

Non-surgical treatment of peri-implant pathology.

**de Araújo Nobre M[‡]*, Capelas C*, Alves A*, Almeida T*, Carvalho R*,
Antunes E*, Oliveira D*, Cardador A*, Maló P⁺.**

Abstract

Introduction: Peri-implant pathologies consist in an inflammatory process affecting the soft and hard tissues surrounding the implants. Chlorhexidine is considered the gold standard antiseptic, with a large variety of choice in administration. In this study, it is described the protocol for irrigation of peri-implant pockets with a chlorhexidine gel, using a plastic needle for the delivery of the product into the peri-implant pockets.

Study participants and methods: Nine patients with at least 1 implant presenting peri-implant pathology (inflamed soft tissue associated with bone loss around the implant) were enrolled in this prospective clinical study, and followed for 1 year, where clinical parameters such as modified plaque index, modified bleeding index, probing pocket depths, attachment levels were assessed at baseline, 1 month, and 1 year after implementation of the treatment protocol.

Results: Treatment success was achieved in 8 of the 9 patients (and in 11 of the 13 patients) according to the success criteria adopted by the authors of this study.

Discussion: Infection control lies at the heart of peri-implant treatment. The control of three factors such as optimal diagnosis, removal of the etiologic factor of the disease (proper removal of debris and decontamination of the peri-implant sulcus/pocket) and a good patient's oral hygiene self-care represent the key to success, resulting in good treatment outcomes when managing peri-implant pathologies. The protocol used (irrigation of peri-implant pockets with chlorhexidine gel delivered by a plastic needle) is considered to be of utility.

Keywords:

Chlorhexidine, chlorhexidine gel, implants, peri-implant pathology, oral hygiene.

Correspondence: DH Miguel de Araújo Nobre;
Clinica Malo, Clinical Dental Research Department;
Av. Dos Combatentes, N° 43, 9° C, Edificio Green Park, 1600-042, Lisbon, Portugal.
(Phone: +351 217 228 100; fax: +351 217 266 965; e-mail: clin.res.dep@clinicamalo.pt .

[‡] Department of Clinical Dental Research – Maló Clinic – Lisbon, Portugal

* Department of Oral Hygiene – Maló Clinic – Lisbon, Portugal

+ Department of Implantology- Maló Clinic- Lisbon, Portugal

Introduction

Peri-implant pathology consists in an inflammatory process affecting the soft and hard tissues surrounding the implant, resulting in rapid loss of supporting bone associated with bleeding and suppuration (1), since the peri-implant connective tissue is a less effective barrier than the same tissue around the tooth (2). The use of chlorhexidine is very well documented, especially in the treatment of periodontitis. Chlorhexidine can inhibit the formation of dental plaque through immediate bactericidal effect, prolonged bacteriostatic effect by surface bound chlorhexidine, blockage of the acidic groups from the salivary glycoprotein's that form the pellicle, binding to the bacterial surface in sub lethal amounts so that initial adhesion to the surfaces is inhibited and disturbing the plaque formation by precipitation of agglutination factors in saliva and by displacing calcium from the plaque matrix (3).

In an *in vitro* study, 0.2%, 1 and 2% chlorhexidine concentrations took 15 seconds to neutralize Gram – strict anaerobic microorganism cultures (*Porphyromona gingivalis* and *Prevotella intermedia*), and 10 minutes to neutralize *Staphylococcus aureus* (4),

The combined use of chlorhexidine together with mechanical treatment produces good results when treating periodontal disease (6-14), as well as in the treatment of implants (15,16). The variety of choice in the administration of this antimicrobial varies from mouthwash [usually, with the objective of a more general control of the microbial activity; or for irrigation (17)], to gel or spray (with the objective of a more localized action) (5).

With the constant development in this field, we arrived to the new generation of chlorhexidine gels, more bio adhesive, and this way, enlarging its action.

The definitive version of this article can be purchased at www.blackwellpublishing.com
Int J Dent Hyg 2006; 4:84-90

In the same way, the needle for irrigation represents an important issue for both the patient's comfort and the efficacy in administering the chlorhexidine, since it has the potential of provoking mechanical trauma to the patient (18), resulting in discomfort, pain, less compliance, and this way, in less efficacy of the treatment.

Several studies demonstrated success in treating of peri-implant pathologies through a non-surgical approach (19, 20, 21).

