Immediate and delayed "All-on-Six" rehabilitation of the atrophic maxilla: literature review and clinical procedures.

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INTRODUCTION

The implant-supported fixed prosthetic rehabilitation of the edentulous jaws is often related to anatomic limitations in the latero-posterior areas by the mandibular canal and the genial foramen in the mandible and the maxillary sinus in the upper jaw. The bilateral posterior tilting of the distal implants sensibly reduces the cantilevers length and allows to increase the distal prosthetic extension without any sinus lift, bone augmentation surgery or mandibular nerve transposition (1, 2). This technique has three advantages: (I) the distal implant support with the following reduction of the prosthetic extension, (II) the implant length increase, (III) the implant anchorage in the dense bone tissue of the anterior sinus wall with improved primary stability (2, 3). From a biomechanical point of view the distalization of the implant platform reduces the moments of strength and helps to a better distribution of loadings.

The immediate loading protocol of the edentulous maxilla shows 87.5-98.9% implant success and 100% prosthetic success (3, 4, 5, 6, 7, 8, 9), both with tilted and non-tilted implants (10, 11, 12, 13) and post-extractive implants (14). Implants failures are above all "early failures". (3, 7, 15, 16, 17). The marginal bone resorption around implants is similar when comparing immediate loading protocol to delayed loading protocol (7, 8, 9, 11, 12, 13, 15, 16, 17), and tilted to non-tilted implants (3, 10, 11, 12, 13).

Histologies underline a percentage of BIC ("bone-implant-contact") which varies from 64,2% to 85% respectively after 2 and 4 months from loading in immediate loading procedures compared to a percentage of 39,9% on delayed loaded implants after 2 months of loading (18, 19, 20) (tab. 1).

(n)	author	follow-up	mand	maxilla	I / D	success upright	success tilted	success prosthesis	success failure	bone loss I / D	bone loss U / T	BIC I	BIC D
9	Grunder, 2001	2 y		x	I	87,50%		100%		similar			
20	Testori et al., 2001	4 mo	x		I							76-85%	
2	Fortin et al., 2002	5 y		x	D	97%		100%	early / 3y post-load				
16	Testori et al., 2002	2 mo	x		I / D							64,20%	39,90%
7	Rocci et al., 2003	3 y		x	I	94%		100%	2 mo	similar			
15	Testori et al., 2003	48 mo	x		I	98,90%		100%	3 we	similar			
6	Jaffin et al., 2004			x	I	93%		100%					
17	Testori et al., 2004	12-60 mo	x		I	99,40%		100%		similar			
16	Testori et al., 2004	6-65 mo	x		I	97,40%		100%	2 mo	similar			
5	Balshi et al., 2005	1-5 y		x	I	99%		100%					
12	Calandriello & Tomatis, 2005	1 y		x	I	96,70%	96,70%	100%			similar		
4	Degidi et al., 2005	5 y		x	I	96%		100%	6 mo				
8	Ostman et al., 2005	12 mo		x	I / D	99,2% /100%		100%		similar			
20	Romanos et al., 2005	2-10 mo	x	x	I							66,80%	
11	Malò et al., 2006	1 y	x	x	I	98,90%		100%			similar		
14	Cannizzaro et al., 2007	12 mo		x - post-ex	I	96,30%		100%					
10	Capelli et al., 2007	40 mo		x	I	97,59%		100%	12-18 mo		similar		
3	Daverio et al., 2007	12 mo		x	I / D	98,07% /100%	100%	100%	2 mo		similar		
13	Testori et al., 2008	12 mo		x	I	98,80%		100%	12-18 mo		similar		

METHODS AND MATERIALS

The clinical application foresees two different kind of approaches: for patient A immediate post-extractive implants followed by an immediate loading procedure, for patient B a traditional protocol with delayed implant positioning at the first surgical stage, implant uncovering at the second surgical stage followed by a delayed loading procedure.

