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Bone remodeling around a conical connection implant system using a short drilling protocol

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Introduction

Since the development of the classic drilling protocol, implant osteotomies are performed with approx. 5 drills, with a drill diameter starting from 2mm. Many studies[1,2,3,4] show temperature alterations in bone during the osteotomy. Therefore it is suggested that the increase in drill diameter should be small. Other studies refer to temperature being connected with drill design, pressure and speed during the osteotomy[5].

Aim

The aim of this study was to optimize a short drilling technique that will not produce changes at the periimplant level. In this study a reduced number of drills,with a final one of special design will be evaluated in order to obtain similar or better results compared to the standard drilling protocol.

Materials and Methods

The study included 32 C1 MIS implants with diameter of 4.2mm and the length ranged between 10mm and 11,5mm. All implants were inserted in pairs in mandibular free end situations, in consolidated bone. All patients were non-smokers.
The mesial implant was inserted with the standard drilling protocol, meaning: round bur, pilot drill with integrated stopper, 3,2mm drill, 3,8mm and final single use drill. The distal implant was inserted with the short protocol drilling sequence: round bur, pilot drill with integrated stopper and final single use drill (Fig. 2).

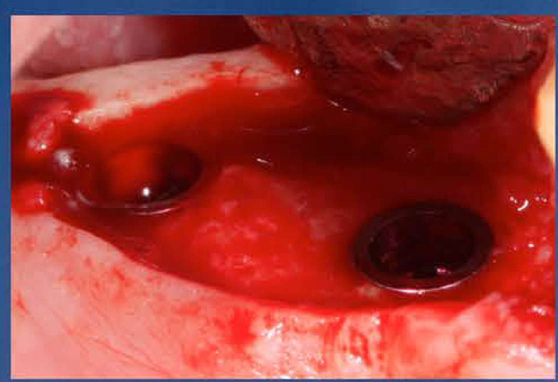

Fig. 1 Implant insertion phase

Fig. 2. Comparing the drills used for preparing the implant socket in standard drill protocol and short drill protocol

Rough calculations of the bone volume that can be accumulated in the grooves of the drills showed that the final single use drill can accommodate approx. 46mm^3 of bone while a standard 3,2mm and 3,8mm drill can accommodate only 36,11mm^3 of bone over the length of 11,5mm.
After insertion, all implants received healing screws. Impressions were taken 3 month after the surgical phase.

Fig. 3. Surgical phase, healing phase, impression phase, restorative phase

The analyze for bone reshaping was accomplished radiographically at insertion, at 3 months, 6 months and one year after insertion. The retro-alveolar radiographies were analyzed using software Image J 1.46r.
Each radiographic image was calibrated at a 1:1 scale knowing the length in mm for the implants, from the platform level to its apex (Fig. 4).
Bone loss was measured in mm distally for every implant. The measurement was carried out from the implant platform to the bone level, keeping in mind that each implant was placed at the crestal level (Fig. 5). Each radiographic image was analyzed as mentioned before.

Fig. 4. Calibration in mm using the software Image J.