The aim of this study was to test the effect of a protocol for irrigating peri-implant pockets on peri-implant pathologies using a bio adhesive gel and a plastic needle, evaluating clinical parameters. The hypothesis tested was the improvement of clinical parameters included in the implant success criteria.

Study participants and methods

This prospective clinical study was performed in a private clinic, Clinica Maló, in Lisbon, Portugal, and included 9 treated patients (mean age 57 yr, range 45-77 years), 8 males and 1 female, divergent systemic conditions (2 smokers, 2 diabetic patients and 2 patients suffering from angina) with 13 implants supporting 9 prostheses. The first patient was treated in June 2003, and the last in October 2003, being the patients followed for at least 1 year post-treatment. All patients had their implants placed according to an immediate function protocol (22, 23) and were osseointegrated and in function over at least 1 year.

The patients were included in the study provided that they had at least one implant respecting the following inclusion criteria: Peri-implant pockets of ≥ 5 mm; bleeding on probing; absence of implant clinical mobility; bone loss between the coronal and the medium 1/3 of the implant; and signed written informed consent to participate in the study.

The definitive version of this article can be purchased at www.blackwellpublishing.com
Int J Dent Hyg 2006; 4:84-90

Before enrolling the patients for this study, a thorough evaluation of the prosthesis was made, to check the patient's occlusion or for any problems with the design of the prosthesis that could influence the patient's oral hygiene.

Clinical parameters evaluated:

Marginal bone loss read from periapical radiographs (taken at the diagnosis appointment); Modified plaque index (mPII) (24); Modified bleeding index (mBI) (24); Probing pocket depth (PPD) (25); Distance between implant shoulder and mucosal margin (DIM) assessed to the nearest mm (in the presence of a subgingival implant shoulder, the measurement was recorded as a negative value) (25); Attachment level (AL) (computed for each site by adding PPD and DIM) (25); Suppuration (Supp) (26) registered as present or absent; Mobility (25) (assessed manually, and registered as present or absent (25); Needle tolerance (assessed by statement from the patient after irrigation).

Criteria of success:

The criteria of success implemented in this study, determined that after the implementation of the protocol, the implants should have: mBI=0; PPD \leq 4mm; improvement of the attachment level; no suppuration; no mobility.

All the diagnostic indexes were taken before implementing the protocol. After baseline indexes, removal of dental plaque/calculus was performed in the infected sites. The irrigation with chlorhexidine gel followed, and was repeated after 2 weeks. For self-care, the patient received dental hygiene instructions to brush with a chlorhexidine gel and a soft tooth-brush.

The definitive version of this article can be purchased at www.blackwellpublishing.com
Int J Dent Hyg 2006; 4:84-90

One month later all indexes were re-evaluated, to check if the implants respected the success criteria. One year later, the clinical indexes were once again evaluated, to follow-up the patient's oral hygiene and the implant's clinical stability.

To analyse the possible differences between the indexes, the data collected was organized in a matrix, and analysed statistically on the patient level using the Wilcoxon Signed Ranks Test (software SPSS for Windows V.11.5).

Irrigation protocol

A clinical case is presented in Fig.1-7.

The protocol for irrigation of the peri-implant pockets used a chlorhexidine 0.2% gel (Clorohexidina Lacer[®], Barcelona-Spain), a plastic disposable syringe (Plastipak[®]-15ml, Lisbon, Portugal) and a plastic needle (Capillary[®] tip, Ultradent[®] - Salt Lake City, USA) of 0.4mm of diameter (27G) attached to the syringe.

The area was isolated and dried, before the technique is applied. The gel was placed into the syringe, and compacted into its lower portion without attaching the needle, so the air could be released from the inside. After this procedure, the needle was attached to the syringe.

For irrigation, the peri-implant pocket was first gently air-dried, the needle was positioned inside the full length of the pocket, and then the syringe was pressed, so that the entire pocket was filled with the chlorhexidine gel. A slight movement from coronal-apical-coronal was applied to better administrate the chlorhexidine gel. After visualizing the gel pouring out of the pocket, the pressure in the syringe was stopped, and the needle was removed from the peri-implant pocket.

The definitive version of this article can be purchased at www.blackwellpublishing.com
Int J Dent Hyg 2006; 4:84-90

This procedure was repeated in all peri-implant pockets enrolled in the study. After the irrigation, the patient was instructed not to eat, drink or rinse for at least half-an-hour, so the gel could remain in the pocket for the longest time possible.

