Safe and Effective Alternatives to Sinus Elevation in the Atrophic Posterior Maxilla

Part I—A Masters Thesis

author_ Adel A. Chidiac, Kuwait

_**Maxillary sinus elevation** and bone augmentation are acceptable techniques that may provide sufficient bone quantity and quality for implant support in the posterior atrophic maxilla (Wallace SS et al. 2003). Yet, given the morbidity risk plus cost and time consuming effects, these techniques are to be reconsidered. Simpler and safer protocols are therefore required for the posterior maxilla where bone resorption, deficient posterior alveolar ridge, and increased pneumatisation of the sinus all result in a minimal hard tissue bed thus render implant placement difficult (Frank R et al. 2005).

N = 630 ITI	35 (6 mm)	141 (8 mm)	454 (10–16 mm)
Survival rates	94.3 %	99 %	97.4%

Table 1_Study of short Straumann implants versus long implants.

Survival Time (mo) of 6 x 5.7 mm Implants vs. non 6 x 5.7 mm					
Time	N° of 6 x 5.7 mm		N° of non 6 x 5.7 mm		
	Implants at risk	Survival (%)	Implants at risk	Survival (%)	p
0	45	100	124	100	
12	NA				
24	31	92.2 ±4	87	95.2 ±2	78
36	16	92.2 ±4	83	94.1 ±2	NA
48	12	92.2 ±4	39	92.4 ±3	NA
60	7	92.2 ±4	29	92.4 ±3	NA
	3	92.2 ±4	19	92.4 ±3	NA

NA = not applicable; P= statistically difference

Table 2_Study with short Bicon implants.

_1. Introduction

The present thesis seeks: (1) to show that applying to specific alternative implantation techniques in the atrophic posterior maxilla is (a) safer than, and (b) as effective as, maxillary sinus elevation and bone augmentation techniques; and (2) to address simplified implantation protocols (Brånemark PI et al. 1995).

The examined alternative techniques are set out in four sections respectively: Short Implant, Tilted Implant, Tuberosity Implant and Disk Implant.

Section one highlights the insertion of short implants in less than 10 mm bone height under the sinus provided they are well anchored in the residual bone (Deporter D et al. 2000). Section two draws attention to the insertion of (longer) tilted implants in the remote available bone avoiding anatomical vital structures such as arteries, nerves and sinus antrum (Pierrisnard L et al. 2003). Section three emphasizes the insertion of implants in the maxillary tuberosity to benefit from available bone usually discarded. In each of the above sections studies are displayed with the aim of examining the results in terms of safety and effectiveness and thus verifying the comparability to the sinus elevation and bone grafting procedures. Section four throws light on Disk Implant that tries to adapt the shape of the implant to the shape of the bone rather than the way around (Ihde S. 2007). It is early, however, to verify the comparability of such attempt due to shortage of studies.

_2. Aim

The reason of examining specific alternatives to sinus elevation and bone augmentation in the atrophic posterior maxilla is to verify whether they are performed with less time consumption, less cost, and less invasive surgeries yet still with comparable and satisfactory results. Examined alternatives in this thesis are tilted implant, short implant, tuberosity implant and disk implant. The aim is to report long term survival rates of these alternatives and to show that applying them is safer than, and as effective as, maxillary sinus elevation and bone augmentation.

_3. Materials and Methods

3.1 Short Implants

(a) A study involved 630 Straumann implants [35 (6 mm long), 141 (8 mm) and 454 (10–16 mm)] placed in 264 patients within 1994 and 2003. Two-year survival rates were comparable between short (6 mm), (8 mm), and longer (10–16 mm) implants in this population (Table 1; Arlin ML. 2006).

(b) A 98.9% survival rate was the result of a retrospective evaluation of 273 consecutive posterior partially edentulous patients treated with 745 implants (7–9 mm) supporting 338 restorations over 1–5 years period (Misch CE et al. 2006).

(c) 129 patients (68 women, 61 men) were treated over a 4-year-period with fixed prostheses supported by 265 different- sized implants: 154 (10 mm) standard and 111 (8 mm) short. Survival rates were 97.9% for 10 mm and 97.1% for 8 mm (Romeo et al. 2006).

(d) For 293 patients treated with 532 short implants (2001–2002), the overall survival rates were 99.2% and 98.7% for the implant- and subject-based analysis, respectively (Anitua E et al. 2008).

