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Case Report

Restorative rehabilitation in a patient with sports trauma

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ABSTRACT

Sports trauma frequently involves insult to oral soft and hard tissues resulting in loss of tooth structure and tooth loss. Multiple sporting equipment's are employed to prevent irreversible damage to oro-facial structures, and to reduce the overall cost of treatment. However in the undesired consequence of loss of oral structures, multiple treatment options are utilized to restore, esthetics, comfort and function. Osseointegrated implant supported rehabilitation of oral structures in trauma cases provides highly predictable treatment outcomes along with preservation of remaining tissues. This case report presents the management of avulsed teeth caused by hockey stick injury, with osseointegrated dental implant supported fixed partial dentures in esthetic zone using contemporary restorative techniques.

Key words: Orofac al trauma, osseointegrated implants, sports dentistry, treatment planning

INTRODUCTION

Sports-related dentistry involves the prevention and management of orofacial athletic injuries and their manifestations. Trauma occurring during sports significantly links dentistry and sports. The impact of injuries during road traffic accidents, violence, and sports has significantly contributed toward the establishment of traumatic dental injuries as a major public dental health problem.[1] Trauma occurring during sports includes concussion, avulsion, and luxation of teeth along with fractures of the facial bones.[2]

According to the surveys conducted by the National Youth Sports Foundation for the prevention of athletic injuries, it is estimated that there is a 10% chance of an injury involving the face and the mouth during sporting seasons.[2] A large number of dental and orofacial injuries related to sports affect the maxilla, maxillary incisors, and the upper lip with 30%–90% of those injuries involving the maxillary incisors.[3-7] The frequency of trauma, which results during sports, is significantly higher in individuals with increased overjet and inadequate coverage of the lips.[8-11]

There are substantial consequences of orofacial trauma for patients and their families, which include the psychological effects and the effects caused by severe pain.[12-14] It has been estimated that in the United States of America (USA), around 30 million children and adolescents participate in sports programs. With an increase in the participation in sports and

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recreational activities,[15] a rise in the prevalence of acute and overuse injuries has been noted.[16]

There are significant costs involved in rehabilitating patients with sports trauma in the USA, estimated to be as high as 1.8 billion dollars annually.[17] Increase in costs could be due to other factors that could disproportionately burden the lower income groups and the children who are not covered by the insurance companies.[17,18] The Council of Clinical Affairs of American Academy of Pediatric Dentistry recommends that the dentists must play an active role in public education on the use of protective equipment during sporting and recreational activities.[19]

Osseointegrated dental implant-supported prosthesis for the replacement of lost teeth is a useful alternative to traditional prosthodontics; however, designing an implant-supported prosthesis with superior esthetics and optimum functional qualities is a greater challenge.[20] Careful treatment planning and the execution of restorative and surgical procedures is the key in achieving good success rates without causing any iatrogenic damage.[21] A successful surgical procedure for implant placement is guided by the accurate use of a surgical stent and accuracy of apico-coronal position of implant platform with respect to soft tissue height.[22,23] The key to a successful implant rehabilitation is astute planning and close collaboration among, restorative, surgical, and periodontal professionals.[24]

This case report details the restorative rehabilitation of a patient who suffered sports trauma of anterior teeth. Treatment was provided with the aim of preserving dental soft and hard tissues. The aim was to prevent the development of periapical and periodontal tissue infection and to restore dentition to achieve a predictable, comfortable, and esthetic outcome.

CASE REPORT

A 27-year-old male patient reported to the outpatient department with a complaint of tenderness on his front teeth [Figure 1] with deranged bite. The patient had suffered trauma to his anterior dentition from ice hockey stick (amateur player) injury 10 weeks before. He had a lacerated lower lip and all mandibular and maxillary incisors avulsed. He also suffered crown/root fractures of teeth 33 and 43. The traumatized incisor teeth had been replanted, repositioned, and splinted by the general dental practitioner (GDP) after 2 h (teeth wrapped in dry gauze). The patient was fit and well with no known drug allergies, was

Figure 1: Preoperative anterior view

registered with the GDP, and was a regular attender. He brushed his teeth twice daily, used floss for interdental cleaning, and was a nonsmoker.

