

Textbook of Oral and Maxillofacial Surgery

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Chapter 18

Traumatic injuries of the teeth and alveolar process

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Traumatic Injuries

Traumatic injuries to the teeth and the alveolar process are an all too frequent childhood and teenage accident and a not uncommon adult injury. A traumatically injured tooth is a distressing accident for the patient, and often the final dental restoration leaves much to be desired in appearance as well as in function. However, since the advent of the acid-etch techniques for the bonding of composite resin restorations, there has been a decided improvement in esthetic and functional rebuilding of fractured anterior crowns.

Review of a long series of accident cases established that, on the basis of frequency, the patient's age must be considered a predisposing cause. The greatest incidence appears to be in children from 7 to 11 years of age. At this period in the development of the anterior teeth the crowns are especially vulnerable because of the large pulp chambers. Also, at this "toothy age", these teeth frequently erupt in positions of isolated prominence in the arch, and they may be exposed to trauma.

Clinical evaluation of the injury

Accidents that produce traumatic injuries to the teeth often are accompanied by hemorrhage, swelling, and laceration of tissue. Such injuries tend to frighten people, and this may complicate the examination procedures. When a small child has been hurt, considerable emotional tension is usually exhibited on the part of both the patient and the parents. By the time this twosome or threesome reaches the dentist, the situation may easily have developed into a difficult problem. To cope with such accidents properly the dentist must conduct himself or herself in a calm and reassuring manner and, in spite of the adverse conditions, must be able to make an accurate diagnosis and decide immediately how to proceed with treatment. It is often expedient to have one of the parents hold a small child while the clinical and radiographic examinations are made. To try to reason with a small child at such times is futile. Gentleness, understanding, and a direct approach to the problem are imperative. In accomplishing the clinical examination, it is necessary to inspect the teeth and alveolar process carefully with a mouth mirror and by digital examination.

The extent of these dental accidents can be evaluated as follows:

First, the injury to the tooth should be classified.

Class I fracture: A fracture of only the enamel cap of the crown of the tooth.

Class II fracture: An injury extending into the dentine but with no exposure of the pulp.

Class III fracture: An extensive injury to the coronal portion of the tooth with a pulp exposure.

Class IV fracture: A fracture occurring at or below the cemento-enamel junction of the tooth.

Second, one should determine clinically if the tooth has been merely loosened or completely displaced from the socket or if it has been forced deeper into the supporting structures. Thus the injured tooth can be classified as *luxated*, *avulsed*, or *intruded*.

Finally, by digital manipulation, any suspected alveolar fracture should be evaluated. Frequently, during such a procedure minor displacements of the alveolar process, or even slight displacement of teeth, can be detected and sometimes advantageously reduced at once.

Since many of the accident patients have mixed dentitions, it is all the more important that the mouth be charted so that this information will be readily available to aid in later interpreting the radiographs and in planning the necessary supporting treatment.

Radiographic evaluation of the injury

In completing the radiographic examination, it is usually necessary to secure more than one angle or line of exposure to demonstrate fractures. Therefore periapical and occlusal films should be used intraorally. Occasionally extraoral exposures will be required, with both lateral and posteroanterior views. Satisfactory radiographs may help verify clinical impressions and often provide additional findings that are not revealed by the clinical examination alone.

It is necessary to study radiographically the odontogenesis of the apical ends of the teeth receiving the trauma. If radiographs reveal a large, funnel-shaped root canal with an incompletely developed apex, it is logical to assume that the vascular supply to the embryonal tissues in the developing apex will assist repair more speedily than if the root canal and apex are those of a fully developed tooth.

Completing the diagnosis and treatment plan

When clinical and radiographic examinations have been accomplished, sufficient information should be available to permit completion of the diagnosis. At this point, it must be decided whether the injured tooth should be treated as a vital or a nonvital tooth. This diagnostic opinion should be based on knowledge of the following conditions:

1. The stage of development of the root end of the tooth.
2. The extent of injury to the tooth itself.
3. The condition of the supporting alveolus.

Therefore if the injured tooth is not fully developed and has an immature apex, if the coronal injury does not involve the pulp, and if the supporting alveolar fracture will retain itself after reduction or can be readily retained by splinting, then all evidence points toward treating the injured tooth as a vital tooth.

Fully developed teeth with mature apices present a much more difficult diagnostic problem. If a fully developed tooth has only been loosened and not avulsed or impacted, then it should be considered for treatment as a vital tooth, provided nothing more severe than a Class I or II coronal fracture is involved.

If the treatment of the injured tooth as a vital tooth should prove unsuccessful or if it seems to be contraindicated at the time of the examination, it will be necessary to treat it as a nonvital tooth. At the time of this decision a root canal treatment plan may be formulated.

Splinting is usually necessary to retain all displaced teeth in a satisfactory arch position until the supporting structures have healed adequately to retain them. The time factor of the healing period is best evaluated by direct clinical testing of the mobility of the tooth in question.