(e) A retrospective study involved 237 patients treated with 408 short Branemark implants: 131 (7 mm) and 277 (8.5 mm) with final fixed prostheses delivered 4 to 6 months later. Cumulative survival rates after 5 years were 96.2% (126/7 mm) and 97.1% (269/8.5 mm) (Malo P et al. 2007).

(f) A cohort study over 5 years involved a total of 62 implants: 28 (6 x 5.7 mm) test group and 34 (non 6 x 5.7 mm) control group non-short (8–14 mm). The survival rates over 5 years were 100% for the test group and 96.8% for the control group. No significant difference was found between the two groups regarding mean changes of radiographic bone levels (Caterina V et al. 2008).

(g) A study on Bicon implants (6 x 5.7 mm) (Fig. 1) reports a survival rate comparable to non-6 x 5.7 mm implants. 172 implants were used 34.3% of which were placed in the posterior maxilla. Survival rates were 92.2% ± 2% for 6 x 5.7 mm and 95.2% ± 2% for non-6 x 5.7 mm implants. The comparable survival rates estimates for 6 x 5.7 mm and non 6 x 5.7 mm suggest that 6 x 5.7 mm implants can bear a functional load after placement. The results are consistent with the findings of Vehement and colleagues in their study (Table 2) (Gentile MA et al. 2005).

(h) A study compared wide diameter short implants (WSI) (6 mm in ø x 5.7 mm in length) (Fig. 2) to narrow and long implants (NLI) (3.5 mm x 11 mm) in various bone densities with finite element analysis (FEA) applied. The results showed that the WSI demonstrated better biomechanical force distribution

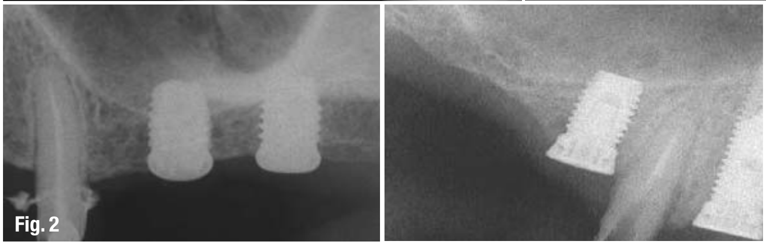

Fig. 1_Short Bicon (6 x 5.7 mm) implants in the posterior maxilla.
Fig. 2_Radiographs of short wide implants (Nobel Biocare) (Courtesy of Prof. Barakat N. Lebanese Univ.).

than the NLI when horizontal forces were exerted. WSI may be considered for implantation in anatomically compromised regions and of poor bone quality (Bozkaya D et al. 2004).

(i) Various studies performed by different authors show 95.8 % mean survival rates as illustrated in (Table 3) (Gentile et al. 2005).

3.2 Tilted Implants

(a) Eighteen patients (mean age 64) were treated with 60 implants between January 2001 and December 2003, and followed up within a range of one to four years. Survival rates were 97.0 % for axial implants (1 failure out of 33) and 96.3 % for tilted implants (1failure out of 27). The cumulative implant survival rates were 96.7 %. The study shows no statistical differences in primary stability between tilted and axial implants (Table 4) (Roos J et al.1997).

As regards changes in marginal bone level, the difference is statistically significant. The study shows that the marginal bone resorption is low for the tilted implants as recorded below in (Table 5) (Calandriello R et al. 2005).

The reason behind the lower bone resorption for the tilted implants may be related to the position of the implant neck relative to the bone crest. Mesially, the neck is positioned supracrestally, whereas distally it is positioned subcrestally, thus resulting in a favorable tissue seal (Hermann JS et al. 2000).

(b) A further study involved 25 patients rehabilitated with 29 partial fixed prosthesis supported by 101 Brånemark Implants: 59 installed in axial direction and 42 installed in tilted direction. Patients were followed up within an average of 37 months. Success rates were 91.3 % for axial implants and 95.2 % for tilted implants. The cumulative success rate was 93.1 % after 5 years. The study shows no statistical difference in pri-

Author	N of yrs.	Implant brand	Length of implants	Survival rate
Bruggenkate 1998	6 yrs.	Straumann	6 mm	94 %
Friberg et al. 2000	5 yrs.	Brånemark	short	95.5 %
Davarpanah et al. 2001	3 yrs.	Osseotite *3i*	short	98.45 %
Fugazzotto 2008	7 yrs.		7 to 9 mm	95.1 %

Table 3_Various studies about short implants.

mary stability between tilted and axial implants (Table 6; Carlos A et al. 2001).