Maxillary and mandibular incisors were splinted with direct resin composite and stainless steel wire, on the labial aspect [Figures 2 and 3]. Tooth 22 was displaced 1 mm mesio-palatally, with no proximal contact with tooth 23. Mandibular incisors were in an imbricated and extruded position [Figure 4]. Tooth 34 had an uncomplicated crown fracture and tooth 33 was missing. Tooth 43 was decoronated submucosally, and tooth 44 had an enamel fracture. Class I composite resin restoration was present on tooth 16 and Class I amalgam restoration was present on tooth 26. Teeth 36 and 46 had Class V composite restorations. The patient also wore a mandibular acrylic partial denture, replacing tooth 33 and the crown of tooth 43.

Radiographic examination included a dental panoramic radiograph and multiple periapical radiographs which showed widening of periodontal ligament space around all mandibular incisors with the roots displaced from the alveolar sockets [Figure 5]. Radiographically, tooth 11 had a root canal obturation present, tooth 34 had an uncomplicated crown fracture, and tooth 43 a crown-root fracture. All incisor teeth gave a negative response, and teeth 34 and 44 gave a positive response to ethyl chloride and electric pulp tester. A diagnostic wax-up for the definitive restorations was performed [Figure 6].

The objectives of the treatment were to prevent the development of periapical and periodontal tissue infection and damage, and in addition, preservation of dental soft and hard tissues and restoration of the dentition to achieve a predictable, comfortable, and esthetic outcome.

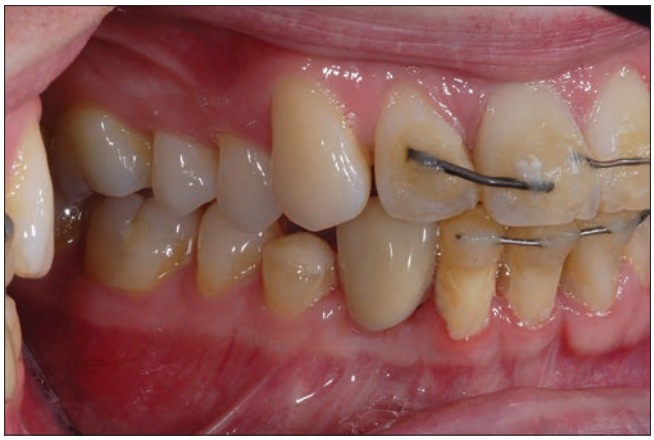

Figure 2: Preoperative right buccal view

Figure 3: Preoperative left buccal view

Figure 4: Preoperative mandibular occlusal

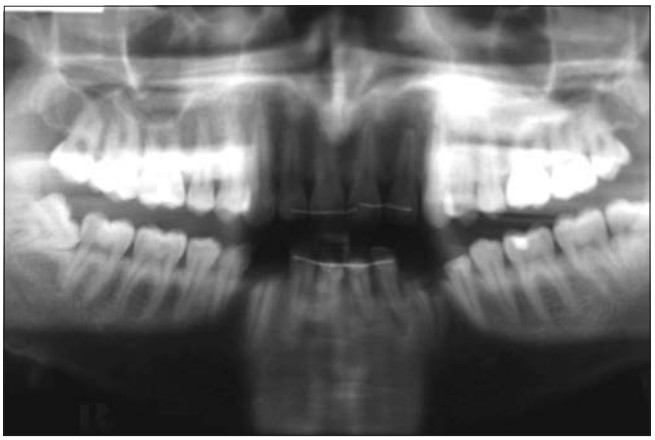

Figure 5: Pretreatment radiograph

Figure 6: Diagnostic wax-up

The treatment plan included following stages:

