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Post-traumatic use of dental implants to rehabilitate anterior maxillary teeth

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Abstract – The treatment sequel of post-traumatic teeth for the use of dental implants in the anterior maxillary region to rehabilitate anterior maxillary missing teeth was evaluated. Files of 53 healthy patients reporting anterior dental trauma were reviewed. All patients had an anterior maxillary dental implant because of tooth loss after trauma. At initial examination, 18 patients (34%) had root canal treatment and an inflammatory lesion, 15 (28.3%) had a missing tooth on admission, 12 (22.6%) had a prior operation (i.e. root-end surgery or crown lengthening), 4 (7.5%) presented an ankylotic root, and 4 (7.5%) had a root remnant not suitable for rehabilitation, with no inflammatory periapical lesion. Treatment sequences and complications were recorded. Augmentation procedure (i.e. onlay bone graft or guided bone regeneration) was performed in 43 patients (81.1%), and 2 patients (3.8%) had orthodontic extrusion prior to tooth extraction and implantation. Implants were placed immediately in 25 patients (47.2%) and 4 (7.5%) had immediate loading at the time of implantation. Complications and postoperative incidents (fistula, inflammation, swelling hematoma, etc.) were observed in 24 patients (45.3%). There was no difference in complication and postoperative incident rates with regards to the implantation technique. Complications were found at the prosthetic phase in seven patients (13.2%; six fistula and one implant failure). When patients were divided into two groups, with and without an inflammatory lesion, a significantly lower complication and postoperative incident rate were found in the non-inflammatory group ($P = 0.057$). This study reaffirmed the necessity for scrupulous diagnosis of teeth and alveolar bone after a traumatic injury. Treatment is multidisciplinary, requiring surgical, orthodontic, endodontic, operative, and prosthetic compliance. A specially designed treatment plan for each patient is necessary. General rules do not apply.

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Anterior maxillary implantation is a challenging treatment for both the surgeon and prosthodontist because of the high esthetic demands in this area. As this area is the most traumatized and exposed to habits (1–5), prompt and appropriate management is necessary to significantly improve the prognosis for many of the dentoalveolar injuries, especially in the young patient. Unfortunately, much of this trauma remains untreated, mistreated, or overtreated (6), leading to a more complicated treatment at the time of tooth loss.

The facial cortical plate over the roots of the maxillary teeth is very thin and porous. In young patients, treatment options of traumatized untreatable teeth should consider preserving the ridge dimension and facial cortical plate. Periapical infections, as well as prolonged and stubborn surgical treatments (repeated root-end surgeries),

can cause resorption of the labial plate, migrate to a more palatal position, and may later require an augmentation procedure prior to implant placement.

Replacement resorption (dentoalveolar ankylosis) is a serious complication following injury to the periodontal membrane, root fracture (7, 8), lateral luxation, intrusion, and avulsion, especially in teeth with mature root formation (9–13). The consequences of this condition are progressive root resorption with replacement by bone and arrested growth of the alveolar process in the growing child (14), leaving the occlusal plane often non-esthetic. Therefore, ankylosed teeth should be treated shortly after diagnosis by decoronation (crown removal leaving the ankylosed root in the alveolous to be substituted by bone; 15), intentional replantation (provided the ankylosis is detected at an early stage or has only affected a small area of the root; 16), extraction and orthodontic space closure, or premolar auto-transplantation (17–19).

The alternative treatment of only surgical removal of an ankylosed tooth often leads to considerable bone loss, which reduces the bone volume in an oro-facial dimension. This may later necessitate an augmentation procedure.

Sufficient ridge dimension and facial cortical plate are essential for dental implantation and esthetic rehabilitation of the traumatized anterior maxillary area. The purpose of this study was to evaluate the treatment sequel of post-traumatic teeth for use of dental implants in the anterior maxillary region.

Material and methods

Files of 53 healthy patients, who reported anterior dental trauma, were reviewed. Information included complete medical and dental history, and clinical and radiographic evaluation. All patients had an anterior maxillary dental implant because of tooth loss after trauma. At initial examination, 18 patients (34%) had root canal treatment and presented an inflammatory lesion, 15 (28.3%) had a missing tooth on admission, 12 (22.6%) had a prior operation (i.e. root-end surgery or crown lengthening), 4 (7.5%) presented an ankylotic root, and 4 (7.5%) had a root remnant unsuitable for rehabilitation, with no inflammatory periapical lesion. Treatment sequences, as well as complications, were recorded. A single surgeon (D.S.-A.) performed all operations between the years 1995–2003.

Statistical analysis included Pearson's Chi-square test of association and analysis of variance (ANOVA) using BMDP statistical software (20).

Results

An augmentation procedure was performed in 43 patients (81.1%): 8 (15.1%) onlay bone grafts, 14 (26.4%) guided bone regeneration, and 21 (39.6%) autogenous bone particles in the gap created between the implant and socket wall in patients with immediate implantation. Bone augmentation, as a separate procedure, was performed several months prior to implantation in 22 patients (41.5%). Orthodontic tooth extrusion prior to extraction and implantation was performed in 2 patients (3.8%). Immediate implantation was performed in 25 patients (47.2%) and immediate loading at the time of implantation in 4 (7.5%). A technique, which does not require any incision during immediate implant placement, was used in 15 patients (60% out of the immediate implantations; 21).