Tilted implants show bone loss of 0.14 mm during the first year of loading with minimal changes observed in the marginal bone height. During the first 60 months of loading, the mean bone loss was 1.21mm for tilted implants and 0.92mm for axial implants. Measurements of periotest variations were not affected by the degree of inclination in respect to the remaining bone. The study shows no significant differences between distal and mesial marginal bone level of tilted and axial implants (Tables 7, 8) (Carlos A et al. 2001).

(c) Another study included 19 patients (6 men and 13 women) with severely resorbed edentulous maxillae (CL IV, CLV) who were treated with tilted implants and fixed dental prostheses 8–12 years previously. In this study, posterior implants were tilted antero-posteriorly more than 30 degrees. The study shows that one man lost one implant whereas one woman lost two implants. No gender difference in the success rate was observed: 97.05 % for men and 97.10 % for women (Annika R et al. 2007).

The study also shows that the overall success rate of the implants after 8 to12 years was 97 %. Indeed, radiographic examination after this period revealed bone resorption in 10 % of the remaining 100 implants. The mean bone loss for 5 patients was 1.2 mm compared to the immediate postoperative radiographic findings, whereas no bone loss was observed for the other 14 patients according to the criteria of Albrektsson et al. (1mm during the first year after loading and 0.2 mm each thereafter (Albrektsson T et al. 1986).

3.3 Tuberosity implants

Several studies were performed to examine the safety and effectiveness of implantation in the

Implant	Mean value, Ncm	SD, Ncm
Axial (n = 32)	48.1	± 28.3
Tilted (n = 26)	41.9	± 27.5

Table 4_Insertion torque of axial and tilted implants of survival implants.

Implant	6 months	1 year
Axial	0.63 ± 0.86 mm	0.82 ± 0.86 mm
Tilted	0.54 ± 0.74 mm	0.34 ± 0.76 mm

Table 5_Changes in the marginal bone level.

Follow up Time (yr)	Number of Implants				Success Rate	
	Beginning of Period	Drop out	Failed	Surviving	During period (%)	Cumulative (%)
Tilted at placement	42	1	0	0	100	100
0–1	41	0	0	2	95.2	95.2
1–2	27	2	0	0	100	95.2
2–3	25	1	0	0	100	95.2
3–4	17	2	0	0	100	95.2
4–5	13	2	0	0	100	95.2
5–6	12	2	0	0	100	95.2
6–7	9	1	0	0	100	95.2
Axial at placement	59	2	2	1	95.0	95.0
0–1	54	0	0	2	96.3	91.3
1–2	37	5	0	0	100	91.3
2–3	31	3	0	0	100	91.3
3–4	19	3	0	0	100	91.3
4–5	15	3	0	0	100	91.3
5–6	13	3	0	0	100	91.3
6–7	8	1	0	0	100	91.3

Table 6_Implant success rate for tilted and axial implants.

maxillary tuberosity (Table 9)

(a) 72 Brånemark implants were inserted with an average follow up of 21.4 months; the results showed 93 % success rate (Bahat O. 1992).

(b) 65 implants were inserted with a follow up of 4 years; the results showed 95 % success.

(c) 42 implants inserted in the posterior maxilla 29 of which in the tuberosity were followed up annually; only 1 of the 42 implants was lost at the second stage surgery (Venturelli A. 1996).

3.4 Disk Implants

Over a 48 months period, 627 laterally inserted disk implants were placed in 72 consecutive patients with completely edentulous maxillae using an immediate loading protocol. The postrestorative follow-up of these patients ranged from 6 to 48 months. 98 % of the implants were radiologically and clinically osseointegrated (Scortecci G. 1999).

