Slip-and-Fall Injuries Causing Dental Trauma

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"Clinical Showcase" is a series of pictorial essays that focus on the technical art of clinical dentistry. The section features step-by-step case demonstrations of clinical problems encountered in dental practice. If you would like to propose a case or recommend a clinician who could contribute to this section, contact editor-in-chief Dr. John O'Keefe at jokeefe@cda-adc.ca.

In 1999, more than 1 million people in the United States suffered a slip, trip or falling injury. Over 17,000 Americans died as a result of such injuries, including 5,100 workers who died from falls alone in that year. Of the estimated 3.8 million disabling injuries that occur each year in the American workforce, 15% are due to slips, trips and falls, and these injuries account for 12% to 15% of all workers' compensation costs.[1] In addition, the number of slip and fall injuries is escalating as the population ages.

Dental injuries sustained as a result of slip-and-fall injuries are often accompanied by temporomandibular dysfunction; head and neck pain; injury to the arms, wrists or legs; and neurological deficits. This paper describes the dental trauma that one person experienced as a result of a slip-and-fall injury and details the specific approach used in treating the injuries.

Relevant Trauma History

A 52-year-old woman slipped on wet tile at her workplace. She sustained fracture of the maxillary anterior dental alveolus, fracture of several anterior teeth, lacerations to her upper and lower lips, and bruising to her chin and temporomandibular joints (TMJ) (**Figs. 1** and **2**). The momentum of her forward fall was broken by her hands, knees and chin.

Dental Observations and Diagnosis

- Three fractured teeth (11, 12 and 21), accompanied by mobility of the premaxilla.
- Partial avulsion of abutments of teeth 11, 12 and 21.
- Fracture of the incisal edge and trauma to the anterior mandibular dentition.
- Laceration of upper and lower lips.
- Extreme tenderness to palpation of the chin and TMJ bilaterally.
- No other jaw fractures (confirmed by extraoral radiography).
- Deep fracture about 6 mm apical to gingival crest on the palatal aspect of abutment 21 (confirmed by intraoral radiography).

Sequence of Dental Treatment

The dental treatment consisted of 3 components: **emergency care** with follow-up 2 weeks later; **preliminary care**, which began 10 weeks after the injury; and **definitive care**, which commenced 12 weeks after the injury.

Emergency Care and Follow-Up

- Review of medical and dental history; preliminary photographs and radiographs obtained.
- Administration of local anesthetic in maxillary anterior region.
- Removal of fractured enamel segments.

Figure 1: Dental trauma caused by a slip-and-fall injury.

Figure 2: Photograph taken during the initial appointment illustrates partial avulsion of abutments 11 and 12 and coronal fractures of abutments 11, 12 and 21.

Figure 3: Photograph taken 2 weeks after the injury illustrates resin bonding to anterior teeth and buccal wire stabilizing the alveolus and teeth.

Figure 4: Photograph taken 2 weeks after the injury illustrates the patient's dentition and healing of the lip lacerations.

Figure 5: Radiograph taken 2 weeks after the injury illustrates an apical fracture of tooth 21 (6 mm apical to the gingival crest on the palate).

Figure 6: Photograph taken 10 weeks after the injury illustrates splinted acrylic temporary crowns (Cold Pac, Motloid, Chicago, Ill.) on abutments 11 and 12 and extraction of abutment 21.

Figure 7: Photograph taken 10 weeks after the injury illustrates labial view of the upper "flipper" partial denture following extraction of abutment 21.

Figure 8: Photograph taken 12 weeks after the injury illustrates the implant with a small closure screw (Standard Plus 4.1 × 12 mm; Straumann). Also shown are parallel posts, Panavia 21 resin dental adhesive, and Core Paste resin core (Den-Mat, Santa Maria, Calif.).

Figure 9: Photograph taken 20 weeks after the injury shows synOcta temporary post head inserted on implant abutment 21. The post head was prepared with a high-speed dental handpiece, and was positioned parallel to the path of insertion for abutments 11 and 12.