Table 1 describes treatment modalities according to the tooth status at presentation. Post-operative inflammation, swelling, hematoma, and premature implant exposure were observed in 17 patients (32%). Complications were found at the prosthetic phase in seven patients (13.2%; six fistula and one implant failure). When postoperative incidents and postprosthetic-phase complications were considered, the fistula was the most common (eight patients, 15%), followed by implant exposure (five patients, 9.4%) and swelling (three patients, 5.7%). Implant failure was observed in two patients (3.7%). There was no difference in complication and postoperative incident rates regarding implantation technique (immediate or late/delayed) or timing of implant loading (immediate or delayed; Table 2). There was also no difference in complication and postoperative incident rates regarding the need for bone augmentation prior to implant placement (Table 3). When the status at presentation was divided into two

Table 1. Treatment modalities according to tooth status at presentation

Tooth status at presentation	No. of patients (%)	Immediate implantation (%)	No incision (21; %)	Immediate loading (%)	Orthodontic extrusion (%)
Missing tooth	15 (28.3)	–	–	1 (6.6)	–
Previous operation*	12 (22.6)	9 (75)	6 (50)	1 (8.3)	–
RCT with inflammation	18 (34.0)	11 (61.1)	7 (38.8)	1 (5.5)	1 (5.5)
Ankylosis	4 (7.5)	3 (75)	2 (50)	–	–
RCT without inflammation	4 (7.5)	2 (50)	–	1 (25)	1 (25)
Total	53 (100)	25	15	4	2

*Root-endsurgery and crown lengthening.
RCT, root canal treatment.

Table 2. Complication and postoperative incident rates and presence of inflammation (in the lost/extracted tooth) in immediate implants

	Lesions		
	Inflammatory (%)	Non-inflammatory (%)	Total (%)
Number of patients	21 (84)	4 (16)	25 (100)
Complications	4 (19)	0 (0)	4 (16)
Post-operative incidents	9 (42.9)	1 (25)	10 (40)

P = NS.

Table 3. Complication and postoperative incident rates in cases with and without augmentation procedure

	Augmentation (OBG or GTR; %)	No augmentation (%)	Total (%)
Number of patients	22 (41.5)	31 (58.5)	53 (100)
Complications	3 (13.6)	4 (12.9)	7 (13.2)
Post-operative incidents	5 (22.7)	12 (38.7)	17 (32.1)

P = NS.
OBG, on-lay bone graft; GTR, guided tissue regeneration.

Table 4. Status at presentation (with or without inflammatory lesion) and complications and postoperative incidents

	Inflammatory (%)	Non-inflammatory (%)	Total (%)
All cases			
Number of patients	30 (56.6)	23 (43.4)	53 (100)
Complications and postoperative incidents	17 (56.7)	7 (30.4)	24 (45.3)
Tooth present at initial examination			
Number of patients	30 (78.9)	8 (21.1)	38 (100)
Complications and postoperative incidents	17 (56.7)	4 (50)	21 (55.3)

P = 0.057.

groups, with or without an inflammatory lesion, there was significantly lower complication and postoperative incident rates in the non-inflammatory group (P = 0.057; Table 4).

Discussion

Treatment of an injury of the anterior maxillary area is usually challenging but difficult. Unfortunately, trauma to this region is very common (1–5). At presentation, there are various post-traumatic bone or tooth conditions that demand different treatment strategies. Patients often present loss of tooth and surrounding bone, a tooth remnant with or without inflammatory lesion, an ankylosed tooth, etc. An appropriate treatment plan can usually improve the success and results of these injuries, especially in the young patient (19).

The results of the present study showed that an augmentation procedure (i.e. onlay bone graft or guided bone regeneration) was necessary in most patients, no matter what the tooth history. Young patients with an anterior maxillary injury should be informed of this future possibility.

Orthodontic extrusion could serve as a way of 'earning' bone before extraction and implantation. This is a valuable adjunct to site preparation prior to implant placement (22).

The relatively high rate of complications and postoperative incidents, although minor, reflects the complexity of treating these patients and the need for scrupulous diagnosis of teeth and alveolar bone after traumatic injury.

Immediate implantation and loading were unrelated to the high risk of complications. These methods, when indicated and possible, can be used predictably. Immediate loading of dental implants shortens treatment time and provides the patient with an esthetic appearance during the treatment period with a good long-term prognosis (23).

Patients with an inflammatory lesion at presentation tend to have a higher risk of complications following anterior maxillary implantation and rehabilitation. These complications do not necessarily influence the long-term implant success.

Trauma of the anterior maxillary region presents many different and complicated cases, as well as a variety of treatment options that change as the clinical and scientific experiences develop. It is important to understand that each patient should be evaluated carefully and thoughtfully before a treatment plan is made.

Conclusion

This study reaffirmed the necessity for scrupulous diagnosis of teeth and alveolar bone after traumatic injury. Treatment is multidisciplinary, requiring surgical, orthodontic, operative, and prosthetic compliance. An individual treatment plan for each patient is necessary. General rules do not apply.

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