	0–1 years	1–2 years	2–3 years	3–4 years	4–5 years	Total
Tilted n MBL (mm)	40	25	24	17	11	
Mesial (SD) Distal (SD) Mean (SD)	0.51 (0.39) 0.64 (0.39) 0.57 (0.50)	0.31 (0.35) 0.26 (0.36) 0.29 (0.32)	0.21 (0.37) 0.17 (0.26) 0.19 (0.28)	0.09 (0.17) 0.06 (0.16) 0.08 (0.11)	0.07 (0.17) 0.09 (0.17) 0.08 (0.12)	1.19 1.22 1.21
Axial n MBL (mm)	53	32	28	16	12	
Mesial (SD) Distal (SD) Mean (SD)	0.43 (0.50) 0.43 (0.44) 0.43 (0.45)	0.20 (0.20) 0.22 (0.28) 0.23 (0.28)	0.10 (0.13) 0.14 (0.13) 0.12 (0.10)	0.06 (0.10) 0.06 (0.08) 0.06 (0.06)	0.06 (0.10) 0.11 (0.10) 0.08 (0.09)	0.85 0.96 0.92
Manova test	p > .40	p > .14	p > .14	p > .55	p > .86	

Table 7_Marginal bone loss of tilted and axial implants during follow-up.

Check-up	Tilted Implants	Axial Implants
At placement	-2.62 (-2.97)	-3.57 (-1.88)
First year	-3.54 (-1.47)	-4.05 (-1.54)
Second year	-4.25 (-1.15)	-4.37 (-1.10)
Third year	-4.38 (-1.10)	-4.36 (-1.19)
Fourth year	-4.76 (-1.20)	-5.10 (-0.74)
Fifth year	-4.73 (-1.27)	-5.00 (-0.85)

Table 8_Variations of mean Periotest (PTV) values of tilted and axial implants depending on time.

Bahat O 1992	72 impl.	21.4 mo	93%
Khayat P et al	65 impl.	48 mo	95%
Venturelli A 1996	29 impl.	12 mo	99.9%

Table 9_Safety and effectiveness of implantation in the maxillary tuberosity.

For the support I thank:

Prof Nabil Barakat , Lebanese University, Beirut, Lebanon

Dr Mazen Tamimi, Private Practice, Amman, Jordan

Dr Rainer Valentin, Private practice, Cologne, Germany

Dr Rolf and Martina Vollmer, Private practices, Wissen, Germany

The publication will be continued with Part II in the next magazine.

_contact implants

Dr Adel Chidiac
International Clinic
P.O. Box 6649 Salmiya
22077 Kuwait
E-Mail: adelchidiac10@hotmail.com

Safe and effective alternatives to sinus elevation in the atrophic posterior maxilla

Part II—A master thesis

Author_Dr Adel A Chidiac, Kuwait

_Maxillary sinus elevation and bone augmentation are acceptable techniques that may provide sufficient bone quantity and quality for implant support in the posterior atrophic maxilla (Wallace SS et al. 2003). Yet, given the morbidity risk plus cost and time consuming effects, these techniques are to be reconsidered. Simpler and safer protocols are therefore required for the posterior maxilla where bone resorption, deficient posterior alveolar ridge, and increased pneumatisation of the sinus all result in a minimal hard tissue bed thus render implant placement difficult (Frank R et al. 2005).

Part I of this publication reported about the aim of the master thesis and materials and methods. Part II follows up with the surgical techniques, discussion and conclusions avoiding a sinus lift procedure.

_Surgical techniques

Tilted implants

The standard procedure is to install the implant, totally covered with bone, in a vertical position. This requires the bone volume in the maxillary alveolar crest to be at least 10 mm vertically and 4 mm horizontally. The success rates of implant treatments as per such procedure are 95 to 99 % (Triplett RG et al. 2000). In case of less bone volume, bone grafting is one of several procedures to reach the required bone volume. An alternative, however, was presented for severely resorbed alveolar crest (Cl IV, V) in which im-

