Success rate and bone loss of immediately loaded
tilted long implants: an up to 1.5 y follow-upRodrigues Pedro¹, Cardoso Jorge André²,
Pimenta Joao³, Veksler Ruth⁴¹. Private practice, Braga, Portugal, ². Private practice, Espinho, Portugal,
³. Private practice, Barcelos, Portugal, ⁴. R & D Dpt , MIS, Israel

Abstract

Background

The All-on-4 protocol to rehabilitate edentulous jaws is a procedure in which 4 implants are placed in the anterior jaw. The two medial implants are straight and the 2 distal ones are tilted; tilted implants can be as long as 18-20 mm. Beyond the scope of pterygoidic and zygomatic implants, the fate of ≥ 18 mm long tilted implants (LTI) has been scarcely addressed with regard to implant failure due to bone overheating and specific features of marginal bone loss related to the crestal position.

Aim

Objective was to document the success rate and radiographic outcomes of long tilted implants used in an All-on-4 protocol in private practice. Specific bone loss features of long tilted implants were compared to tilted and straight 10-16 mm long (STD) implants when placed crestally and subcrestally.

Material and Methods

In a single private practice, 234 SEVEN (MIS) implants were placed in 36 maxillae and 22 mandibles of 36 edentulous patients (21 women, 15 men, mean 57.1y) using the All-on-4 MULTIFIX protocol; 146 were inserted in the maxilla. Implants were 70 LTIs (66 in max, 4 in mand), 46 tilted and 113 straight STD implants. All received a per-operative multi-unit abutment (MUA); bone profiling was done at 174 sites. 36 straight implants and the distal side of 112 angulated MUAs were placed subcrestally. Implants were loaded within 3-5h with a screw-retained full-arch prosthesis. Radiographic data were recorded post-op (baseline) and at the 1y and 1.5y follow-up. Crestal bone loss (CBL) was measured on both sides from panoramic radiographs using the Image J software with internal calibration. Success rate and CBL were compared for LTIs vs. angulated STDs vs. straight STDs. Bone features specific to the distal side of angulated MUAs in subcrestal position vs. the mesial side were also recorded.

Results

All patients passed the 1y control, 13 pat / 20 prosth / 80 imp passed the 1.5 year control. No implant failed; overall success rate was 97.9% (5 imp. with CBL ≥ 1.2 mm on both sides). Success rate of straight and tilted implants was 96.6% and 99.1%. At bone profiled sites bone remained slightly away from the machined MUA surface; it migrated apically down to the neck level; the same applied to the distal side of angulated MUAs. A bone densification (BD) feature was observed at straight and tilted implants; at tilted implants BD happened only on the distal side. In the mandible, BD frequency was 25.0% (11/44) for tilted and 2.3% (1/44) for straight; in the maxilla, it was 38.9% (28/72) for the tilted and 6.8% (5/74) for the straight. Mean CBL of straight vs. tilted implants was 0.28 ± 0.51 mm vs. 0.28 ± 0.54 mm. Mean CBL of LTI vs. tilted STD was 0.25 ± 0.5 3mm vs. 0.32 ± 0.56 mm. At tilted implants, mean CBL mesial side vs. distal was 0.39 ± 0.60 vs. 0.17 ± 0.46 mm. 75.4% of implant sides had a 0-0.5 mm CBL.

Conclusion and Clinical implications

The All-on-4 MULTIFIX protocol with SEVEN implants in the maxilla was as predictable as in the mandible. Overall success rate was 97.9%; it was 96.6% for the straight implants and 99.1% for the tilted ones. Overheating during placement of long tilted implants was not a concern. Bone densification at the distal sides of the tilted implants was more frequent (38.9%) in the maxilla than in the mandible (25.0%). CBL was similar for straight and tilted implants, and for LTIs and tilted STDs.

Methods and Materials(Cont.)

Radiography of an All-on-Four case in the maxilla with its temporary prosthesis. Note the straight and the tilted implants, the standard and the long implants.

Results

Bone densification pattern at the distal side of the tilted implants. Left at placement, right at the 1-year control.

Bone loss pattern at submerged distal sides of the tilted implants. Left at placement, right at the 1-year control.

	straight (n=118)	tilted (n=116)
	mean	mean
Mesial	0.29 ± 0.50 (-0.25; 2.10)	0.39 ± 0.60 (-0.46; 3.15)
Distal	0.27 ± 0.53 (-0.35; 2.63)	0.17 ± 0.46 (0; 2.98)
Mean	0.28 ± 0.51 (-0.35; 2.63)	0.28 ± 0.54 (-0.46; 3.15)

Crestal bone loss (mm) measured at straight and tilted implants.

	standard (n=46)	long (n=70)
	mean	mean
Mesial	0.44 ± 0.63 (-0.18; 3.15)	0.35 ± 0.59 (-0.46; 2.08)
Distal	0.21 ± 0.46 (0; 1.80)	0.15 ± 0.45 (0; 2.98)
Mean	0.32 ± 0.56 (-0.18; 3.15)	0.25 ± 0.53 (-0.46; 2.98)

Crestal bone loss (mm) measured at tilted implants, standard and long ones.