Results

At baseline, the mPII ranged from 1 to 3 (mean=2.2); the mBI ranged from 2 to 3 (mean=2.4); the PPD ranged from 5 to 7mm (mean=5.2mm); DIM ranged between -7 to 4mm (mean= -0.7mm); AL ranged from -2 to 9mm (mean=4.5mm); 5 of the 13 implants presented Supp; 4 of the 13 implants presented bone loss to the medium third of the implant, whereas 9 implants presented bone loss in the coronal third of the implant (table 1). One month later, the large majority of the implants presented significant changes in the clinical parameters which are presented in Table 2. The mPII ranged from 0 to 3 (mean= 1.2); the mBI ranged from 0 to 2 (mean= 0.3); the PPD values ranged from 3 to 5mm (mean=3.5mm); the DIM ranged from -3 to 4mm (mean= -0.1mm); the AL ranged from 0 to 8mm (mean=3.5); no suppuration was observed in any implant. There were 2 implants in one patient that did not respond positively to the protocol, being classified as non successful. For the 2 implants that did not meet the success criteria, surgical treatment was referred.

Taking into consideration that these 2 implants didn't meet the success criteria, and analysing the clinical parameters for the remaining 11 implants, the results are as follows: mPII ranged from 0 to 1 (mean=0.8); mBI was 0; PPD ranged from 3 to 4mm (mean= 3.4mm); DIM ranged from -3 to 4mm (mean= -0.6mm); AL ranged from 0 to 8mm (mean=2.7mm).

The definitive version of this article can be purchased at www.blackwellpublishing.com
Int J Dent Hyg 2006; 4:84-90

The plastic needle was well tolerated by the patients, whose statements following the irrigation ranged from “not feeling the needle” to “slight discomfort”.

After 1 year, the clinical parameters were measured again (Table 3): mPII ranged from 1 to 2 (mean=1.3); mBI ranged from 0 to 2 (mean=0.6); PPD ranged from 3 to 4mm (mean=3.5mm); DIM ranged from -4 to 4mm (mean= -0.6mm); AL ranged from 0 to 8mm (mean=2.8mm). The mean changes between baseline, post-treatment diagnosis and 1 year of follow-up are outlined on table 4.

Discussion

The treatment of peri-implant pathology is challenging due to the specific anatomical characteristics of the implants.

Infection control lies at the heart of peri-implant treatment. The control of optimal diagnosis, removal of the etiologic factor of the disease (proper removal of deposits and decontamination of the peri-implant sulcus/pocket) and good patient's oral hygiene self-care represent the key to success, resulting in good treatment outcomes when managing peri-implant pathologies.

A correct diagnosis allows not only for a correct classification of the problem faced, but also for a risk analysis assessment of the patient's oral health (27). When baseline indexes were taken, all patients enrolled in the study had implants with clinical and radiological signs of peri-implant pathology. In this study, we aimed to investigate the efficacy of the proposed protocol.

From the results on the mPII, one can conclude that the patient's oral hygiene still plays a major role in the development of the treatment, because without the proper debris removal,

The definitive version of this article can be purchased at www.blackwellpublishing.com
Int J Dent Hyg 2006; 4:84-90

the etiological cause of the disease will persist, not allowing the tissue to heal, and therefore no benefit can be achieved with any protocol (28-30). In this study the mPII decreased between the pre-treatment and post-treatment diagnosis, due to a better self care performed by the patient.

The peri-implant mucosa health can be best examined by the gingival or bleeding indexes (25). In this study, the reduction of mBI and PPD are clear indicators of disease control. Also AL decreased between baseline and post-treatment. Taking into consideration that DIM did not differ significantly between baseline and post-treatment, means that the changes in AL were due to the reduction of peri-implant pockets and gingival inflammation.

Regarding the hypothesis tested in this study through the application of this protocol, we managed to confirm it on 8 of the 9 patients (and 11 of the 13 implants), representing a good result in treating the compromised implant with an easy to use protocol. The 2 implants that did not respond to treatment were from one patient, which clearly indicates that the success is very much patient related. The patient in question presented osteoporosis and was a heavy smoker, and one can only put the hypothesis about the possible interference of these factors in the treatment outcome. However, the mPII remained the same, indicating that the patient was unable to perform the correct oral hygiene self-care, leading to persistency of the etiological factor (dental plaque), and this way introducing another variable to the treatment outcome.