The bone volume of surgical interest is outlined by the lateral wall of the nose, by the anterior recess of the maxillary sinus and by the residual alveolar crest. Important bone resorptions at the premolars level are not included in the clinical indication. The tilted implant must have maximum length in order to exploit the whole length of the mesial wall of the maxillary sinus up to the lateral wall of the nose.

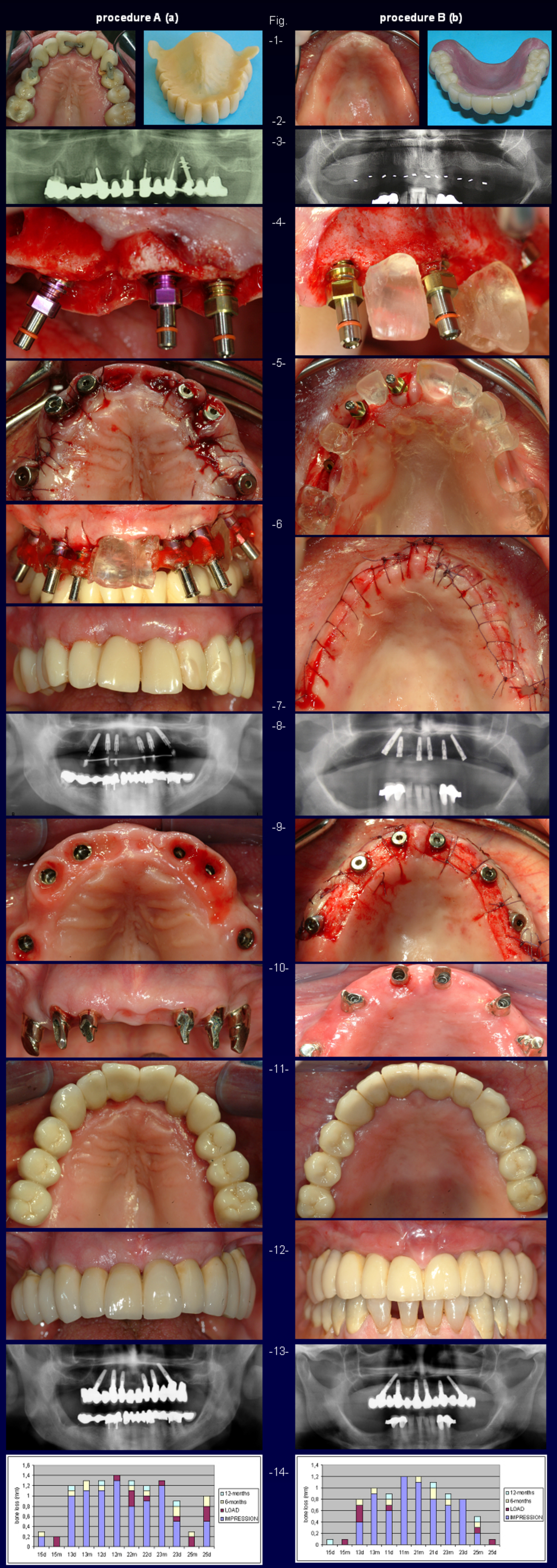
The surgical phase starts only after having precisely defined the implant prosthetic design and after the realisation of a surgical device (fig. 1, 2, 3). The bilateral surgical approach, where possible, results more conservative for the tissues and less traumatic for the patient. The raise of a total thickness flap through a crestal cut and mesial and distal releases must expose the area of the maxillary sinus. A diagnostic antrostomy of the maxillary sinus lengthened mesially and tangent to the anterior sinus wall may help to identify it easily and to control directly the correct implant placement. According to the prosthetic design, the implant emergency should be placed in the second premolar area (fig. 4, 5), with a 30-35 degrees inclination to the upright plane.

