ORIGINAL ARTICLE

A COMPARISON OF TWO WIRE-COMPOSITE SPLINTS HAVING DIFFERENT WIRE DIAMETERS IN THE MANAGEMENT OF TRAUMATIC DENTAL INJURIES

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ABSTRACT

The objective of the study was to evaluate the effectiveness of 0.7mm and 0.4mm stainless-steel wire-composite splints in management of dental traumatic injuries. A comparative study was conducted at Armed Forces Hospital, Jubail, Saudi Arabia and Farooq Hospital, Lahore, Pakistan from Feb. 2014 to Aug. 2016. A total of 73 teeth in 60 children (30 in each group) who fulfilled our inclusion criteria were included in the study. In Group A and Group B, 0.7- and 0.4-mm stainless-steel wire-composite splints were used respectively. Splints were removed on 14th day. Pain, lacerations and tooth mobility were evaluated on 7th, 14th and 90th day after splinting. Periapical radiographs were also taken on the 90th day. Difference between the two groups in pain relief was found to be statistically significant (p value < 0.05). Healing of dental traumatic injuries was seen with no statistically significant difference (p values >0.05) between the two groups. It can be concluded that splinting with both 0.7mm and 0.4mm stainless steel wire is equally effective. However, splinting with 0.7mm wire which is more rigid than 0.4mm wire is more effective in relieving post splinting pain.

Key Words: *Splints, Stainless steel, Tooth mobility*

INTRODUCTION

Trauma to dentition is a serious health problem and is relatively common among children.[1] Dental traumatic injuries can lead to pain, infection, fracture or loss of the offended tooth/teeth. Trauma to the primary teeth may affect the developing permanent teeth which may result into delayed eruption or more serious damage to the developing teeth including infection, hypoplasia or malformations.[2]

Trauma to the teeth may lead to various types of injuries including luxation, sub-luxation, lateral luxation, avulsion, intrusion, extrusion, root fractures and alveolar fractures. Management of these injuries involves splinting of traumatized teeth.[3] As per International Association of Dental Traumatology guidelines, such traumatic dental injuries that do not involve alveolar or root fractures should be managed by splinting the affected tooth/teeth with adjacent normal teeth for a period of 2 weeks using a flexible splint whereas in cases with root or alveolar bone fracture, splinting with flexible splints for 4 weeks is recommended.[4] These guidelines have also been endorsed by American Academy of Pediatric Dentistry[5]

A flexible splint allows physiologic tooth movement and thus helps in healing of periodontal ligament as opposed to a rigid splint that hinders physiologic tooth movement and leads to pulp necrosis, root resorption or ankylosis to the surrounding bone.[6,7] A more precise classification of dental trauma splints classifies them into three categories namely, a)Flexible splints: that allow slightly more mobility than the uninjured tooth, b)Semi-rigid splints: that allow mobility equal to uninjured teeth and c)Rigid splints: that allow mobility less than the uninjured tooth.[8]

Commonly used methods of splinting include simple composite splints, wire and composite splints, composite and fishing line splints, orthodontic wire and bracket splints, fiber splints, titanium trauma splints, arch bar splints and wire ligature splints.[3,9]

Wire and composite splints have been in use for many years. In this technique, traumatized tooth is splinted to healthy teeth using a metal wire and composite resin. Rigidity or flexibility of a wire and composite splint is based on the diameter of the stainless-steel wire.[3] Different authors have recommended different diameters of stainless-steel wire to be used for

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flexible splinting in management of traumatic dental injuries.[10,11,12,13] This study was conducted to evaluate the effectiveness of two wire and composite splints having different stainless-steel wire diameters (0.4mm & 0.7mm) in management of dental traumatic injuries.

