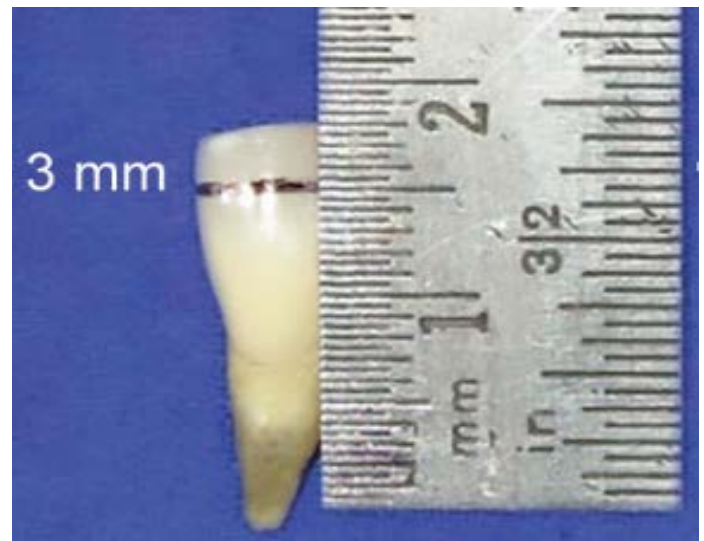


Figure 1

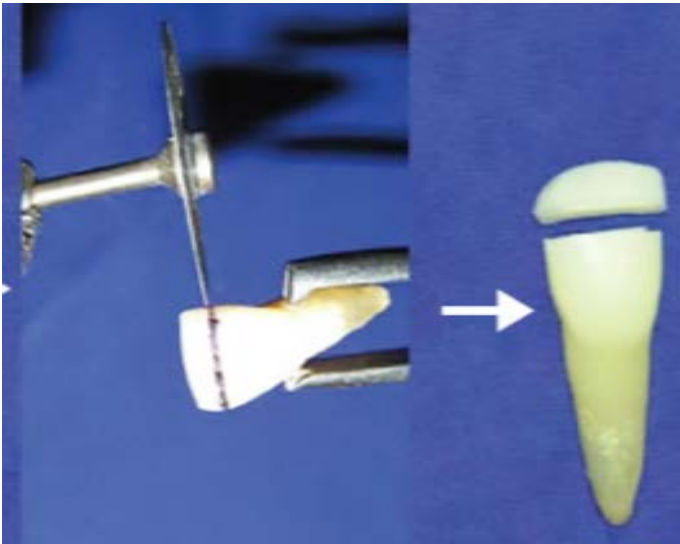


Figure 2

Samples were sectioned using a diamond disk and stored in already labeled respective ice trays for storage media. Four storage media were used including TOOTH MOUSSE, 3M CLINPRO TOOTHPASTE, SHY NM TOOTHPASTE, SALINE. All the fragments were preserved in the respective storage media and the apical portions of teeth were stored in distilled water.

Tap water was taken as a control group. After 12 and 24 hours, in group I, fragments were rinsed dried, and bonded to a respective apical portion of a tooth. Both the fractured surfaces were etched by 37% phosphoric acid for 15 seconds and rinsed with water for 15 seconds and dried with paper towel. Both the fractured surfaces were etched by 3M ADPER SINGLE BOND UNIVERSAL BOND for 15 seconds and cured by light cure gun. The fragments were attached with respective apical portion using a 3M filtek 350 flowable composite by pressing both the parts together and curing for 40 seconds. Reattached samples were kept in distilled water. A similar procedure was carried out respectively for groups II, III, and IV. All the samples were mounted on an acrylic block up to 1 mm apical to the cingulum and specimens were loaded on the universal strength testing machine (Instrol devices, Nasik, India). In order to evaluate the impact, a crosshead speed

of 1 mm/minute was selected and the compressive load was applied on the incisal third of teeth specimen at 90° using universal strength testing machine to simulate the impact from a fall.