- Apical repositioning of partially avulsed teeth by manual manipulation.
- Reconstruction of maxillary anterior teeth with composite resin and Bond-a-Braid lingual retainer wire (Reliance Orthodontics, Chicago, Ill.) on the labial surface of abutments 11, 12, 13, 21, 22 and 23 to stabilize the alveolus and the maxillary anterior teeth.
- Suture of lip lacerations with nylon suture (5-0 Ethilon monofilament, Johnson & Johnson, Somerville, N.J.).
- Referral for immediate endodontic treatment of abutments 11 and 12 (completed on same day).
- A follow-up and suture removal appointment was scheduled 2 weeks after the injury (**Figs. 3, 4** and **5**).

Preliminary Care

Treatment Commencing 10 Weeks after Injury

- Removal of braided wire and evaluation of tooth mobility. Teeth were stable in the alveolus.
- Placement of parallel posts (Whaledent Parallel SS posts, New York, N.Y.) in abutments 11 and 12, cemented with resin dental adhesive Panavia 21 (Okayama, Japan).
- Preparation for porcelain-bonded-to-metal (PBM) crowns on abutments 11 and 12, with provision for splinted temporary acrylic crowns (**Fig. 6**).

Figure 10: Shape developed to establish the emergence profile, with tissues surrounding implant abutment 21.

Figure 11: Photograph taken 21 weeks after the injury illustrates early tissue adaptation in the region of the interdental papilla and the crestal soft tissues.

Figure 12: Photograph taken 22 weeks after the injury illustrates tissue adaptation around implant abutment 21.

Figure 13: At 24 weeks after the injury, tissue training was complete before the final impression was taken for the implant crown.

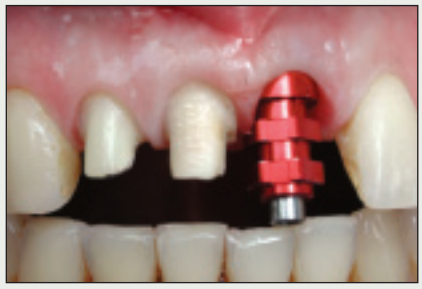

Figure 14: Try-in transfer coping for "open top" impression. Note the presence of a space that will collapse if not maintained with pressure from a dental material such as Duralay (Reliance Dental Mfg, Worth, Ill.).

- Extraction of abutment 21.
- Fabrication of an upper "flipper" partial denture for missing tooth 21 (**Fig. 7**).

Definitive Treatment

Treatment Commencing 12 Weeks after Injury

- Soft-tissue closure of tooth socket 21 complete 2 weeks after extraction of the tooth.
- Dental implant (Straumann, Waldenburg, Switzerland) placed into healing socket with primary stability of the implant (**Fig. 8**).
- Upper "flipper" partial denture adapted to the implant site. This prosthesis was to be worn for 2 months during healing of the implant.

Treatment Commencing 20 Weeks after Injury

- Using a 2-stage surgical approach, the dental implant remained subgingival for a period of 8 weeks. Following successful osseointegration, a tissue punch was used to expose the head of the dental implant at the tooth 21 site. A Straumann synOcta temporary post head was then inserted into the dental implant (**Fig. 9**).
- A single acrylic temporary crown was fabricated on the temporary post head to replace the "flipper" partial denture (**Fig. 10**).

Figure 15: An analog is attached to the temporary acrylic crown. The analog will be embedded in a slurry mix of dental stone.

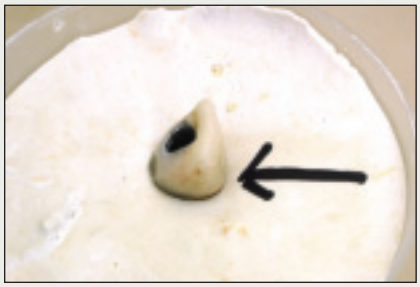

Figure 16: Dental stone covers the analog. The crown is depressed into the stone to the level of the interproximal contact area. The arrow indicates the midfacial surface.