The results obtained with this approach are comparable to other studies, where the combined use of chlorhexidine with mechanical treatment produced good results when treating peri-implant infections (15, 16, 19, 20, 21, 31).

The definitive version of this article can be purchased at www.blackwellpublishing.com
Int J Dent Hyg 2006; 4:84-90

The clinical indexes after 1 year of follow-up tend to approach but stabilize below those of the pre-treatment diagnosis (Table 4), being in agreement with other studies on peri-implant pathology treatment (31).

The plastic needle used in this irrigation protocol was well tolerated by patients and therefore, increased its efficacy when irrigating peri-implant pockets, unlike metal irrigation needles, which have the potential of causing mechanical trauma (21).

Chlorhexidine, with its long-acting antimicrobial and substantivity properties, plays an important role in this process (32-34), and therefore by keeping the chlorhexidine inside the pocket for a longer period, it is possible to increase its efficacy in the treatment of peri-implant pathologies, in a similar way as in periodontal treatment (8, 11, 35-39).

Large randomized controlled trials are needed to further study the effect of local antimicrobials on bacteria present in the peri-implant pocket when managing peri-implant pathology.

Acknowledgements

The authors would like to acknowledge the outstanding team work performed by the professionals at the Maló Clinic.

The definitive version of this article can be purchased at www.blackwellpublishing.com
Int J Dent Hyg 2006; 4:84-90

References

1. Romeo E, Ghisolfi M, Carmagnola D. Peri-implant diseases. A systematic review of the literature. *Minerva Stomatol* 2004 (May): 53(5):215-30.
2. Forma N, Burlui V, Luca IC, Indrei A. Peri-implantitis. *Rev Med Chir Soc Med Nat Iasi* 1998 (Jul-Dec): 102 (3-4): 74-9.
3. Quirynen M, Avontroodt P, Peeters W, Pauwels M, Coucke W, Van Steenberghe D. Effect of different chlorhexidine formulations in mouthrinses on de novo plaque formation. *J Clin Periodontol* 2001; 28: 1127-1136.
4. Vianna ME, Gomes BP, Berber VB, Zaia AA, Ferraz CC, Souza-Filho FJ. In vitro evaluation of the antimicrobial activity of chlorhexidine and sodium hypochlorite. *Oral Surgery Oral Medicine Oral Pathology* 2004 (Jan): 97 (1): 79-84.
5. Martens L, Marks L, Kint J. The use of chlorhexidine as a preventive and therapeutic means of plaque control in the handicapped. Review of the literature and definitive advice for application. *Rev Belge Med Dent* 1997; 52 (2):27-37.

The definitive version of this article can be purchased at www.blackwellpublishing.com
Int J Dent Hyg 2006; 4:84-90

6. Hoffmann T, Bruhn G, Richter S, Netuschil S, Brex M. Clinical controlled study on plaque and gingivitis reduction under long-term use of low-dose chlorhexidine solutions in a population exhibiting good oral hygiene. *Clinical Oral Investigations* 2001 (Jun): 5 (2), 89-95.
7. Vinholis AH, Figueiredo LC, Marcantonio Junior E, Marcantonio RA, Salvador SL, Goissis G. Subgingival utilization of a 1% chlorhexidine collagen gel for the treatment of periodontal pockets. A clinical and microbiological study. *Brazilian Dental Journal* 2001: 12 (3).
8. Jeffcoat MJ, Palcanis KG, Weatherford TW, Reese M, Geurs NC. Use of a Biodegradable Chlorhexidine Chip in the Treatment of Adult Periodontitis: Clinical and Radiographic Findings. *Journal of Periodontology* 2000 (Feb): 71 (2): 256-262.
9. Newman MG, Sanz M, Nachnani S, Saltini C, Anderson L. Effect of 0.12% chlorhexidine on bacterial recolonization following periodontal surgery. *Journal of Periodontology* 1989: 60: 577-581.
10. Eren K, Ozmeriço N, Sardas S. Monitoring of buccal epithelial cells by alkaline comet assay (single cell gel electrophoresis technique) in cytogenetic evaluation of chlorhexidine. *Clinical Oral Investigation* 2000: 6: 150-154.