Figure 3



Figure 4

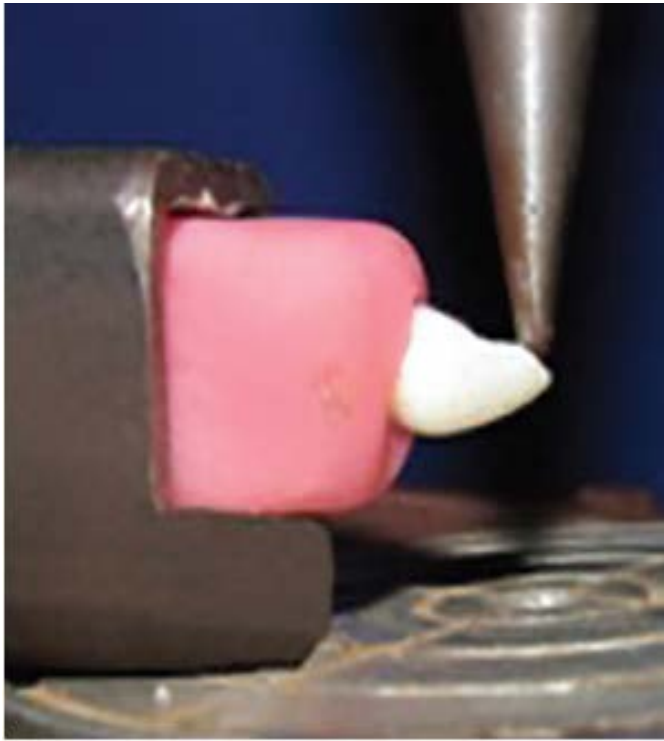


Figure 5



Figure 6

The bond strength of each specimen was tested and measured in Newton and the collected data were tabulated using a Kruskal–Wallis and Mann–Whitney tests. A p -value ≤ 0.05 was considered. The statistical calculations were executed using Statistical Package for the Social Sciences version 20.0 statistical software.

Results

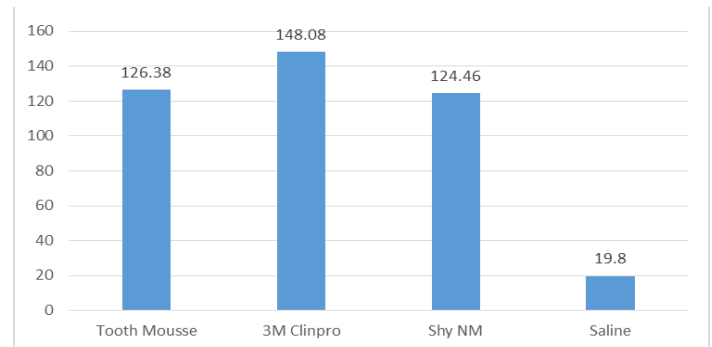
Mann–Whitney test was performed for inter comparison between the groups at 12 and 24 hours; groups 1 & 2 showed statistically high significant values.

There was a modest statistically significant difference between groups 2 and 1 but the mean value of bond strength of these groups was higher than that of other groups .

The mean value of bond strength was lesser in groups 3 and 4 at 12 and 24 hours respectively.

Table 1: Mean values of bond strength of reattached fragments in different storage media at 12 hour's duration.

