# Splinting of an injured tooth as part of emergency treatment

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Avulsion and luxation are complex injuries that affect multiple tissues (1-3), accounting for up to 16% of all traumatic injuries in the permanent dentition (4, 5) and 7–21% of injuries in the primary dentition (6). According to the World Health Organization classification of dental injuries, avulsion is the complete displacement of the tooth from its alveolar socket (7). In the permanent dentition, the maxillary central incisors are the most frequently avulsed and luxated (8). Sport and automobile accidents are common causes, involving mainly children, aged 7–10 years old (9).

The large number of motor vehicle accident injuries with multi-organ trauma, the necessity for life saving, and the lack of dental instruments in the emergency and operating rooms, may lead the general medical practitioner or surgeon to ignore the dental trauma or postpone dental treatment to a later stage.

Prompt and appropriate management is necessary to significantly improve the prognosis for many dentoalveolar injuries (10). The most important factor in the treatment of injured teeth is time. The longer the time lapse between tooth avulsion and re-implantation, the greater the risk of replacement resorption and inflammatory root resorption. The probability of revascularization (in teeth with open apex) is reduced (2, 11, 12).

An easy-to-perform procedure is examined for re-implantation and fixation of traumatized teeth in multi-injured patients in the emergency or operating room where standard splinting methods are not available.

### Treatment modality

Splinting, as a treatment modality for traumatized teeth after avulsion or luxation (with the exception of intrusive luxation), is recommended (3, 13). In a dental setting, splinting with flexible wire and dentin adhesive with composite resin is usually preferred. However, in an emergency or operating room situation, where reimplantation and fixation are usually delayed, it is recommended that the emergency room medical staff suture the tooth to improve its long-term survival.

Following the Glasgow Coma Scale used to evaluate brain injury and generalized head and neck trauma, avulsed teeth should be maintained in a storage medium (14), such as milk, Viaspan, Hanks balanced salt solution (HBSS), saliva, and saline. The preferred storage medium recommended by The American Association of Endodontists is HBSS, because of its ability to preserve the vitality of periodontal ligament (PDL) cells for a longer duration (15, 16). HBSS preserves the vitality of fibroblast cells for 72 h (17), but is not commonly found in the emergency room. As an alternative, saline can be used, but it only has a 2 h preservation time (18). As medical procedures usually take longer, tooth re-implantation and stabilization are recommended.

A luxated tooth should be returned to its original position and fixated as soon as possible. An avulsed tooth should be removed from the storage medium avoiding contact with the root. Antibiotic solution



*Fig. 1.* (a) The suture penetrates the buccal flap on the base of the distal papilla and over the incisal edge of the injured tooth toward the mesial angle (mesio-palatal aspect). The suture enters the palatal flap outwards in the base of the disto-palatal papilla and on the surface to the base of the mesio-palatal papilla. (b) The suture passes over the incisal edge and penetrates the base of the mesial papilla in the buccal aspect. (c) From the previous point, the suture passes underneath the previous crossing of the sutures on the buccal aspect, fixed in the mid-buccal keratinized tissue, and the suture tied.

should be applied on the root surface. The blood clot is removed from the socket with saline or chlorhexidine and the tooth re-implanted and fixated (13).

A suture can be used for rapid and easy-to-perform fixation. The suture is made using silk 2/0 dental suture from the palatal soft tissue to the vestibular soft tissue incorporating the teeth in a 'criss-cross' manner, with a locking horizontal mattress to maintain the tooth in position (Figs 1–3). In young patients, where mamelons are present, it can be used to increase suture retention.

This procedure is performed to stabilize the tooth and for primary retention of the injured tooth until the patient is referred to a dental or oral and maxillofacial surgery department for further treatment with strict instructions to replace this temporary, primary fixation to the conventional recommended splint.



*Fig. 2.* A 19-year-old patient presenting in the emergency room with multiple facial injuries and an avulsed central maxillary tooth.



*Fig 3*. Fixation of the central maxillary incisor following re-implantation, using the easy-to-perform temporary fixation method.

# Discussion

After an injury which causes tooth mobility at the socket or total avulsion, there is damage to the tooth support system, including the periodontal ligament, cementum layer, and blood vessels that supply blood to the tooth pulp. The support system may not heal properly when extensive damage affects over 20% of the root surface (19).

Prompt tooth re-implantation and fixation are most important in these injuries to prevent future complications (20). The longer the tooth remains out of the mouth, beyond the recommended time limit, even when restored in a storage medium, the greater the risk for ankylosis (21). Splinting stabilizes the dental segment allowing pulpal and periodontal healing. A suture splint has been used to treat traumatized tooth injuries in pediatric patients (22). In a hospital scenario, the first medical aid is usually given by the medical staff. The necessity for lifesaving procedures and the lack of dental instruments in the emergency/operating room may lead the general medical practitioner or surgeon to ignore the dental trauma or postpone the dental treatment to a later stage. The present recommendation for re-implantation and the easy-to-perform fixation can be carried out by the general medical staff. This method is quick and does not delay the general medical treatment needed. Furthermore, the suture splint can be used in multi-injured patients treated under general anesthesia where standard splinting is not possible to perform.

Educational efforts should be made to train general practitioners, dental surgeons in the emergency room, or other emergency room staff to perform the above described re-implantation and fixation. This could result in improvement of the long-term prognosis of an injured tooth.

## Conclusion

Fixation with suturing, which is available in the emergency or operating room, could improve the prognosis of traumatized teeth in the long term. Further research is warranted.

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