The definitive version of this article can be purchased at www.blackwellpublishing.com
Int J Dent Hyg 2006; 4:84-90

11. Frentzen M, Ploenes K, Braun A. Clinical and microbiological effects of local chlorhexidine applications. *International Dental Journal* 2002; 52: 325-329.
12. Hanes PJ, Purvis JP. Local Anti-Infective Therapy: Pharmacological Agents. A Systematic Review. *Annals of Periodontology* 2003; 8 (1): 79-98.
13. Perinetti G, Paolantonio M, Cordella C, D'Ercole S, Serra E, Piccolomini R. Clinical and microbiological effects of subgingival administration of two active gels on persistent pockets of chronic periodontitis patients. *Journal of Clinical Periodontology* 2004; 31: 271-281.
14. Pai MR, Acharya LD, Udupa N. The effect of two different dental gels and mouthwash on plaque and gingival scores: a six-week clinical study. *International Dental Journal* 2004; 54: 219-223.
15. Lavigne SE, Krust-Bray KS, Williams KB, Killoy WJ, Theisen F. Effects of subgingival irrigation with chlorhexidine on the periodontal status of patients with HA-coated integral dental implants. *International Journal of Oral and Maxillofacial Implants* 1994 (Mar- Apr): 9 (2): 156-62.
16. Meffert RM. Maintenance and treatment of the ailing and failing implant. *J Indiana Dent Assoc* 1994 (Fall):73(3):22-4

17. Jolkovsky DL, Waki MY, Newman MG, Otomo-Corgel J, Madison M, Flemmig TF, Nachnani S, Nowzari H. Clinical and microbiological effects of subgingival and gingival marginal irrigation with chlorhexidine gluconate. J Periodontol 1990 (Nov): 61(11):663-9.
18. Kalaitzakis CJ, Tynelius-Bratthall G, Attstrom R. Clinical and microbiological effects of subgingival application of a chlorhexidine gel in chronic periodontitis. A pilot study. Swed Dent J 1993;17(4):129-37.
19. Porras R, Anderson GB, Caffesse R, Narendran S, Trejo PM. Clinical response to 2 different therapeutic regimens to treat peri-implant mucositis. J Periodontol 2002; 73:1118-1125.
20. Schwarz F, Sculean A, Rothamel D, Schwenzer K, Georg T, Becker J. Clinical evaluation of an Er:YAG laser for non-surgical treatment of peri-implantitis: a pilot study. Clin Oral Implants Res. 2005 Feb;16(1):44-52.
21. Karring ES, Stavropoulos A, Ellegaard B, Karring T. Treatment of peri-implantitis by the Vector system. Clin Oral Implants Res. 2005 Jun;16(3):288-93.

The definitive version of this article can be purchased at www.blackwellpublishing.com
Int J Dent Hyg 2006; 4:84-90

22. Maló P, Rangert B, Dvarsater L. Immediate function of Brånemark implants in the esthetic zone: a retrospective clinical study with 6 months to 4 years of follow-up. Clin Implant Dent Relat Res. 2000;2(3):138-46.
23. Maló P, Rangert B, Nobre M. "All-on-Four" immediate-function concept with Brånemark System implants for completely edentulous mandibles: a retrospective clinical study. Clin Implant Dent Relat Res. 2003;5 Suppl 1:2-9.
24. Mombelli A, Van Oosten MAC, Schurch E, Lang NP. The microbiota associated with successful or failing osseointegrated titanium implants. Oral Microbiol Immunol 1987; 2: 145-151.
25. Buser D, Weber HP, Lang NP. Tissue integration of non-submerged implants. 1-year results of a prospective study with 100 ITI hollow-cylinder and hollow-screw implants. Clin Oral Impl Res 1990; 1: 33-40.
26. Maló P. Clinical applications of immediate function implants. In: Chiapasco M, Gatti C, Gottlow J, Lundgren A, Maló P, Meredith N, Polizzi G, Sennerby L. Osteointegrazione e carico immediato. Fondamenti biologici e applicazioni cliniche. Milano, Italia: Masson, Spa, 2002: 60-102.
27. Lang NP, Tonetti MS. Periodontal risk assessment (PRA) for patients in supportive periodontal therapy (SPT). Oral Health Prev Dent. 2003;1(1):7-16.

