ISSN: 2581-5989
PubMed - National Library of Medicine - ID: 101738774

International Journal of Dental Science and Innovative Research (IJDSIR)

IJDSIR : Dental Publication Service

Available Online at: www.ijdsir.com

Volume – 4, Issue – 4, July - 2021, Page No. : 645 - 649

Effect of storage media on fracture resistance of reattached tooth fragments using flowable composite

[1]Reeni Mary Joseph, Post Graduate Student, Department of Conservative Dentistry and Endodontics , KMCT Dental College, Manassery, Kozhikode 673602, Kerala

[2]Vaisakh Krishnan S, Post Graduate Student, Department of Conservative Dentistry and Endodontics , KMCT Dental College, Manassery, Kozhikode 673602, Kerala

[3]Ramesh Kumar. M, Professor & Head, Department of Conservative Dentistry and Endodontics, KMCT Dental College, Manassery, Kozhikode 673602, Kerala

Corresponding Author: Reeni Mary Joseph, Post Graduate Student, Department of Conservative Dentistry and Endodontics, KMCT Dental College, Manassery, Kozhikode 673602, Kerala

Citation of this Article: Reeni Mary Joseph,Vaisakh Krishnan S, Ramesh Kumar. M, "Effect of storage media on fracture resistance of reattached tooth fragments using flowable composite", IJDSIR- July - 2021, Vol. – 4, Issue - 4, P. No. 645 – 649.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Aim: To compare the fracture resistance of incisor tooth fragments stored in four storage media: Dry air, milk, coconut water, or normal saline before reattaching them with Flowable composite.

Materials and Methods: Twenty freshly extracted maxillary incisors were divided into four groups. Teeth will be then sectioned, and fragments were stored in dry air (Group I), milk (Group II), coconut water (Group III), and normal saline (Group IV). The fragments were reattached using simple reattachment technique and fracture resistances of the samples were measured using a Universal Testing Machine.

Results: The highest fracture resistance value was demonstrated by Group II(Milk), followed by Group III(coconut water), followed by Group IV(normal saline)and least fracture resistance values were observed in Group I(dry air).

Significance: The mode of storage of a fragment before its reattachment significantly affects the prognosis. Thus, there is a need to give awareness to the public about the manner of preservation of such fragments such as their avulsed counterparts.

Keywords: Fracture resistance, fragment reattachment, Filtek ^{Z350} XT, storage medium.

Introduction

In anterior teeth Coronal fractures represents 18–22% of all injuries to dental hard tissues; 96% of them involving the maxillary incisors alone[1].

Various techniques have been put forth to reconstruct such traumatically injured teeth

- Resin crowns

- Stainless steel crowns
- Orthodontic bands
- Ceramic crowns and
- Composite resin restorations.

All these interventions may lead to sacrifice a lot of healthy natural tissue[2].

Coronal fracture treatment is a considerable challenge for the dentist because they have to fulfill the parameters, like form and dimension, opacity, and translucence of the original tooth to obtain a successful restoration[3]. Although restoration with composite resin is indicated in the management of fractured anterior teeth, reattachment is an excellent option when the fragment is available. The concept of 'fragment reattachment' came with the development of adhesive dentistry[4]. Being a highly conservative technique reattachment offers the advantages of and does not involve any kind of preparation that promotes the preservation of natural tooth structure, good esthetics, and acceptance by the patient who receives the treatment. Fragment reattachment offers several advantages compared to conventional techniques, the most predominant one being-aesthetics[5]. It is considered as a minimally invasive biological option for managing such injuries[6].

Prognosis of the reattached fragment is dictated by

- firmness of its attachment to the tooth
- mode of storage immediately following trauma[7]

Storage medium acts as one of the key determinants since hydration helps to maintain the vitality, esthetic appearance, and the bond strength[8,9] . Hydrophilic characteristic of adhesive systems also means that hydration acts to ensure adequate bond strength[4] .

Hence, the present study was planned to compare the fracture resistance of fractured incisor tooth fragments stored in four storage media namely, dry air, milk, coconut water, or normal saline which were eventually reattached using a newer nano-hybrid flowable composite.

Materials and Methods

Sixteen freshly extracted permanent maxillary incisors extracted due to therapeutic reasons with intact crown structures were collected. Teeth with defects such as fractures, decalcification, or caries were discarded.

The selected teeth were randomly divided into four groups of four each based on the storage medium used.