The basic principle to consider in the treatment of the traumatically loosened or displaced vital tooth is the prognosis for the repositioned tooth. Vascular nourishment of the pulp must be reestablished if possible. If the blood supply to the pulp is lost, the pulp will become necrotic or gangrenous, and this will necessitate early recognition and appropriate treatment. In fully developed teeth the root canal, as revealed by x-ray films, can become narrowed or constricted. It is unlikely that such a tooth, if displaced or impacted, can become revascularized as a vital tooth. If the injured tooth appears not to be fully developed in the radiographic studies, or, if by direct examination of such a displaced tooth, the mesenchymal tissue is found to be present and intact in the cupped-out apex, then repositioning the tooth and retaining it by splinting is justified until sufficient time has lapsed to permit it to prove itself.

Early coronal discoloration alone, especially in teeth having incompletely developed apices, is not sufficient indication for an immediate root canal treatment or extraction. The accumulated extravasated blood in the pulp normally releases hemoglobin, which causes discoloration of the tooth. If, however, the pulp becomes revascularized through the embryonal tissues in the apical area, the injured tooth may recover and continue to be a vital tooth.

In the treatment of a Class I fracture of the coronal portion of the tooth, it is usually necessary to reduce irregularities along the fracture line of the crown by the use of abrasive disks or stones. This procedure tends to reduce irritations to the tongue and lips and minimizes the chance of other fracture lines developing under stress along the unprotected enamel rods. This can usually be accomplished at the time of the preliminary examination and often requires no anesthesia.

For the treatment of other than a Class I fracture of the coronal portion of the tooth, the patient will require additional supportive treatment from his dentist. Extended treatment of injuries to a fractured tooth other than emergency treatment, as previously discussed, will not be included here, since this subject is covered in excellent detail in numerous operative and pedodontic texts.

Splinting procedures

Injuries to a tooth alone, without displacement from the socket or a fracture of the alveolus, do not require splinting procedures. However, to stabilize a repositioned tooth with or without an alveolar fracture and to protect the organizing clot at the apex to enhance revascularization of the tooth, a splint is necessary.

Numerous techniques for this type of stabilization or support have been advocated. As a general rule, the simple, easily managed procedures, such as the application of Erich arch bars or an Essig-type splint, are adequate measures. The primary purpose is to stabilize the repositioned tooth or teeth to minimize traumatic stress on the organizing clot. Sometimes a heavier arch bar or sectional bar is indicated if an impacted alveolar fracture requires slow, elastic traction to secure a functional position. Selected cases may benefit from the use of acid-etched resins as a splinting technique. Usually a section of an arch bar may be incorporated into the resin splint to provide adequate stabilization for such injuries.

Anesthesia

The patient's need dictates the type of anesthesia necessary for the accomplishment of any surgical procedure.

Occasionally, if the patient is seen soon after an injury, minor manipulations and repositioning procedures may be tolerated without any anesthetic agent. However, most of these procedures are painful, and to effectively control the pain and allay the apprehension of the patient, some type of anesthesia is indicated together with preoperative and postoperative sedation.

For the uncooperative and fearful child or adult, it is usually desirable to complete the examination insofar as possible and then to schedule the surgical procedure under general anesthesia. The reassurance to the patient that he will be asleep and not be hurt during the necessary surgery often will aid in quieting him, and this fact alone may permit a more complete preliminary clinical and radiographic evaluation of his injuries.

Postoperative considerations and care

The concept of stages of healing in the repair of bone fractures can be applied in principle to the repair of the displaced tooth, with or without an alveolar fracture.

To the period immediately after the traumatic insult and continuing for approximately 24 to 72 hours, the term *hematoma phase* has been aptly applied. During this period the blood clot is forming and beginning to undergo its earliest organization.

From approximately the third day through the first 3 weeks after injury, the healing progresses and may be described as the *fibrous repair phase*. During this period every precaution should be taken to prevent additional injury to the organizing blood clot by any traumatic movement of the tooth in the socket. During this period, however, gentle, slow repositioning stresses are usually tolerated without impediment to the healing of the supporting tissues.

The fourth through the sixth week usually is considered to be the *final bone-forming phase* in the repair of the supporting tissues. During this period the bone formation is

completed, and any undesirable movement or traumatic stress at this time may result in a surgical failure.

It should be remembered that most traumatic wounds of the oral cavity are "open" and, because of the bacteria normally present in the mouth, all such injuries should be treated as infected wounds. The same basic principles in surgical care should be applied here as to any other contaminated wound. Special attention to oral hygiene should be stressed, and systemic antibiotic coverage should be administered as indicated.

An understanding of surgical principles coupled with the proper use of antibiotics should encourage conservative treatment of teeth in the line of an alveolar fracture. Teeth that are determined on the basis of clinical and radiographic findings to have a favorable prognosis should be carefully retained until they have had ample time to prove their status.