Interval (mm)	mesial	distal	percentage (%)
0-0.5 mm	161	192	75.4
0.5-1.2 mm	50	26	16.2
> 1.2 mm	23	16	8.3
			100%

Frequency of bone loss on mesial and distal sides.

Background and Aim

The All-on-4 protocol to rehabilitate edentulous jaws is a procedure in which 4 implants are placed in the anterior jaw. The two medial implants are straight and the 2 distal ones are tilted; tilted implants can be as long as 18-20 mm. Beyond the scope of pterygoidic and zygomatic implants, **the fate of ≥ 18 mm long tilted implants (LTI) has been scarcely addressed with regard to implant failure due to bone overheating and specific features of marginal bone loss related to the crestal position.**

Objective was to document the success rate and radiographic outcomes of long tilted implants used in an All-on-4 protocol in private practice. **Specific bone loss features of long tilted implants were compared to tilted and straight 10-16 mm long (STD) implants when placed crestally and subcrestally.**

Methods and Materials

In a single private practice, 234 SEVEN (MIS) implants were placed in 36 maxillae and 22 mandibles of 36 edentulous patients (21 women, 15 men, mean 57.1 years) using the All-on-4 MULTIFIX protocol; 146 were inserted in the maxilla. Implants were 70 LTIs (66 in Max, 4 in Mand), 46 tilted and 113 straight STD implants. All received a per-operative multi-unit abutment (MUA); bone profiling was done at 174 sites. 36 straight implants and the distal side of 112 angulated MUAs were placed subcrestally. Implants were loaded within 3-5h with a screw-retained full-arch prosthesis. Radiographic data were recorded post-op (baseline) and at the 1 year and 1.5 year follow-up. Crestal bone loss (CBL) was measured on both sides from panoramic radiographs using the Image J software with internal calibration. **Success rate and CBL were compared for LTIs vs. angulated STDs vs. straight STDs. Bone features specific to the distal side of angulated MUAs in subcrestal position vs. the mesial side were also recorded.**

Results

All-on-Four protocol in the mandible and the maxilla. Left at implant placement, Right at the 1-year control with the final prosthesis.

Time interval (months)	Implants at interval start	Drop-out during interval	Failures during interval	Implants with CBL ≥ 1.2 mm on both sides	Survival rate on interval (%)	Success rate on interval (%)	Cumulative success rate (%)
0-12	234	0	0	0	100	100.00	100.00
12-24	234	0	0	5	100	97.86	97.86

2-year Life time analysis (LTA) of all implants.

	Standard	Long	Axial	Tilted
Number of implants with CBL ≥ 1.2 mm on both sides	4	1	4	1
Success rate (%)	97.48	98.67	96.61	99.14

Success rate of straight and tilted implants, standard and long ones.

Conclusion

The All-on-4 MULTIFIX protocol with SEVEN implants in the maxilla was as predictable as in the mandible. Overall success rate was 97.9%; it was 96.6% for the straight implants and 99.1% for the tilted ones. **Overheating during placement of long (18-20mm) tilted implants was not a concern.** Bone densification at the distal sides of the tilted implants was more frequent (38.9%) in the maxilla than in the mandible (25.0%). **CBL was similar for straight and tilted implants, and for LTIs and tilted STDs.**

References

- Bruschi E, Manicone PF, De Angelis P, Papetti L, Pastorino R, d'Addona. Comparison of marginal bone loss around axial and tilted implants: a retrospective CBCT analysis of up to 24 months. Int J Periodontics Restorative Dent. 2019;39:675-684.
- Krekmanov L, Kahn M, Rangert B, Lindstrom H. Tilting of posterior mandibular and maxillary implants for improved prosthesis support. Int J Oral Maxillofac Implants. 2000;15:405-414.
- Lin WS, Eckert SE. Clinical performance of intentionally tilted implants versus axially positioned implants: A systematic review. Clin Oral Implants Res. 2018;29 Suppl 16:78-105.
- Maló P, de Araújo Nobre M, Lopes A, Ferro A, Nunes M. The All-on-4 concept for full-arch rehabilitation of the edentulous maxillae: a longitudinal study with 5-13 years of follow-up. Clin Implant Dent Relat Res. 2019;21:538-549.