How to Cite:
Abdullah, S., Malik, A. A., Rashid, M. W., Ghaffar, M. A., Chauhdry, W., & Manzoor, U. (2023). Simulation's usage in training for dental trauma: An analysis of four splinting methods. *International Journal of Health Sciences*, *7*(S1), 128–134. https://doi.org/10.53730/ijhs.v7nS1.14163

Simulation's usage in training for dental trauma: An analysis of four splinting methods

Shamima Abdullah
BDS, MSPH, Assistant Professor, Department of Community & Preventive Dentistry, Bakhtawar Amin Medical and Dental College, Multan

Ammar Abdullah Malik
BDS, M.Phil (Oral Biology), Assistant Professor, Department of Oral Biology, Foundation University College of Dentistry, Foundation University, Islamabad

Muhammad Waqas Rashid
BDS, M.Phil (Oral Biology), Assistant Professor, Department of Oral Biology, University Medical and Dental College, Faisalabad

Muhammad Asad Ghaffar
BDS, M.Phil (Dental Materials), Senior Lecturer, Department of Dental Materials, Bakhtawar Amin Medical and Dental College, Multan
Corresponding author email: assadmalik533@gmail.com

Wajeeha Chauhdry
BDS, FCPS (Oral & Maxillofacial Surgery), Assistant Professor, Department of Oral Medicine, CIMS Dental College, CMH Multan

Usman Manzoor
BDS, MDS (Oral & Maxillofacial Surgery), Senior Registrar, Department of Oral & Maxillofacial Surgery, Avicenna Dental College, Lahore

***Abstract*---**Background and Aim: Majority of the dentists gain hands on experience in managing dental traumas after entering into the field practically leading to an overall limited exposure to dental trauma injuries before their graduation time. The present study aimed to assess the dental student's perception regarding simulation based dental trauma training. Materials and Methods: This comparative cross-sectional study involved 80 dentistry students at a Tertiary Care teaching institute of Lahore, Pakistan. A questionnaire based survey was done on final year dentistry students to answer the questions regarding their experience of simulated trauma splinting. Prior to this simulation-based practice, all participants were given a 60-minute lecture on oral trauma damage, followed by post-training questions. All the students completed simulated treatment using orthodontic

wire, twist flex wire, nylon fishing line, and powermesh as splints. The glass ionomer cement and composite resin were bonding materials used. A 5-point Likert scale was used for post-training questions and answers. Results: Out of the 80 dental students, there were 46 (57.5%) male and 34 (42.5%) female students. The incidence of students who agreed and strongly agreed to their learning assisted by simulated trauma practice were 46.3% (n=37) and 33.8% (n=27) respectively. Compared to educational instruction, the simulation based dental training added value to their practical experience and showed agreement in 30% (n=24) and strong agreement in 65% (n=52) of the students. Likewise, the incidence of agreed and strongly agreed students who felt engaged in learning activity was 42.5% (n=34) and 51.3% (n=41) respectively. The incidence of agreed and strongly agreed students for their perception that if the simulation felt realistic was 55% (n=44) and 10% (n=8) respectively. The most easy to place splint was Power mesh/composite splint reported by 57.5% (n=46) students whereas the least difficult to remove splint was nylon fishing line Ortho splints reported by 33.8% (n=27) students. Conclusion: The present study found that the most easy to place splint was Power mesh/composite splint reported by 57.5% (n=46) students whereas the least difficult to remove splint was nylon fishing line Ortho splints. In the nutshell, using simulated trauma exercises in dentistry curriculum can improve learning for the undergraduate dental students.

***Keywords*---**Dental trauma, splinting, power mesh, simulation exercises, nylon finishing line.

Introduction

Trauma to the human dentition is a major health issue worldwide that is rather frequent in youngsters [1]. Traumatic dental injuries can cause infection, discomfort, fractures and tooth/teeth loss. The primary tooth injury can impact the permanent tooth's development, causing delayed eruption or else wise can lead to more serious implications such as infection, hypoplasia or malformations [2]. The knowledge concerning the repair of traumatically displaced teeth has increased over the previous few decades and concepts for their treatments have evolved over time. Extensive splinting with strict immobilization has been proven to increase the likelihood of causing healing problems [3–5]. Injuries to the teeth can result in luxation, subluxation, root fractures, avulsion and alveolar fractures. Splinting of severed teeth is used to treat these injuries [6]. The dental trauma splints are usually categorized as following; a) Flexible splints, which allow somewhat more movement than the undamaged tooth, b) Semi-rigid splints, which allow mobility equal to the uninjured tooth, and c) Rigid splints which allow mobility less than the unaffected tooth [7, 8].