Group I: Dry storage

Group II: Milk as storage medium

Group III: Coconut water as storage medium

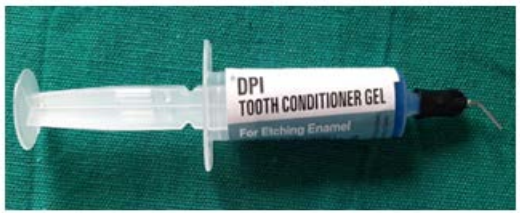
Group IV: Normal saline as storage medium.

Intentional fracture of freshly extracted sound teeth: The cervicoincisal distance was measured for each of the tooth on the labial surface. One-third of this distance was then calculated and marked on the labial surface from the incisal edge. The tooth was cut on the marked line perpendicular to its long axis with a low-speed diamond disk

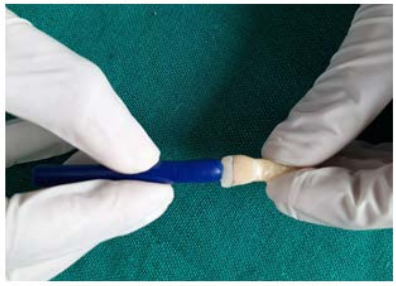
Immediately after fracturing, the fragments were stored in separate marked containers with appropriate storage media (milk, coconut water, and normal saline)

- Fragments were reattached after 2 hours by means of simple reattachment technique.
- About 37% phosphoric acid was applied to the fragment and the tooth for 15 s, rinsed for 10 s followed by air drying for 5 s.

- Bonding agent (Te-Econom Bond , Ivoclar Vivadent) was applied in two consecutive coats
- surfaces were dried for 5 s using an air syringe to allow solvent evaporation.
- The bonding agent was then light cured for 20 s in the fractured fragment and 20 s in the tooth remnant.



- Nanohybrid flowable composite (Filtek Z350 XT) was applied on the surface of the fragment and tooth remnant.
- The fragment was then positioned back to the tooth remnant by means of a sticky wax (to carry the fractured fragment).
- After ascertaining the correct position, light curing was carried out: 40 s labial half , 40 s lingual half



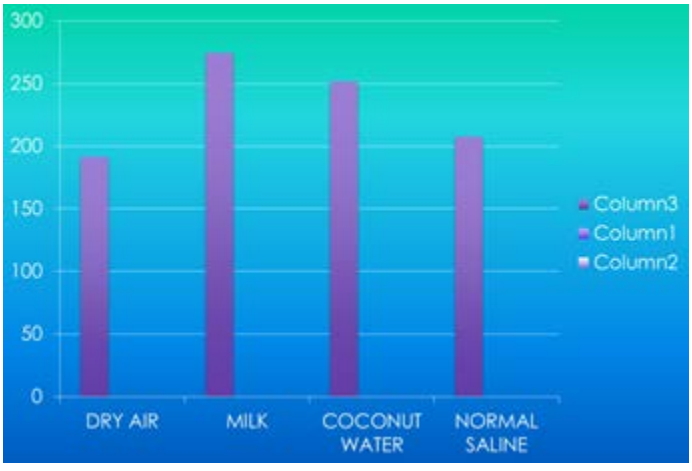
- Each sample was then embedded in a self-cure acrylic resin block such that only the coronal portion of the tooth was exposed
- Fracture resistance of the samples were measured using a Universal Testing Machine
- The rod of universal testing machine was held perpendicular to the long axis of the tooth at the incisal third of the crown near the bonding line on the labial surface.

- The load was applied at a crosshead speed of 1 mm/min.
- The load was increased progressively and the value at which the reattached fragment debonded was recorded in kilograms and converted into Newton (N) using the relationship, 1 kg = 9.81 N.

This load represented the fracture resistance of the reattached tooth.

Results

GROUPS	n	MEAN VALUE(N)
Dry air	4	191.3
Milk	4	274.2
Coconut water	4	251.5
Normal saline	4	207.6



The highest fracture resistance value was demonstrated by Group II(Milk), followed by Group III(coconut water),

followed by Group IV(normal saline)and least fracture resistance values were observed in Group I(dry air).

Discussion

Central incisors of maxillary arch were selected for the study because of the high incidence and prevalence of trauma in this region.[10,11] Bond strength evaluation of reattached fragment is relevant because most often reattachment failures occur due to repeated trauma.[12] Bond strength can be enhanced by storing the fragment in various storage media.