MATERIALS AND METHODS

It was a comparative study conducted at Armed Forces Hospital, Jubail, Saudi Arabia and Farooq Hospital, Lahore, Pakistan from February 2014 to August. 2017. Prior approval was taken from the Ethical Review Committees of the institutions. All the participants and their parents were explained the purpose of study and an informed consent was obtained. Inclusion criteria was children of both genders reporting to hospital during the period of study, dental trauma leading to mobility (Grade 2 or Grade 3) of one or more permanent maxillary incisors and age between 7 to 12 years. Avulsed teeth and teeth with root, crown or/and alveolar fractures were not excluded from the study. The children who missed any follow up visit were also excluded from the study. If a child had trauma to multiple teeth, only those teeth/tooth that fulfilled the above-mentioned criteria were included in the study. After clinical and radiographic evaluation, a total of 73 teeth from 60 children who fulfilled our inclusion criteria were included in the study. At the time of presentation, child was randomly allocated to one of the two groups using balloting method. In Group A, splinting of traumatized teeth was done using 0.7mm stainless steel orthodontic wire and composite resin. In Group B, splinting was done using 0.4mm stainless steel orthodontic wire and composite resin. Traumatized teeth were splinted to one adjacent healthy tooth on both sides. Wire was adapted and secured with light cured composite resin on the middle third of the crowns on buccal surface of the teeth being splinted. Splint was removed on 14th day. Follow up was done on 7th, 14th and 90th day after splinting. Tooth mobility, pain on biting and gingival lacerations were evaluated at follow up visits. Radiographic evaluation was performed on the 90th day to evaluate the periodontal status of teeth. Radiographic evaluation of periodontal status was done on the basis of presence or obliteration of normal periodontal space. Mobility of teeth was graded on a 4-point scale where Grade 0=physiologic mobility, Grade 1=≤1mm mobility, Grade 2= >1mm but ≤2mm mobility and Grade 3= >2mm mobility. Pain on biting was evaluated on a 4-point verbal rating scale (VRS) from 0 to 3 where 0=no pain, 1=mild pain/irritation/annoyance, 2=moderate pain and 3=severe pain. Responses of children with multiple traumatized were recorded for each tooth separately on the VRS pain scale and similarly mobility for each tooth was also recorded separately.

All data were entered and analyzed using IBM SPSS Version 20. Frequencies and ratios were computed. Chi-square test was used to compare the differences between the two groups. A p-value of ≤ 0.05 was considered as statistically significant.

RESULTS

A total of 60 children were included in the study, n=43 (72%) were males and n=17 (28%) were females. In Group A, out of n=30 cases n=7 (23%) were females while in Group B, n=10 (33%) were females. Mean age of the study sample was 9.14 years with ±SD 1.42 and age range of 7 to 12 years. In Group A, mean age of the males was 9.52 years with ±SD 1.09 and mean age of females was 8.43 years with ±SD 1.74. In Group B, mean age of the males was 9.33 years with ±SD 1.50 and mean age of females was 8.40 years with ±SD 1.45. In 60 included children; number of traumatized teeth was n=73, n=38 in Group A while n=35 in Group B.

Pain on biting was present in all the cases of both the groups on the day of splinting. In Group A, obvious pain relief was observed on the 7th day with only n=6 (16%) children complaining of pain while in Group B, n=20 (57%) of children complained of pain on the 7th day. Difference between the two groups in pain relief was found to be statistically significant with p value = 0.001. Responses of children on VRS pain scale in both groups have been described in table 1 and 2.

Gingival Lacerations were present in n=23 (77%) cases on the day of splinting in Group A and n=20 (67%) cases in Group B. Condition improved over time as depicted in figure 1. Grade 2 or 3 mobility was present in all the cases of both the groups on the day of splinting. Mobility was not assessable on the 7th day due to splints. Mobility decreased on the follow up visits which is presented in tables 3 and 4. Differences between the two groups in regard to healing of lacerations (p value = 0.640) and tooth mobility (p value = 0.718) were not found to be statistically significant. Radiographic evaluation on the 90th day revealed normal periodontal

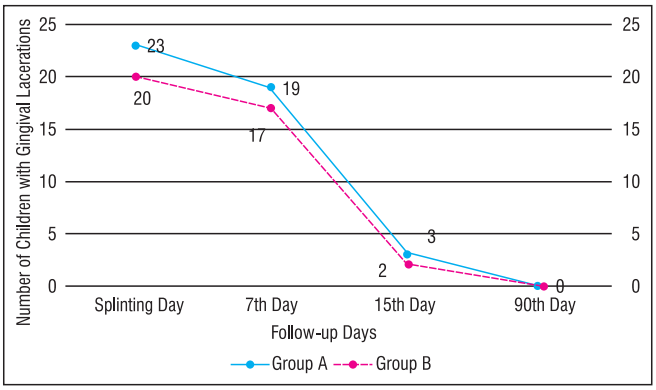

Fig 1: Children with Gingival Lacerations over the period of study in both groups

TABLE 1: RESPONSES OF CHILDREN ON VRS PAIN SCALE IN GROUP A ON FOLLOW UP VISITS.