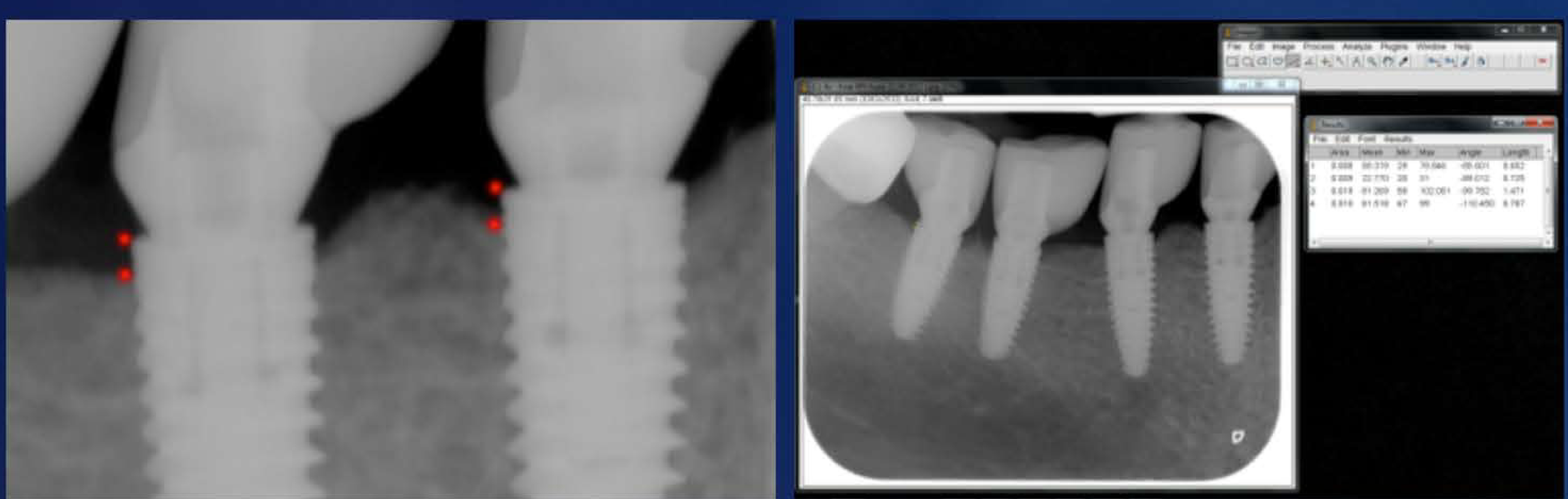

Fig. 5. Measurements. of the distances from the implant platform to the bone level were marked with red dots on the distal side of the implant images analyzed with the Image J software.

Results

The combined effects of implant insertion with standard protocol and short drill protocol on equivalent stain distribution are presented in Tab. 1.

Tab. 1. Differences in mm at the crestal bone level at 3, 6 and 12 months with classical protocol and short drill protocol.

	Name	Implant diameter	Surgical phase	3 mounts		6 mounts		12 mounts		Mean	
				C	S	C	S	C	S	C	S
1.	C. I.	2 x 4.20/11.50	09.02.2012	0.75	0.88	0.95	0.80	0.88	0.84	0.86	0.84
2.	C. I.	4 x 4.20/10	19.02.2012	0.95	0.42	1.22	0.73	1.12	0.87	1.09	0.67
3.	C. C.	4 x 4.20/11.5	23.12.2011	1.21	1.75	1.79	1.93	1.81	1.85	1.60	1.84
4.	I. A.	4 x 4.20/11.50	01.11.2011	1.04	0.75	1.34	1.22	1.55	1.30	1.31	1.09
5.	I. M.	2 x 4.20/11.50	10.02.2012	1.02	0.85	1.28	0.95	1.20	1.10	1.16	0.96
6.	I. M.	2 x 4.20/10	10.02.2012	0.75	0.63	0.86	0.79	0.80	0.67	0.80	0.69
7.	P. V.	2 x 4.20/10	24.11.2011	0.87	0.37	0.95	0.55	1.10	0.87	0.97	0.59
8.	P. I.	4 x 4.20/10	08.11.2011	0.42	0.56	0.44	0.71	0.26	0,44	0.37	0.63
9.	P. I.	2 x 4.20/10	08.11.2011	0.39	0.59	0.43	1.08	0.47	1.23	0.43	0.96
10.	S. M.	2 x 4.20/10	05.12.2011	0.65	0.56	0.77	0.84	0.88	0.99	0.76	0.79
11.	S. D.	2 x 4.20/10	14.02.2012	0.96	0.62	0.56	1.25	0.69	0.54	0.73	0.80
12.	T. T.	2 x 4.20/11.50	27.01.2012	1.03	0.96	1.30	1.03	1.48	1.20	1.27	1.06
Total mean C vs. S										0.94	0.91

From the total of 12 patients included in this clinical investigation, 9 were men and 3 women, with ages ranging from 34 and 64, with a mean of 52,5 years old. There were no significant differences between women and men regarding the bone loss (Fig. 6).