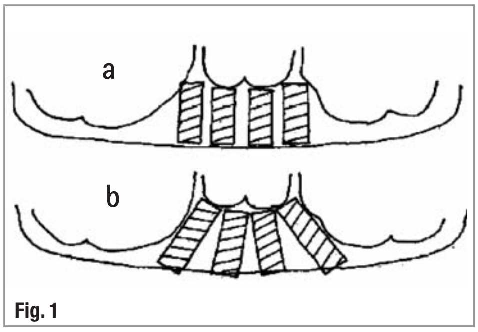

Fig. 1

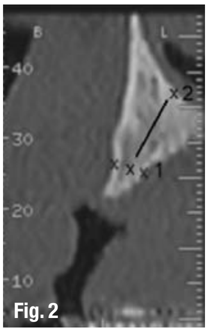

Fig. 2

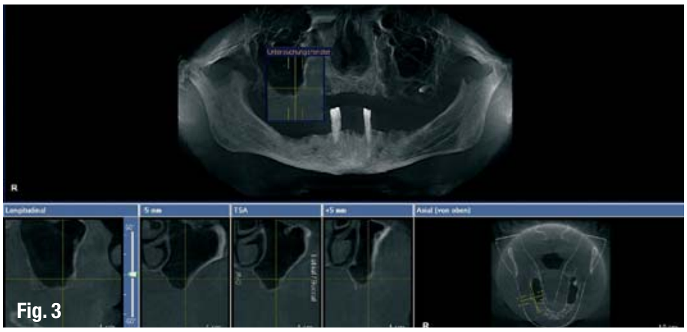

Fig. 3

Fig. 1_Diagram of implant insertion in the maxilla.
a_Conventional straight vertical position
b_Mesio-distal angulations of the implants permitting longer implants posterior as well as better distal support of the denture.

Fig. 2_Sagittal cross-section reconstructed perpendicular to the alveolar crest. From the 4-mm level (1), the distance to the bottom of the maxillary sinus and the nasal cavity (2) can be determined.

Fig. 3_Presurgical radiography.

Fig. 4a

Fig. 4b

Fig. 5

plants were placed without bone grafting (Mattsson T et al. 1999). Theoretically, tilted implants in the residual crestal bone lead to (Aparicio et al. 2001):

(a) Placement of longer implants that increases implant-to-bone contact area and implant primary stability;
(b) Longer distance between implants that allows the elimination of cantilevers in the prosthesis thus improving load distribution;
(c) Placement of implants in residual bone that avoids further complex techniques such as sinus lifting or bone grafting.

Clinically, the anatomy of the bone within the margins of the nasal cavity, the maxillary sinuses, and the alveolar crest margin all allow alternative mesio-distal angulations of implants. The height at the 4 mm width of an alveolar crest, being the measure to describe the available bone volume for total coverage of the implant, is often not enough for implant installation in severely resorbed maxillae.

Mesio-distal angulations of the implant thus provides better primary stability than conventional straight vertical positioning as it permits the use of a longer implant. A surgical technique was developed to make use of the maximum amount of available bone and to allow the installation of longer implants as indicated from computed tomography parasagittal reconstructions (Fig. 1; Mattsson T et al. 1999).

Mattsson et al. described a surgical technique to visualize the total amount of maxillary bone and to place posterior implants at a more than 30 degree angle to the horizontal plane. By this technique the fixed bridge can be extended to at least the first molar position without previous bone grafting.

Presurgical examinations include a panoramic radiograph. Yet, in most cases, the extension of the maxillary sinus or the nasal cavity and the volume and density of the remaining bone are evaluated by maxillary computed tomography (Fig. 2). The estimation of bone quantity and bone quality is based on presurgical radiography and computer aided planning (Figs. 3 & 4) as well as on the resistance of bone to drilling during surgery (Kerkmanov et al. 2000).

Significantly, tilted implants can be anchored in the bone pyramid anterior to the maxillary sinus where anatomic vital structures, such as arteries or nerves, are absent. Multiunit implantation thus allows the extension of prosthetic support posteriorly and reduces cantilever arms. The results of biomechanical analyses and animal study indicate that tilting implants has no adverse effect on bone resorption (Gotfredsen K et al. 2001).

This alternative is in fact less time-consuming for the patient and the dentist; scientific investigations support the concept of immediate and early function as a modern therapeutic option (Testori T et al. 2004). Table 1 shows different degrees of angulations

Number of implants per angulation

Inclination	15-30°	>30°
Mesiodistal	0	23
Distomesial	4	0

Table 1_Degrees of angulations of tilted implants.

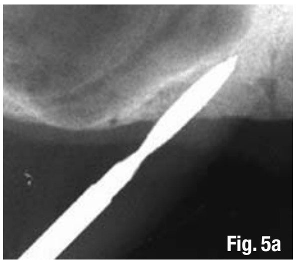

Fig. 5a

Fig. 4a_Presurgical computer aided planning (IMPLA 3D).
Fig. 4b_Presurgical soft tissue appearance (IMPLA 3D).
Fig. 5_Situation pre operation (Courtesy Dr R. & M. Vollmer).
Fig. 5a_Drilling of the titled implant site. Placing mesial axial implants before tilted ones. Intrasurgical radiographs or navigation are necessary to assess the precise drilling direction.
Fig. 5b_After the pilot drilling for the titled implant osteotomes are used for enlargement and final preparation of the implant site. First the axial implant was inserted.
Fig. 5c_Tilted implant insertion following the direction of the initial hole.
Fig. 5d_Tilted implant in site.
Fig. 5e_Radiograph after insertion.
Fig. 5f_Exposure and insertion of the abutments.
Fig. 5g_Final result.