VRS value	Day of Splinting	7th Day	14th Day	90th Day
0= No pain	0	32 (84%)	33 (87%)	38 (100%)
1= Mild pain/irritation	0	4 (10.5%)	5 (13%)	0
2= Moderate pain	15 (39%)	2 (5%)	0	0
3= Severe pain	23 (61%)	0	0	0
Total	38 (100%)	38 (100%)	38 (100%)	38 (100%)

TABLE 2: RESPONSES OF CHILDREN ON VRS PAIN SCALE IN GROUP B ON FOLLOW UP VISITS.

VRS value	Day of Splinting	7th Day	14th Day	90th Day
0= No pain	0	15 (43%)	29 (83%)	35 (100%)
1= Mild pain/irritation	0	11 (31%)	5 (14%)	0
2= Moderate pain	16 (46%)	6 (17%)	1 (3%)	0
3= Severe pain	19 (54%)	3 (9%)	0	0
Total	35 (100%)	35 (100%)	35 (100%)	35 (100%)

TABLE 3: MOBILITY OF TEETH RECORDED AT MULTIPLE VISITS IN GROUP A

Mobility of Teeth	Splinting Day	14th Day	90th Day
Grade 0 (Physiologic)	0	14 (37%)	38 (100%)
Grade 1 (<1mm)	0	19 (50%)	0
Grade 2 (>1 but <2mm)	23 (61%)	5 (13%)	0
Grade 3 (>2mm)	15 (39%)	0	0
Total	38 (100%)	38 (100%)	38 (100%)

TABLE 4: MOBILITY OF TEETH RECORDED AT MULTIPLE VISITS IN GROUP B

Mobility of Teeth	Splinting Day	14th Day	90th Day
Grade 0 (Physiologic)	0	9 (26%)	35 (100%)
Grade 1 (<1mm)	0	20 (57%)	0
Grade 2 (>1 but <2mm)	19 (54%)	6 (17%)	0
Grade 3 (>2mm)	16 (46%)	0	0
Total	35 (100%)	35 (100%)	35 (100%)

ligament space around all the teeth in both groups.

DISCUSSION

The present study investigated clinical effectiveness of two wire and composite splints in the management of traumatic dental injuries. In this study, a male predominance was observed in dental traumatic injuries. This goes hand in hand with the studies reported in literature, in which a male predilection was observed.[14,15] The reason for this may lie in the behavioral difference among genders as males being more hyperactive than females in general thus, making them prone to more accidental trauma.[15]

Both the splints had no effect on gingiva around the affected teeth and gingival lacerations healed in due course of time. Soft tissue injuries generally take 2 to 3 weeks for healing as documented in literature[16] and similar results were observed in this study.

Pain relief was better in group with 0.7mm stainless steel wire splint which could be due to the reason that 0.7mm wire is more rigid as compared to 0.4mm wire and better tolerated the mechanical stresses from biting force. Periodontal healing was found to be adequate on follow up radiographs in both groups. Flexibility of the splint is a major factor in post-traumatic healing of the injured tooth. Diameter of wire to be used in wire and

composite splint has been a topic of great discussion. Berthold et al.[11,17] in their multiple comparative studies found stainless steel wire of 0.45mm diameter suitable for flexible wire and composite splint whereas stainless steel 0.8×1.8mm rectangular rigid wire for splinting of traumatized teeth.[11,17] Similar results have been reported by Franz et al.[18] Kwan et al.[12] in their study on human cadaveric model found that increasing the thickness of stainless steel wire increases the rigidity of wire-composite splint but their study was inconclusive in defining the threshold wire diameter at which a wire-composite splint becomes too rigid to be used for splinting of traumatized teeth.[12] The results of the study conducted by Zhu et al.[10] found that 0.8 mm stainless steel wire and composite splint allows more than physiologic tooth movement of injured tooth and thus can be considered as flexible.[10] Thus, 0.7mm wire-composite splint used in this study allowed mobility higher than the uninjured tooth and was a flexible splint.

CONCLUSION

Splinting with 0.7mm and 0.4mm stainless steel orthodontic wires are equally effective in the management of traumatic dental injuries. However, splinting with 0.7mm stainless steel wire which is slightly more rigid in comparison to 0.4mm stainless steel wire has added effectiveness in managing post splinting pain.

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