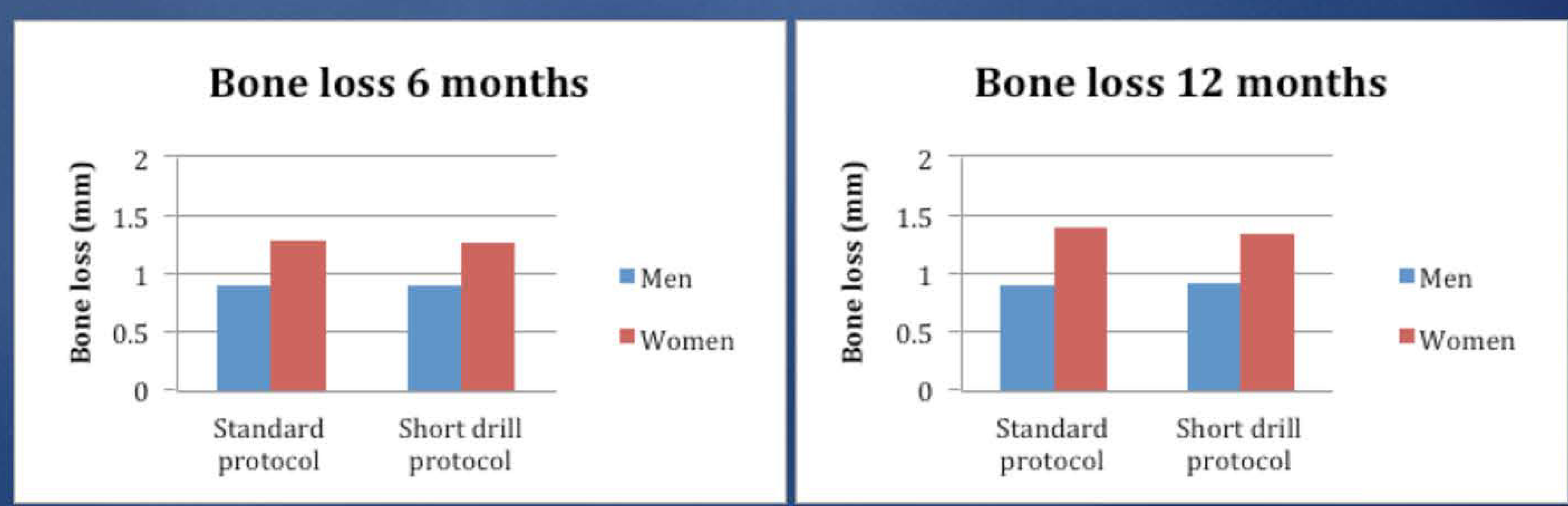

Fig. 6. Comparing the bone loss between men and women at 3 month and at 6 month after loading with final restoration.

The study was conducted over o period of one year and all the implants were osteointegrated and the survival rate of the examined implants was 100% for both test and control sites.
The mean values of crestal bone loss at time of the insertion of the final restoration were 0.94mm for the standard protocol and 0.91mm with short drill protocol. The two-tailed test indicated that between the two drilling protocols there were no statistically significant differences.
Following our research it was determined that the drilling time was reduced up to 50%, without any significant differences between the bone reshaping for the two protocols. The final precalibrated single use drill, found together with the implant, is fine cutting and doesn't create pressures or heat at the bone level. Due to the guiding marks of the final drill the drilling depth is correspondent for each implant.

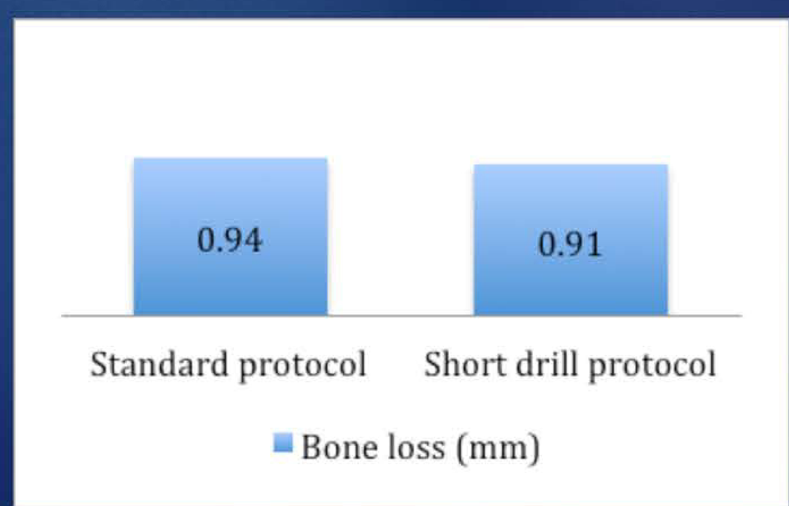

Fig. 7. Difference between standard and short drill protocol

Conclusions

Short drill protocol seems to limit crestal bone remodeling same as standard techniques. This may be especially beneficial when is need to insert more implants and the operator time is reduced more than 50%, reducing also the healing process. By using the single use sharp final drill with the short drilling technique the overheating is limited therefore the bone loss is minimum.

References:

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