Many flexible metals such as nickel titanium, titanium mesh, stainless steel wire, fibre, and composite resin are used for splinting purposes which are either glued or else tied around the injured teeth [9]. The higher hardness and fracture

resistance of certain resin materials such as nylon splints, fiberglass splints, titanium trauma splints, and Kevlar has been suggested and these materials are therefore utilized for bonding purposes in dental trauma management [10]. Numerous studies mentioned the use of more flexible materials like Twistflex wire and Power chain [11, 12]. Twistflex wire is made up of interlaced wire ropes that are commonly used in Orthodontics as a single strand [13]. Fishing line and orthodontic wires are the most usually suggested forms of splints since they are easy to apply and are less expensive [14]. The splinting material and its technique of application are significantly associated with the complexity of the trauma and its acceptability by the patient [15]. There is paucity of data regarding the usage of various splinting methods for managing dental trauma. Therefore, the present study mainly assessed the simulation based trauma training in dentistry students using four such splinting methods.

Methodology

This comparative cross-sectional study involved 80 dentistry students at a Tertiary Care teaching institute of Lahore, Pakistan. A questionnaire based survey was done on final year dentistry students to answer the questions regarding their experience of simulated trauma splinting. Prior to simulation-based practice, all participants were given a 60-minute lecture on oral trauma damage, followed by post-training questions. All the students completed simulated treatments using orthodontic wire, twist flex wire, nylon fishing line and power mesh as splints. The glass ionomer cement and composite resin were bonding materials used. A 5-point Likert scale was used for post-training questions and answers. All the students made two splints with etch and bond and composite resin, as well as two other light cured (LC) Ortho splints as well.

All the participants were advised for pre-bending of wire in order to adjust the tooth's labial surface and it was made sure that the wire joins on either side of the avulsed tooth particularly for composite resin splints. The wire was stretched two-thirds of the way towards the tooth's distal end in order to elude any piercing ends. During the second exercise, tooth's labial surface was adjusted with power chain. The splint was bonded in flat position utilizing the power chain with composite resin for retention after the tooth surface was etched and bonding agent was applied. Statistical Package for Social Sciences (SPSS) version 27 was used for data collection and descriptive statistics' analysis. The responses were compiled and compared.

Results

Out of the 80 dental students, there were 46 (57.5%) male and 34 (42.5%) female students. The incidence of students who agreed and strongly agreed to their learning assisted by simulated trauma practice were 46.3% (n=37) and 33.8% (n=27) respectively. Compared to educational instruction, the simulation based dental training added value to their practical experience and showed agreement in 30% (n=24) and strong agreement 65% (n=52) of the students respectively. Likewise, the incidence of agreed and strongly agreed students who felt engaged in learning activity was 42.5% (n=34) and 51.3% (n=41) respectively. The incidence of agreed and strongly agreed students for their perception that if the

simulation felt realistic was 55% (n=44) and 10% (n=8) respectively. The most easy to place splint was Power mesh/composite splint reported by 57.5% (n=46) students whereas the least difficult to remove splint was nylon fishing line Ortho splints reported by 33.8% (n=27) students.

Dental student's impressions about post-traumatic simulation training are shown in Table-I. The ease with which the various splints may be installed or removed was also rated by the participants and is shown in Table-II.

Table-I: Dental student's impressions about post-traumatic simulation training

Questions	Agree (n) (%)	Strongly agree (n) (%)	Disagree (n) (%)
Did the dental trauma simulation feel realistic?	44 (55)	8 (10)	28 (35)
Did the training assist in learning?	37 (46.3)	27 (33.8)	16 (18.9)
Did simulation based dental training add value to your practical experience?	24 (30)	52 (65)	4 (5)
Did you feel engaged in the learning activity?	34 (42.5)	41 (51.3)	5 (6.2)

Table-II: Simplicity of installation and removal of the different splints as rated by the participants

Splint types	Placing splints (n) (%)	Removing splints (n) (%)
Wire/composite resin	19 (23.8)	14 (17.5)
Power mesh/composite resin	46 (57.5)	16 (20)
Nylon fishing line/LC Ortho	8 (10)	27 (33.8)
Twist flex wire/LC Ortho	7 (8.7)	23 (28.7)