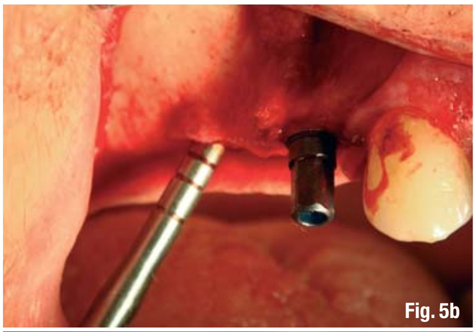

Fig. 5b

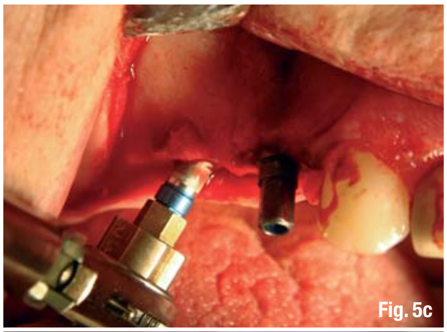

Fig. 5c

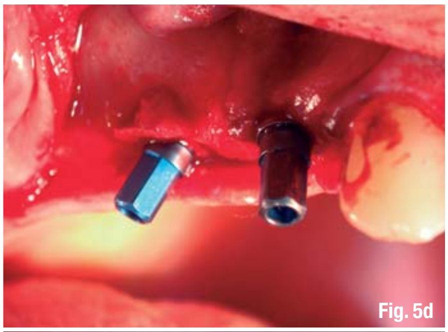

Fig. 5d

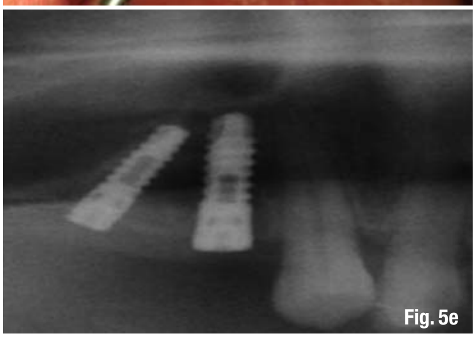

Fig. 5e

Fig. 5f

Fig. 5g

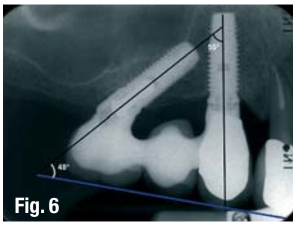
Fig. 6

Fig. 6_Surgical placement of an axial implant following the anterior wall of the maxillary sinus is shown. The mesial axial implant will be the guide for the orientation of the tilted implant.
Fig. 7_Implant inserted in the tuberosity.
Fig. 8_Situation pre surgery with a small sinus situation.
Fig. 9_Osteotomes.
Fig. 10_Modified osteotomes (Zepf) for bone harvesting and condensing.
Fig. 11a_Insertion of modified osteotomes (Zepf acc. to Vollmer and Valentin).
Fig. 11b_Implants in site (IMPLA 3D, Schütz).
Fig. 11c_Fixation of the angulated abutment.

of tilted implants. Figure 5 (Vollmer R et al. 2008, Calandiello R et al. 2005), and Figure 6 illustrate the insertion of tilted implants (Aparicio C et al. 2001).

Tuberosity implants

Recently the maxillary tuberosity region has been increasingly utilized in preprosthetic implantation surgery especially when sinus floor elevation and bone grafting are rejected by patients due to high cost, longer healing time and increased risk of intraoperative complications. Implants, however, can be inserted in the maxillary tuberosity region as an alternative to sinus floor elevation (Fig. 7; Regeev E et al. 1995).

Osteotomy during the implantation in the maxillary tuberosity is most likely performed by an expansive and bone condensing technique with almost no bone removal like in the clinical case (Figs. 8 & 11a–e). Such osteotomy is certainly achieved in Type D IV bone acc. to the C. E. Misch classification in the tuberosity by avoiding drilling and thus reducing complications mainly hemorrhage from the palatine artery (Fernandez V. 1997).