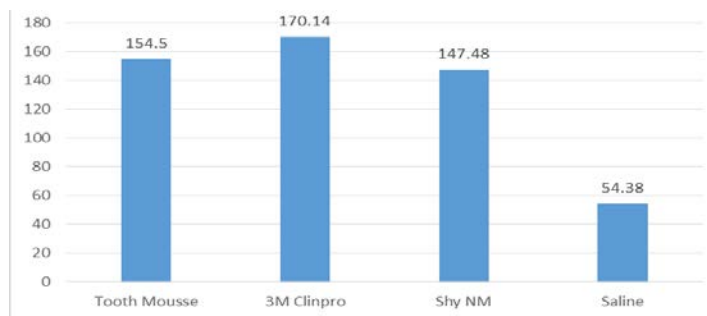
Duration	Group	N	Mean	Std. Deviation	F value	P value
12 hrs	Tooth Mousse	5	126.380000	5.7629853	341.659	0.001*
	3M Clinpro	5	148.080000	10.4415995		
	Shy NM	5	124.460000	5.8921982		
	Saline	5	19.800000	4.1472883		



Graph1

Table 2: Mean values of bond strength of reattached fragments in different storage media at 24 hour's duration.

Duration	Group	N	Mean	Std. Deviation	F value	P value
24 hrs	Tooth Mousse	5	154.500000	10.4004808	160.192	0.001*
	3M Clinpro	5	170.140000	12.5360680		
	Shy NM	5	147.480000	6.6190634		
	Saline	5	54.380000	5.7582115		



Graph 2

Discussion

Maxillary incisors are suitable for studying the evaluation of bond strength because in natural conditions these teeth are most prone to trauma and are easily available. In case of enamel and dentin fracture, as the fracture is quite massive, there are greater chances of availability of intact fragment, which can be bonded to the tooth with the help of reattachment procedure. In this study, in order to investigate the effect of different storage media on bond strength of reattached tooth fragment only the other retentive features such as enamel bevel or chamfer preparation were not used. Also, single bond was used in order to have a durable and strong enamel bond along with an acceptable dentin bond, and not the self-etching systems which have a weaker enamel bond. Despite significant improvements in adhesive systems and

composite resins in the last decades, some limitations are still present with these materials, such as polymerization shrinkage and questionable longevity of the adhesive interface. These critical factors can affect the fracture strength of reattached teeth, being a problem for longevity of the reattached teeth. However, studies conducted have shown that the material combinations used to reattach the fragments are secondary to the technique used which influences the fracture toughness of a reattached tooth. Some studies recommend keeping fractured parts in moisture in order to prevent dehydration or discoloration. Some suggest a normal saline solution at 37°C and others recommend water or salt solution in a closed container. Tooth Mousse (CPP-ACP), 3M Clinpro toothpaste (TCP), shy NM toothpaste (Bioactive glass) were selected in this study because they have highest remineralization potential which can affect the bond strength of reattached fragment. However, in the present study, focus had been on achieving better bond strengths and the fractured parts had to be kept in proper storage environments. No major changes were seen in the appearance of the teeth. The teeth were fractured in order to optimize the simulation conditions. Shirani et al.²² proved that milk elements, such as calcium and phosphate can harden and stiffen both demineralised and healthy dentin by permeating the surface.

According to Farik, moisturizing the fractured part affects the bond strengths and the bond strength improves by increasing the moistening time, thus 24hrs storage groups has higher bond strength than 12 hours group. The best storage environments, as observed in this study, are 3M Clinpro, tooth mousse, shy NM respectively, which has different remineralizing agent in their composition, there is no mention of this in the current literature and more investigations are required on the subject. However, further SEM (scanning electron microscopy) investigations

of fractured surfaces before and after acid etching are suggested for evaluation of the surface roughness in different groups, and also for measuring their thickness and depth of the hybrid layer.

In our study the highest bond strength was observed in group 2(3M Clinpro) as it contains TCP which has defined and stable structure . It also acts like partially soluble precursor to hydroxyapatite, the principle mineral of teeth.

Conclusion

The amount of load required to fracture the reattached fragment is influenced by the media and duration where the fragment is stored before reattachment.

The best result is obtained when the fragment is stored in 3M Clinpro

3M Clinpro can be considered as a best storage media for fragment reattachment.

Clinical significance

3M Clinpro can be considered as a best storage media for fragment reattachment, as it increases the bond strength.

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