Discussion

The present study mainly focused on the use of simulation for dental trauma training based on four different flexible splint types with two different techniques of tooth bonding. The most easy to place splint was Power mesh/composite splint reported by 57.5% (n=46) students whereas the least difficult to remove splint was nylon fishing line Ortho splints as reported by 33.8% (n=27) students. Dental trauma exercises for tooth splinting are rendered as a pivotal aspect for an undergraduate dental student’s preclinical training. Majority of the dental students have got a limited exposure to manage and thereafter treat dental trauma patients before graduation [16]. In this context, clinical competency should be evaluated with expectations for a continuous education in this field and this scrutiny should impact both the instruction and professional up skilling of an undergraduate dental student [17, 18]. The keen selection of required materials and procedures ultimately affects the healing outcomes in dental trauma subjects such as sensitivity to injury, chances of speech impairment, splinted teeth’s prognosis, lip abrasion settlement with esthetics preserved and oral hygiene maintenance [19]. Many hurdles have been identified by dentists in this regard to manage the aforementioned complexities such as time restrictions, recalcitrant patients as well as a lack of knowledge and abilities in this particular domain [20, 21].

In the current study, an avulsed tooth (a real human maxillary incisor, central or lateral) with blood attached to it was investigated for the learning task. To replicate a recent avulsion injury, the dental students transplanted the Typodont socket of the incisor tooth. This paradigm created new opportunities for training in specialized dental procedures that would otherwise be difficult to recreate in a pre-clinical context [21]. Orthodontic wire and Twist flex wire were utilized as flexible metal splints, whereas Power chain and nylon fishing line were employed as non-metal splints. In the trauma literature, both forms of wire are recommended as appropriate [22]. Students completed a voluntary, anonymous questionnaire after completing the splinting activities.

Although a majority of students found the learning exercise engaging, the incidence of students who agreed and strongly agreed to the realistic approach of simulated dental trauma was 55% and 10% respectively. As the limitation of the study, students expressed a dire need for additional clinical situations to be provided to them such as luxation injuries were recommended to be included in further research activities. This section might be enhanced in future trauma simulations by including diagnosis and treatment planning and a possible selection of severe injuries as well [23].

The management of severe dental injuries in permanent teeth as soon as possible can have a significant influence on the tooth's long term prognosis [24]. Zhu et al investigated that Power mesh lies gently on the tooth, and the inter-connected loop design made composite application straightforward, however wires such as Twist flex wire were difficult to bend into the right form and usually slid during application [25]. It was further shown in other studies that it takes a longer time to remove the composite resin and avoiding enamel damage is difficult in this task as well [26, 27]. To mitigate the cosmetic difficulties after a severe oral dental injury, an urgent and up-to-date care is essential. Despite this, conventional dentists frequently lack understanding in providing an adequate treatment for an injured tooth [28, 29].

Conclusion

The present study found that the most easy to place splint was Power mesh/composite splint reported by 57.5% (n=46) students whereas the least difficult to remove splint was nylon fishing line Ortho splints which was reported by an overall of 33.8% (n=27) students. Using simulated trauma exercises in dentistry curriculum can improve instruction and learning abilities for the undergraduate dental students in this particular subset of trauma management. It was further concluded that this research delivered important learning advantages while piqued students' attention to the point that most of the students believed that this training should be made mandatory.

References

1. Zafar S, Peters CI. Dental trauma simulation training using four splinting models: A crosssectional study. Dental Traumatology. 2022;38: 519–525.https://doi.org/10.1111/edt.12772.