1. Immediate phase (stabilization - 1st week)
   It included:
   - Dentine coverage of tooth 34
   - Root canal treatment teeth 11, 21, and 22
   - Oral hygiene instructions.
2. Transitional phase (preliminary restorative - week 2 and 3)
   It included:
   - Extraction of mandibular teeth from 33 to 43
   - Extraction of maxillary incisor teeth with placement of immediate denture.
3. Reconstructive phase (definitive treatment - week 4–20)
   It included:
   - Early implant placements at anterior maxilla and mandible
   - Implant exposure and pick up impressions for provisional restorations
   - Fabrication and fit of screw-retained implant provisional (maxilla and mandible)
   - Crown preparation and provisionalization of tooth 34
   - Direct restoration of tooth 44
   - Provision of definitive restoration at tooth 34
   - Provision of definitive implant-retained restorations for anterior maxilla and mandible.
4. Maintenance phase
   It included review appointments.

The course of the treatment focused on improvement of patients' anterior dental esthetics, and provision of stable and predictable restoration of the traumatized dentition using a conformed approach. All maxillary and mandibular incisor teeth and tooth 43 were extracted in a staged approach under local anesthesia and immediate dentures fitted [Figure 7]. Early (4–6 weeks) implant placements were placed under LA in two different procedures (maxilla and mandible). Two bone level (4.1 Ø, 12 mm) implants were placed at sites 12 and 22 [Figure 8], and two standard plus (4.1 Ø, 12 mm), Straumann (Basel, Switzerland) implants were placed at sites 33 and 43 [Figure 9] using surgical stents to achieve planned positions of implants. During the surgical procedure, labial bone was found to be lacking (0.5–1 mm) to achieve desire coronal position of implant collar, and as a result, simultaneous guided tissue regeneration using xenograft and membranes (Bio-Oss and Bio-Guide, Geistlich, Germany) was performed at both maxillary and mandibular sites.

All four implants were surgically exposed under LA at 8 weeks, and impressions were recorded for provisional restoration fabrication, with screw-retained impression copings using a custom-made open tray and single phase, medium body polyvinyl siloxane (PVS) impression material. Transmucosal healing abutments were placed for healing of soft tissues around implants.

A wax-up was performed to replicate ideal anterior esthetic contours and duplicated into screw-retained provisional fixed partial dentures (FPDs) [Figure 10] using polymethylmethacrylate temporary restoration material. Provisional restorations were screw torqued using a torque wrench and screw holes covered with esthetic composite resin restorative material [Figure 11].

Using an index from the diagnostic wax-up, tooth 34 was prepared for a porcelain fused to metal (PFM) crown. A provisional crown was fabricated and fitted using zinc oxide-eugenol temporary cement (noneugenol). At the same appointment, a

