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Immediate functional loading of provisional implants in the reconstructed atrophic maxilla: preliminary results of a prospective study after 6 months of loading with a provisional bridge

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Abstract. Implant-prosthetic rehabilitation of atrophic maxillae remains a challenging problem. The aim of this paper is to describe a novel treatment for functional rehabilitation of the atrophic maxilla and to discuss preliminary results of this treatment protocol. A prospective pilot study was carried out in 10 patients who underwent bony reconstruction of atrophic maxillae under general anaesthesia, with autologous calvarial bone grafts and simultaneous placement of six provisional implants. The provisional implants were loaded with a provisional acrylic bridge 1 day after surgery. After 6 months, the provisional implants were removed and final implants were placed under local anaesthesia, again in an immediate loading concept with a provisional bridge, followed by a final bridge after another 6 months of healing. The bone grafts integrated well in all 10 patients without infectious complications. The prosthetic survival of the provisional bridge at the time of placing the implants was 100%. All final implants could be placed and immediately loaded with a second provisional bridge. Patient satisfaction was high due to limited postoperative inconvenience and immediate fixed prosthetic rehabilitation. The preliminary results of this pilot study demonstrate that this treatment protocol is a well tolerated treatment for patients with maxillary atrophy desiring dental rehabilitation.

Key words: dental implants; dental prosthesis; implant supported; provisional implants; temporary implants; immediate loading; bone resorption; bone grafting; calvarium; bone regeneration; immediate function; one-stage surgery; bone resorption; maxilla; alveolar ridge augmentation; methods; titanium.

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Alveolar bone loss is a common finding in periodontal disease and in edentulism. The retention of a removable prosthesis becomes arduous with progressive bone atrophy[4] and accelerates bone loss. Implant treatment is difficult due to insufficient bone height and width for implant placement. Many non-grafting and bone-grafting implant protocols have been described, but implant treatment in severe maxillary bone atrophy remains a challenge.

Non-grafting solutions[3] include placement of angulated implants, zygoma implants and more palatal placement of implants to obtain a prosthetic rehabilitation, but if non-removable implant-supported restorations are placed, the maxillomandibular relation can not be altered to compensate for the changes in facial form and appearance[5,6]. Other solutions include guided bone regeneration, distraction osteogenesis, crestal split osteotomy and sinus floor elevation[7].

In cases of extensive grafting procedures, autologous bone remains the gold standard. Bony reconstruction with autologous bone grafting is considered time-consuming. After extensive reconstruction of the alveolar ridge, a healing period of 3–6 months is required before final implants can be placed. If no immediate loading protocol is followed, osseointegration takes another 4–6 months before prosthetic rehabilitation.

Autologous bone grafting from the anterior iliac crest is associated with post-operative morbidity (e.g. pain and gait disturbance due to muscle detachment). Since the amount of resorption of the grafted bone is variable and unpredictable, resorption is anticipated by overcompensating the volume during reconstruction. The use of calvarial bone has been described extensively. Its mechanical and biological superiority to iliac crest bone is well documented in the literature[9,20,23].

Regarding prosthetic rehabilitation, wearing a removable denture during the healing phase following bone grafting is problematic due to lack of retention. Resorption of the grafted bone also increases.

The purpose of this prospective pilot study is to present the preliminary results after immediate functional loading of provisional implants in the reconstructed atrophic maxilla.

Table 1. Treatment protocol.

First visit
Medical history
Sinus problems (if history: ENT)
Smoking
Clinical evaluation
Denture convertible?
Radiological evaluation
If not present CBCT
Explanation of operation and rehabilitation
Informed consent
Operation
General anaesthesia
Harvesting cranial bone, reconstruction donor site
Reconstruction maxillae
Placement of IPIs
Day (operation) + 1 day
Dismissal from hospital
Coupling of temporary IPI-supported fixed bridge (immediate loading of IPIs)
Day + 10 days
Check-up
Removal of skin staples (donor site)
Day + 6 months
Local anaesthesia
Removal of temporary fixed bridge
Removal of IPIs
Removal of osteosynthesis screws
Placement of implants
Coupling of temporary implant-supported fixed bridge (immediate loading of implants)
Day + 1 year
Removal of temporary implant-supported fixed bridge
Placement of final implant-supported fixed bridge

Materials and methods

This prospective pilot study involved patients with moderate to extreme maxillary bone atrophy: class IV to VI according to Cawood and Howell[4], caused by terminal periodontitis or edentulism. Ten consecutive patients were recruited from 2006 to 2009 and underwent identical surgical treatment protocols (Table 1). Patients unable to quit smoking or with severe uncontrolled diabetes were excluded. All patients were treated by

Table 2. Patient information, dental status, maxillary atrophy.

Patient	Initials	Date of birth	Age (years)[o]	Sex	Dental status	Cawood[4]	Smoker	Disease
1	VB A	28/01/1967	39	F	16, 17, 27 *in situ*	IV	Yes	Eating disorder
2	C A-M	11/09/1954	52	F	Fully	VI	No	
3	V S	18/01/1959	47	F	Fully	IV	No	Allergy
4	V C	11/10/1961	46	F	17, 11, 21, 24, 26, 27 *in situ*; terminal periodontitis	IV	No	
5	T C	20/08/1948	59	F	Fully	V	No	
6	DM F	21/11/1948	59	M	Fully	V	No	GERD[*]
7	V K	26/06/1955	53	F	Periimplantitis and implant loss, after earlier bone grafting[$]	VI	No	
8	DV G	30/08/1951	58	F	Fully	V	No	
9	L I	30/04/1954	56	F	17, 25 *in situ*	V	No	Hepatitis A
10	V J	27/05/1949	60	F	Fully	VI	No	

[o] Age at enrolment/operation.
[*] GERD: gastro oesophageal reflux disease.
[$] With iliac bone grafts, in another hospital.