After having placed the first tilted implant the surgical procedure continues according to the prosthetic design with the placement of the implant in the incisive central or lateral area, strictly prosthetically guided with the help of the surgical device (fig. 5b). The intermediate implant is generally placed in the canine zone. Root-form implants are particularly suitable to this kind of placement thanks to their proper geometry. The reduced apical shape of these implants allow their correct placement avoiding contacts among them and bone perforations in the apical restricted zone of the maxilla basis (fig. 8). Once the implant placement is completed the sinus antrostomy can be sealed up with collagen sponges without invading the sinusal cavity in case of accidental perforation. Procedure B ends with the suture and the X-ray check (fig. 7b, 8b).

The immediate loading procedure (A) foresees the recording of the implants position immediately after their placement with the help of an individualized surgical device / impression carrier (fig. 6a) which allows the assembly of the model cast directly in the articulator and the realization of the temporary prosthesis through the insertion of abutments in the previously completed provisional full-arch restoration. The placement of the temporary screwed prosthesis four hours after surgery ends with the x-Ray check (fig. 7a, 8a).

After completed implants osteointegration, procedure B foresees a second surgical phase with the uncovering of the implants according to the standard dictates of periodontology (fig. 9b), followed by the healing and maturation of the soft tissue through the placement of a fixed temporary prosthesis which can be screwed or cemented according to the esthetic demands and to the necessity of tissue conditioning. Procedure A foresees the removal of the temporary restoration and the impression taking (fig. 9a). The fixed prosthesis (A+B) is cemented on individualized abutments (fig. 10,11,12).

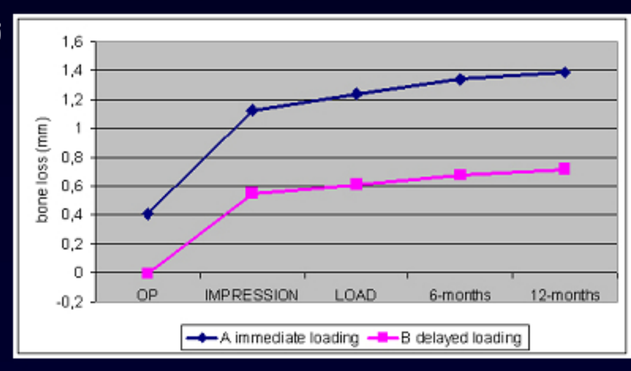
The correct placement of the full-arch restoration, the implants osteointegration and the periimplant marginal bone resorption are periodically subjected to clinical and radiographic check (fig. 13). The marginal bone resorption is measured at the implant platform level, mesial and distal, at implant placement, impression taking, placing of the final prosthesis and during semestral regular recalls (6-12 months) (fig. 14).



RESULTS

During the 12-months follow-up no implant failure and no prosthetic complication were recorded. The marginal bone resorption curves are overlapping comparing immediate loading (A) to delayed loading (B), independently from the baseline value at implant positioning (OP). Marginal bone resorption, measured mesial (m) and distal (d) on each implant, is greater in the interval between implant positioning (OP) and impression taking (IMPRESSION), decreasing and becoming constant with time (6-- & 12-months), lower around tilted than non-tilted implants, both in the immediate loading (A) and the delayed loading protocol (B) (fig. 15). The rates of implant and prosthetic success recorded in the literature review (2, 3, 10) and in the clinical appliance show: (a) the implant position is not determinant for implant and prosthetic failure, (b) tilted implants are not determinant for marginal bone resorption, (c) the implant axis to the surrounding bone and to the functional load is not determinant for marginal bone loss (fig. 14, 15). The data validate the predictability of the implant-supported fixed rehabilitation of the edentulous maxilla with distally tilted implants, with both immediate and delayed loading procedures, reducing the need for bone augmentation procedures, the post-surgery discomfort and treatment timing. Periimplant measurements show bone resorption curves as described in the literature and their overlapping shape, both in tilted and non-tilted implants, immediate and delayed loading procedures.

Fig. 15



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