2. Marriot-Smith C, Marino V, Heithersay GS. A preclinical dental trauma teaching module. Dent Traumatol. 2016;32: 247–50.
3. Rozi AH, Scott JM, Seminario AL. Trauma in permanent teeth: factors associated with adverse outcomes in a university pediatric dental clinic. J Dent Child. 2017; 84:9–15.
4. Fouad AF, Abbott PV, Tsilingaridis G, Cohenca N, LauridsenE, Bourguignon C, et al. International Association of Dental Traumatology guidelines for the management of traumatic dental injuries: 2. Avulsion of permanent teeth. Dent Traumatol.2020;36: 331–42.
5. Day PF, Flores MT, O'Connell AC, Abbott PV, Tsilingaridis G, FouadAF, et al. International Association of Dental Traumatology guidelines for the management of traumatic dental injuries: 3. Injuries inthe primary dentition. Dent Traumatol. 2020;36: 343–59.
6. Bourguignon C, Cohenca N, Lauridsen E, Flores MT, O'Connell AC,Day PF, et al. International Association of Dental Traumatology guidelines for the management of traumatic dental injuries: 1.Fractures and luxations. Dent Traumatol. 2020;36: 314–30.
7. Levin L, Day PF, Hicks L, O'Connell A, Fouad AF, Bourguignon C,et al. International Association of Dental Traumatology guidelines for the management of traumatic dental injuries: general introduction. Dent Traumatol. 2020;36: 309–13.
8. Al-Haj Ali SN, Algarawi SA, Alrubaian AM, Alasqah AI. Knowledge of general dental practitioners and specialists about emergency management of traumatic dental injuries in Qassim, Saudi Arabia.Int J Pediatr. 2020;2020: 6059346.
9. Bucchi C, Arroyo-Bote S. Knowledge and attitudes of dentists regarding traumatic dental injuries. Eur J Paediatr Dent.2021;22: 114–8.
10. Zhao Y, Gong Y. Knowledge of emergency management of avulsedteeth: a survey of dentists in Beijing, China. Dent Traumatol.2010;26:281–4.
11. Reymus M, Fotiadou C, Hickel R, Diegritz C. 3D-printed modelfor hands-on training in dental traumatology. IntEndod J.2018; 51:1313–9.
12. Zafar S, Renner MP, Zachar JJ. Dental trauma simulation training using a novel 3D printed tooth model. Dent Traumatol.2020;36:641–7.
13. Nicot R, Druelle C, Schlund M, Roland-Billecart T, Gwenael R, FerriJ, et al. Use of 3D printed models in student education of craniofacial traumas. Dent Traumatol. 2019;35: 296–9.
14. Kahler B, Hu JY, Marriot-Smith CS, Heithersay GS. Splinting of teeth following trauma: a review and a new splinting recommendation. Aust Dent J. 2016;61(Suppl 1):59–73.
15. VonArx T, Filippi A, Lussi A. Comparison of a new dental trauma splint device (TTS) with three commonly used splinting techniques. Dent Traumatol. 2001;17: 266–74.
16. Ben Hassan MW, Andersson L, Lucas PW. Stiffness characteristics of splints for fixation of traumatized teeth. Dent Traumatol.2016; 32:140–5.
17. Schutz-Fransson U, Lindsten R, Bjerklin K, Bondemark L. Twelve year follow-up of mandibular incisor stability: comparison between two bonded lingual orthodontic retainers. Angle Orthod.2017;87:200–8.
18. Matthews DC, McNeil K, Brillant M, Tax C, Maillet P, McCulloch CA,et al. Factors influencing adoption of new technologies into dental practice: a qualitative study. JDR Clin Trans Res. 2016; 1:77–85.

19. Siqueira MB, Gomes MC, Oliveira AC, Martins CC, Granville-Garcia AF, Paiva SM. Predisposing factors for traumatic dental injury in primary teeth and seeking of post-trauma care. Braz Dent J. 2013;24(6):647-54.
20. Lam R. Epidemiology and outcomes of traumatic dental injuries:A review of the literature. Aust Dent J. 2016;61(Suppl 1):4–20.
21. Kahler B, Hu JY, Marriot<Smith CS, Heithersay GS. Splintingof teeth following trauma: a review and a new splinting recommendation. Aust Dent J. 2016;61(S1):59-73.
22. Borin-Moura L, Azambuja-Carvalho P, Daer-de-Faria G, Barros-Gonçalves L, Kirst-Post L and Braga-Xavier C. A 10-yearretrospective study of dental trauma in permanent dentition.Rev. esp. cir. oral maxilofac. (Internet, Engl. ed.). 2018;40(2):65-70.
23. ML, Lenzi AR, Malmgren B, Moule AJ, Pohl Y and TsukiboshiM. Guidelines for the management of traumatic dental injuries:1. Fractures and luxations of permanent teeth. Pediatr Dent.2017;39(6):401-411.
24. Franz F, Potapov S, Petschelt A and Berthold C. Influence ofadhesive point dimension and splint type on splint rigidity--evaluation by the dynamic Periotest method. Dent Traumatol.2013;29(3):203-11.
25. Zhu Y, Chen H, Cen L, Wang J. Influence of abutment toothposition and adhesive point dimension on the rigidity of a dental trauma wire<composite splint. Dent Traumatol. 2015;32(3):225-30.
26. Kroger E, Dekiff M, Dirksen D. 3D printed simulation models basedon real patient situations for hands-on practice. Eur J Dent Educ.2017; 21:e119–25.
27. Traebert J, Traiano ML, Armenio R, Barbieri DB, de Lacerda JT,Marcenes W. Knowledge of lay people and dentists in emergency management of dental trauma. Dent Traumatol. 2009; 25:277–83.
28. Yeng T, Parashos P. An investigation into dentists' perceptionsof barriers to providing care of dental trauma to permanent maxillary incisors in children in Victoria, Australia. Aust Dent J.2007; 52:210–5
29. Baginska J, Wilczynska-Borawska M. Continuing dental educationin the treatment of dental avulsion: polish dentists' knowledge ofthe current IADT guidelines. Eur J Dent Educ. 2013; 17:e88–92.