Fig. 10

Efficient in the maxillary tuberosity, Summers Osteotomes favor osseointegration by minimizing bone heating, dilating and compacting spongy bone, and maintaining the remaining maxillary bone (White GE 1993; Fig. 9). Summers osteotomes were modified to improve the access in the challenging areas through a double shaft design involving less pressure and less tension on the labial commissural. These modified osteotomes allow obtaining best handling of the implant receiving site (Fig. 10; Valentin, Vollmer & Vollmer, 2002). Figures 11a–e demonstrate the final clinical case (Courtesy of Dr R. Vollmer & Dr M. Vollmer and Dr R. Valentin).

Disk implants

Disk Implant or basal osseointegrated implant can be installed where the vertical bone supply is reduced. This applies to the posterior areas of the maxilla (Ihde S et al. 2004). The insertion of the disk-design implant is laterally performed. The technique is less invasive than bone grafting and allows a tricortical or multicortical anchorage (Bocklage R. 2001).

_Discussion

Short implants

Implantation in the atrophic posterior area of the maxilla is a challenge. The placement of short implants in this area is yet another alternative to sinus elevation and bone augmentation. The use of short implants (10 mm) has been a source of debate in the past decade. Some studies report higher failure rates with short implants; others report comparable results to longer implants (Buser D et al. 2000). Frequently affected by minimized bone volume, edentulous sites in the posterior maxilla prevent the placement of 10 mm implants without sinus augmentation. If shorter implants are used nevertheless, the need for more extensive sinus floor elevation is diminished and both treatment duration and morbidity are reduced (Toffler M. 2006).

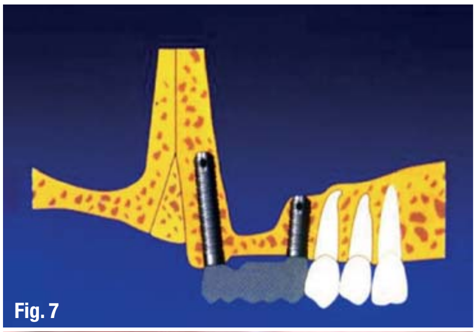
Fig. 7


Fig. 8


Fig. 9


Fig. 11a

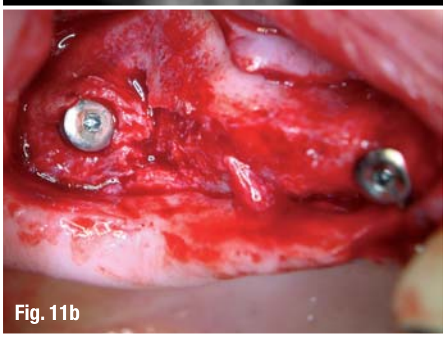
Fig. 11b


Fig. 11c

With the reduced amounts of bone, the use of long implants would be a difficult option. Although several studies in the literature have shown that short implants have risk factors therefore higher failure rate (Winkler S et al. 2005), the recent studies prove the good long term prognosis of short implants (Tawil G et al. 2006).

A review of the results displayed above show a range of success between 92 % and 96 % approximately. Failure rates were minimized by using the short implants due to several variables, including among others, change in implant design, splinting implants together, absence of cantilevers in the prosthesis, and additional methods to decrease stress to the implant interface. According to the same results, it is possible to use short implants to support fixed restorations in the atrophic posterior maxilla (Misch et al. 2006).

Implant sizes did not appear to compromise the effectiveness (Romeo E et al. 2006), and the short length was not associated with reduced survival rates (Arlin ML 2006). Researchers using finite elemental analysis (FEA) demonstrated that vertical and horizontal occlusal forces placed on implants were distributed primarily in the crestal bone rather than along the implant/bone interface. The group of Lum concludes that short implants serve as well as longer ones. Short implants show a survival rate exceeding five years and crestal bone level maintenance similar to longer implants. They can be successfully used in maxilla with limited bone length (Venuelo C et al. 2008).

Tilted implants

The results of applying the technique of using posterior tilted implants are comparable with the more resource demanding techniques applying bone grafting which often necessitates general anesthesia and hospitalization and could often lead to the following implications, including but not limited to, postoperative infection problems with the graft or maxillary sinusitis, host morbidity, lower implant success rates, and higher cost of treatment (Yerit KC et al. 2004). In fact, by tilting the posterior implants in the maxilla, the compromised bone of the sinus antrum could be circumvented with the clinical advantage of avoiding cantilever arms and using fewer implants (Calandriello R et al. 2005).