One of the factors that play a significant role in the outcome of fragment reattachment is the type of storage media used for the storage of fragment following trauma. If the coronal fragment has been allowed to dry out prior to reattachment, the fragment will dry and in vitro tests have shown decreased bond strength of such reattached fragment. Fragment storage in a moist environment ensured that there is no or minimal collapse of the collagen fibers in the dentin leading to a better bond strength. It prevents the drying of the fragment which can be detrimental to the esthetics.[6] Farik et al[13] showed that drying for more than 1 hour prior to bonding of the fragment resulted in declined fracture strength.

- In this study, the fracture resistance value for Group II was recorded as the highest being statistically significant over Group I and Group IV.
- The teeth were cut in a standardized manner using a low-speed diamond disk, as the aim was to evaluate the storage media.
- Dehydration of human dentin has demonstrated a brittle behavior
- It can be attributed to the isotonicity of milk with high water content which allowed adequate rewetting of the dentinal tubules
- Coconut water has higher osmolality than milk.
- The water content of coconut water might have allowed better wetting of the dentin preventing the collapse of the collagen fibers which play a role in resin tag formation.
- The difference between the fracture resistance values between Group II and Group III were not statistically significant.

Considering the Indian situation for the problem in question, there is a greater probability of coconut water being readily available at the site of trauma such as a typical school playground[14]. Hence, this study has the potential to realise the fact that the mode of storage of a fragment before its reattachment significantly affects the prognosis. Thus, there is a need to give awareness to public about the manner of preservation of such fragments such as their avulsed counterparts.

Conclusion

Within the limitations of this study, it can be concluded that:

- Hydration of the fragment does improve its fracture resistance significantly
- Milk offers the highest fracture resistance values among the tested media
- Coconut water can also be considered a viable alternative.

References

1. Andreasen JO, Ravn JJ. Epidemiology of traumatic dental injury to primary and permanent teeth. Int J Oral Surg 1972; 1(5):235-239.
2. Buonocore MG, Davila J. Restoration of fractured anterior teeth with ultraviolet-light-polymerized bonding materials: A new technique. *J Am Dent Assoc*. 1973;86:1349–54.
3. Demarco FF, Fay RM, Pinzon LM, Powers JM. Fracture resistance of reattached coronal fragments—

influence of different adhesive materials and bevel preparation. Dent Traumatol 2004 Jun;20(3):157-163

4. Capp CI, Roda MI, Tamaki R, Castanho GM, Camargo MA, de Cara AA. Reattachment of rehydrated dental fragment using two techniques. Dent Traumatol 2009 Feb;25(1):95-99.
5. Reis A, Francci C, Loguercio AD, Carrilho MR, Rodriques Filho LE. Re-attachment of anterior fractured teeth: Fracture strength using different techniques. *Oper Dent.* 2001;26:287–94.
6. Sharmin DD, Thomas E. Evaluation of the effect of storage medium on fragment reattachment. *Dent Traumatol.* 2013;29:99–102.
7. Prabhakar AR, Kurthukoti AJ, Kayalvizhi G. A comparison of impact strength of fragment-bonded anterior teeth using three different restorative materials: an in vitro study. J Indian Soc Pedod Prev Dent 2007 Apr-Jun;25(2):88-92.
8. Simonsen RJ. Restoration of a fractured central incisor using original tooth fragment. J Am Dent Assoc. 1982;105:646–8.
9. Perdigão J, Van Meerbeek B, Lopes MM, Ambrose WW. The effect of a re-wetting agent on dentin bonding. Dent Mater. 1999;15:282–95.
10. . Tovo MF, dos Santos PR, Kramer PF, Feldens CA, Sari GT. Prevalence of crown fractures in 8-10 years old schoolchildren in Canoas, Brazil. Dent Traumatol 2004 Oct;20(5):251-254.
11. Zuhal K, Semra OE, Huseyin K. Traumatic injuries of the permanent incisors in children in southern Turkey: a retrospective study. Dent Traumatol 2005 Feb;21(1):20-25.
12. Rajput A, Ataide I, Lambor R, Monteiro J, Tar M, Wadhawan N. In vitro study comparing fracture strength recovery of teeth restored with three esthetic bonding materials using different techniques. Eur J Esthet Dent 2010 Winter;5(4):398-411.
13. Farik B, Munksgaard EC, Andreasen JO, Kreiborg S. Drying and rewetting anterior crown fragments prior to bonding. Endod Dent Traumatol 1999 Jun;15(3):133-116.
14. Prabhakar AR, Yavagal CM, Limaye NS, Nadig B. Effect of storage media on fracture resistance of reattached tooth fragments using G-aenial Universal Flo. Journal of conservative dentistry: JCD. 2016 May;19(3):250.