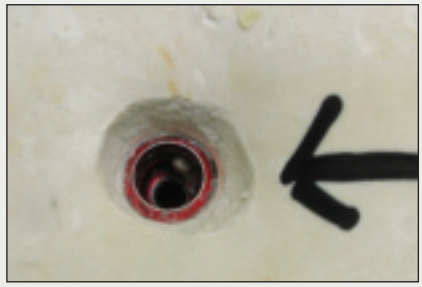

Figure 17: The crown is removed, and lubricant (tin foil substitute or petroleum jelly) is placed around the analog.

Figure 18: A midline labial groove placed in the transfer (impression) coping is identified and lined up with the pencil line in the dental stone. Duralay fills the depression in the stone pattern.

Figure 19: Transfer coping is reseated into the implant and screwed into place. The position of the soft tissues around abutment 21 is maintained for the final impressions of teeth 11, 12 and 21.

Figure 20: Complete seating of the transfer coping is confirmed by radiography. Note the metal-to-metal interface between the transfer coping and the implant's beveled collar.

- The emergence profile was established with the shape of the temporary crown on implant abutment 21.
- Tissue "training" of the interdental papillae and apical tissues surrounding abutment 21 continued over a period of 4 weeks (**Figs. 11, 12** and **13**).

Soft-Tissue Emergence Profile: Technique to Capture Soft-Tissue Morphology

Tissue adaptation established with a provisional acrylic crown may be difficult to replicate in the final impression. In many cases, the dentist will insert a standard impression transfer coping on the implant abutment with no positive pressure or support of the surrounding tissues (**Fig. 14**). The tissues quickly collapse, and the "trained" soft tissues are not recorded in the impression. The technique that is described here (**Figs. 15** to **24**), which can be used to avoid this problem, successfully duplicates the oral soft tissues once tissue "training" has been completed.

Discussion

The injuries sustained by the patient included facial lacerations, fracture of the premaxilla, fracture of 3 maxillary anterior teeth, bruising to her chin, arms, knees and wrists, and TMJ dysfunction. Adjunctive treatment included endodontics on one lower incisor, fabrication of a maxillary occlusal stabilization prosthesis and medical referral for assessment and treatment of post-traumatic stress syndrome and neurological disorders that resulted from the slip-and-fall injury. Dental treatment took a total of 13 months. The final prosthetic result was a natural-looking dentition that was esthetically pleasing to the patient (**Fig. 25**).

Figure 21: Final impression with custom transfer coping.

Figure 22: Soft-tissue cast with emergence profile established.

Figure 23: Soft-tissue training of implant abutment 21.

Figure 24: Porcelain-bonded-to-metal (PBM) crowns for teeth 12 and 21 with butt joint porcelain buccal margins.

Figure 25: Restored dentition with natural tooth crowns on teeth 11 and 12 and implant-retained PBM crown on tooth 21.

A sequence and method of treatment have been detailed in this article. Removal of the upper left incisor (tooth 21) at the appropriate time was essential to healing of the fractured alveolus.

The option of immediate rather than delayed loading (restoring) of the dental implant is dependent on the degree of primary stability of the implant in the tooth socket. In this particular case, it was decided to allow additional time for osseointegration without loading.

"Forced eruption" continues to be a reasonable treatment alternative for moderate fractures of teeth. In the case reported here, however, the lingual root fracture was more than 6 mm below the gingival crest on the palate. The patient was deemed a poor candidate for forced eruption, and an implant was placed at the tooth 21 site.

Techniques to control emergence profile are time consuming and very technique sensitive. Many dental laboratories do not utilize soft tissue casts for either natural teeth or dental implants properly. Clear communication between doctor and laboratory technician is essential.

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