Figure 7: Interim mandibular denture

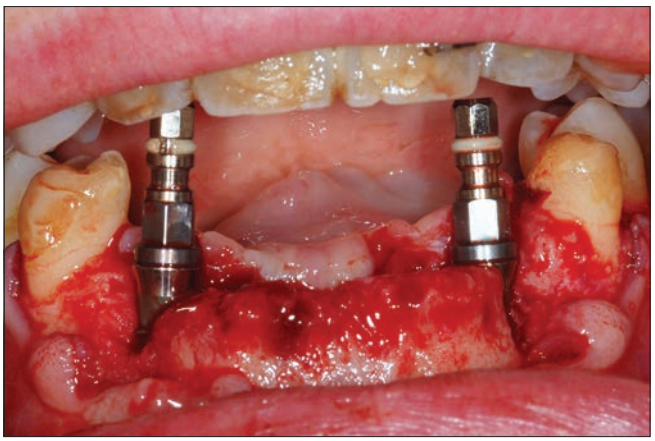

Figure 8: Mandibular implant surgery

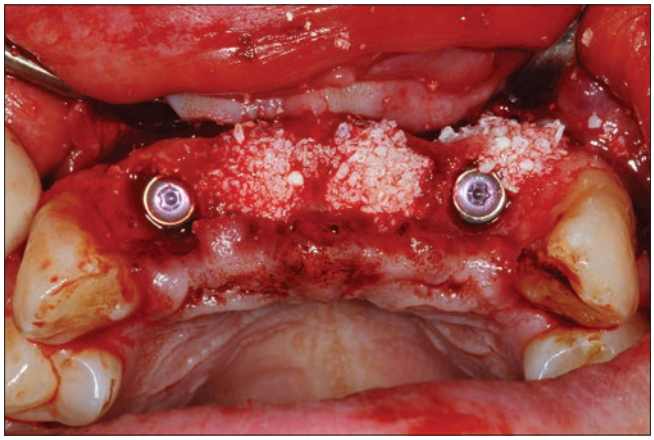

Figure 9: Maxillary implant surgery

Figure 10: Implant provisionals

direct restoration of resin composite under rubber dam isolation was completed on tooth 44.

To achieve an identical definitive restoration with regard to tooth and soft tissue contours, customized screw-retained implant impression copings were used for the definitive maxillary impression [Figure 12]. A customized guidance table from the provisional restoration was also utilized. A putty index of the provisional restoration was also used to duplicate contours of provisional restorations into definitive restorations. Impressions for both maxilla [Figure 13] and mandible [Figure 14] were recorded in a custom-made open tray/screw-retained impression copings using dual-phase PVS impression technique. Maxillary FPD was a cement-retained restoration, customized lab-made precious metal abutments were torqued (35 Ncm), and PFM FPD fitted using implant restoration cement [Figures 15 and 16]. Mandibular FPD was made screw-retained (all implants were loaded at 12 weeks) and was torqued (35 Ncm) directly onto the implant surfaces and screw holes restored with resin composite material [Figure 17]. Maintenance phase included follow-up of the patient after 1 month followed by 3 months and later 6 monthly. The implant restorations were assessed for esthetic, soft and hard tissue health [Figure 18]. Both direct and indirect restorations were also assessed for esthetics, wear, discoloration, occlusal contacts, and soft and hard tissue health. Oral prophylaxis was provided to the patient at each follow-up visit and oral hygiene instructions were reinforced.

DISCUSSION

The oral health practitioners play a vital role in apprising patients, athletes, and their parents about the significance of prevention, diagnosis, and treatment of the orofacial traumatic injuries in sports. It has been reported that among team sports for high school males, ice hockey athletes have shown to have the highest concussion incidence of around 3.6 per 1000 athlete-exposures.[24,25] One of the most important factors in the prevention of sports-related orofacial injuries is by wearing the basic protective devices

Figure 11: Maxillary implant-retained provisional fixed partial denture

Figure 12: Maxillary customized impression copings

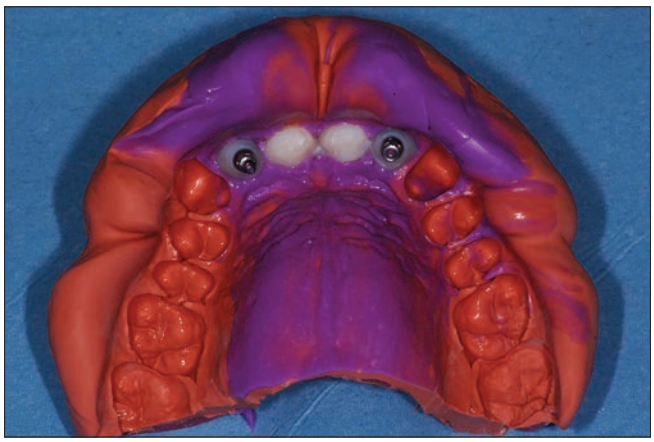

Figure 13: Definitive maxillary impressions

Figure 14: Definitive mandibular impression

such as mouthguards, suitably fitting helmets, and face masks.[24,26] Many materials are being used for fabrication of mouthguards which include polyvinyl chloride, polyvinyl acetate-polyethylene copolymer, or ethylene vinyl acetate.[27-31]

Contact sports, carries significant risks of facial injuries and requires individuals to wear protective gear.[32] An increase in the rates of diagnosed concussions and facial trauma has been noticed during the sport, and helmets are considered to be greatly responsible for the protection of hockey players from the most catastrophic head injuries and facial injuries.[25,33,34] The patient described in the current case report was not wearing a helmet at the time of facial injury which occurred during his practice session that resulted in severe trauma to his anterior dentition.