Mattsson et al. were the first to report well functioning fixed prostheses with no symptoms after treatment with the tilted implant technique (Annika R et al 2007). The success rate for the patients included in the study was 97%. Krekmanov et al also demonstrate that biomechanical measurements in tilting implants showed no negative effects on load

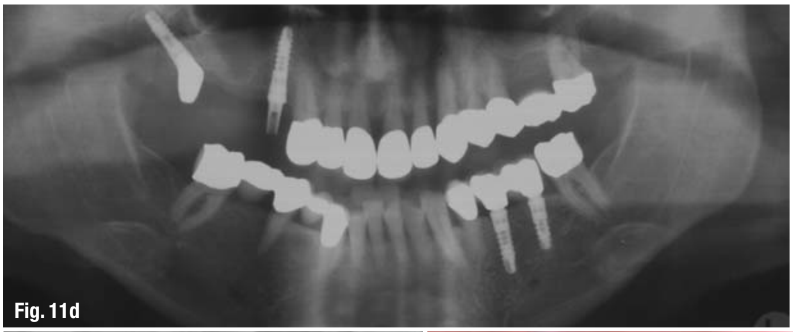
Fig. 11d


Fig. 11e


Fig. 12


Fig. 13

Fig. 11d_Situation post surgery. Perfect seating of the individually casted angulated abutment.
Fig. 11e_Final prosthetics.
Fig. 12_Disk Implant X-Ray. (Martin Schweppe 2007 Wikipedia).
Fig. 13_Lateral insertion of a disk implant.

distribution in fixed prosthetic constructions. The different follow up studies prove that patients with severely resorbed maxillae can be treated successfully with conventional implant treatment (Kerkmanow L et al. 2000).

Relatively easy to be applied, the implant tilting technique decreases the treatment time compared with bone grafting and more extensive procedures such as zygoma implants. The need for other more resource demanding techniques is sometimes overestimated. However, bone augmentation may be still necessary in case bone volume is severely limited (Annika R et al. 2007).

Tuberosity implants

The few studies on implantation in the tuberosity show high percentage of success rate on condition that strict protocols and careful handling are applied to preserve the soft bone in this area (Venturelli A 1996). In combination with tilting the implants the indications for this therapy concept even increase.

Disk implants

Despite the shortage of clinical studies in the literature, the use of disk implant may be an alternative to bone augmentation in both moderately and severely resorbed posterior maxillae. The initial multicortical anchorage provided by the disk-design implant, coupled with biomechanical splinting through a rigid prosthesis, permits a one stage predictable alternative offering rapid restoration of masticatory function (Scortecci G 1999).

_ Conclusion

The thesis highlights alternatives to sinus elevation and bone augmentation in the atrophic posterior maxilla. These alternatives prove to be (a) safer than, and (b) as effective as, maxillary sinus elevation and bone augmentation techniques. The overall results show high rate of success: 90 % and above.

Short implants, tilted implants and tuberosity implants involve mainly less morbidity and less invasive surgeries. Patients are likely to be less reluctant compared to sinus elevation and bone grafting. Disk implants are worth considering despite the more invasive procedure and the shortage of high level evidence based studies. Further data, however, are required to elaborate on the safety and effectiveness of this alternative.

Recently practiced, the three dimensional implant planning software for computed tomographic (CT) scan (e.g. Schütz IMPLA-3D Navigation; Merli M et al. 2008) is becoming of benefit as it may help evaluate the exact remaining bone in the maxilla. Such planning allows the application of the most convenient implant like f short implant, tilted implant or tuberosity implant or a combination of both. Interestingly, to avoid a sinus elevation and bone augmentation to the most possible, the examined alternatives in this thesis may be applied in sole or in either combination to rehabilitate the posterior atrophic maxilla.

I would like to thank:

Prof. Nabil Barakat , Lebanese University, Beirut, Lebanon; Dr. Mazen Tamimi, Private Practice, Amman, Jordan; Dr. Rainer Valentin, Private practice, Cologne, Germany; Dr. R. & M. Vollmer, Private practices, Wissen, Germany, for their support._

Editorial note: The literature list can be requested from the author.

_contact implants

Dr Adel Chidiac
International Clinic
P.O. Box 6649 Salmiya
22077 Kuwait
E-Mail: adelchidiac10@hotmail.com