Figure 15: Postoperative anterior view

Figure 16: Postoperative maxillary occlusal view

Figure 17: Postoperative mandibular occlusal view

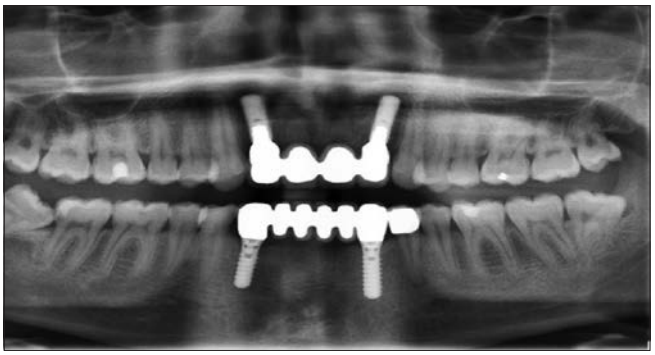

Figure 18: Postoperative radiograph

Figure 19: Postoperative anterior smile view

Figure 20: Postoperative left buccal view

Figure 21: Postoperative right buccal view

Avulsion causes complete displacement of a tooth from the socket and occurs in 0.5%–3% of individuals with dental and facial injuries.[35,36] In primary dentition, it typically results due to objects hitting the teeth directly, whereas in permanent dentition, it usually occurs due to fights, sport injuries, and other accidents.[37,38] The main objective in the treatment of avulsed permanent teeth is to preserve the teeth along with the surrounding tissues and to replant the affected teeth as soon as possible.[32] Patient's general health, the maturity of the root of the avulsed tooth, storage medium, and the time the tooth remains out of the socket are significant factors, which are responsible for success and failure of the replantation procedure.[31-33] In the present case, the dry extra-oral time was 2 h, which according to guidelines supports very poor prognosis for reintegration of teeth with periodontal tissues.[34] Outcomes of delayed reimplantation of avulsed teeth often included inflammatory resorption, infection, and ankylosis.[6] Therefore, although the teeth were reimplanted by the GDP, the proposed treatment included extraction of the affected teeth followed by provision of implant-retained fixed prosthesis.

In the present case, root canal treatments for incisors were performed to stabilize and prevent periapical or periodontal infections. Acrylic immediate dentures were provided (long span edentulous area) for the interim period during soft and hard tissue healing after extractions and implant placements. Straumann implant system was used due to its SLA®/SLActive® surface (allowing for good primary stability),[39] and the width of the implants was compatible to the cervical dimensions of lateral incisors and canines in maxilla and mandible, respectively (as assessed by radiographic assessment using radiographic stent). Early implant placements were allowed for soft tissue coverage after implant surgeries. In the maxilla, implants were placed at 12 and 22 for the following reasons: to avoid the risk of dissimilar cervical soft tissue levels at sites 11 and 21, the presence of lack of labial bone at central 11 and 21 sites, and to avoid a cantilever restoration.[40,41] In the mandible, implants were placed at canine site due to lack of bone width and an avoidance of narrow diameter implants at the incisor sites.[41] Temporary implant restoration was allowed for adequate soft tissue conditioning. Maxillary cement-retained and mandibular screw-retained implant restorations were prescribed esthetics (labial placed implant necks) and retrievability, respectively.[42]

Based on the existing dentition, there are a variety of prosthesis which can be provided to the patient which include a fixed bridge, a removable partial denture, and an over-denture.[43] Implants offer good long-term prognosis in light of current evidence,[44] along with preservation of remaining tooth structure and bone, predictability, ability to support fixed restoration, ease of prosthodontic procedures, and esthetic outcome. However, it requires high maintenance commitment. Contemporary techniques were employed to achieve optimum esthetics and stable guidance [Figures 18-21].

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Conflicts of interest
There are no conflicts of interest.

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