The definitive version of this article can be purchased at www.blackwellpublishing.com
Int J Dent Hyg 2006; 4:84-90

28. Jovanovic S. Peri-Implant Tissue Response to Pathological Insults. Advantages Dental Research 1999 (Jun): 13: 82-86.
29. Clarizio LF. Peri-implant infections. Abstract. Atlas of Oral and Maxillofacial Surgery Clinical North America 2000 (Mar): 8 (1): 35-44.
30. Quirynen M, DeSoete M, VanStreenberghe D. Infectious risks for oral implants: a review of the literature. Clinic Oral Implant Research 2002: 13: 1-19.
31. Mombelli A, Lang NP. Antimicrobial treatment of peri-implant infections. Clin Oral Impl Res 1992: 3: 162-168.
32. Hennessey TD. Antibacterial properties of hibitane. Journal of Periodontal Research 1977: 4: 36-48.
33. Salas Campos L, Gomez FO, Villar MH, Martin RB. Antiseptic agents: chlorhexidine. Rev Enferm 2000 (Sep): 23 (9): 637-40.
34. Moshrefi A. Chlorhexidine. Journal West Soc Periodontol Periodontal Abstr 2002: 50 (1):5-9.

The definitive version of this article can be purchased at www.blackwellpublishing.com
Int J Dent Hyg 2006; 4:84-90

35. Loesche WJ, Giordano J, Soehren S, Hutchinson R, Rau C, Walsh L, Schork A, Arbor A, Mich D. Nonsurgical treatment of patients with periodontal disease. Oral Surgery Oral Medicine Oral Pathology 1996 (May): 81 (5): 533-543.
36. Salvi GE, Mombelli A, Mayfield L, Rutar A, Suvan J, Garrett S, Lang NP. Local antimicrobial therapy after initial periodontal treatment. A randomized clinical trial comparing three biodegradable sustained release polymers. Journal of Clinical Periodontology 2000; 29: 540-550.
37. Heasman PA, Heasman F, Stacey F, McCracken GI. Local delivery of chlorhexidine gluconate (Periochip) in periodontal maintenance patients. Journal of Clinical Periodontology 2001; 28: 90-95.
38. Azmak N, Atilla G, Luoto H, Sorsa T. The Effect of Subgingival Controlled-Release Delivery of Chlorhexidine Chip on Clinical Parameters and Matrix Metalloproteinase-8 Levels in Gingival Crevicular Fluid. Journal of Periodontology 2002 (Jun): 73 (6): 608-615.
39. Killoy W. The Clinical Significance of local chemotherapies. Journal of Clinical Periodontology 2002; 29 (2): 22-29.

Table index:

N°	Position of implants	Pre-treatment Diagnosis							
		Gingival inflammation	mPII (0-3)	mBI (0-3)	PPD (mm)	DIM (mm)	AL (mm)	Supp	Bone loss
1	32	Yes	3	3	5	-7	-2	No	Coronal third
2	42	Yes	3	3	5	-5	0	No	Coronal third
3	34	Yes	2	2	5	4	9	Yes	Medium third
4	21	Yes	1	2	7	-3	4	Yes	Coronal third
5	34	Yes	1	2	5	4	9	Yes	Medium third
6	44	Yes	1	2	5	4	9	Yes	Medium third
7	12	Yes	1	2	5	-1	4	No	Coronal third
8	42	Yes	3	2	5	2	7	No	Coronal third
9	44	Yes	3	2	5	3	8	No	Medium third
10	42	Yes	3	3	5	-1	4	No	Coronal third
11	36	Yes	1	2	5	-1	4	Yes	Coronal third
12	42	Yes	3	3	5	-4	1	No	Coronal third
13	44	Yes	3	3	5	-4	1	No	Coronal third
Means:		--	2.2	2.4	5.2	-0.7	4.5	--	--

Table 2: Post-treatment diagnosis									
N°	Position of implants	Post-treatment Diagnosis							
		Gingival inflammation	mPII (0-3)	mBI (0-3)	PPD (mm)	DIM (mm)	AL (mm)	Supp	Bone loss
1	32	No	1	0	3	-3	0	No	Coronal third
2	42	No	1	0	3	-3	0	No	Coronal third
3	34	No	1	0	3	4	7	No	Medium third
4	21	No	1	0	3	-3	0	No	Coronal third
5	34	No	1	0	4	4	8	No	Medium third
6	44	No	1	0	4	4	8	No	Medium third
7	12	No	0	0	4	-1	3	No	Coronal third
8*	42	Yes	3	2	5	2	7	No	Coronal third
9*	44	Yes	3	2	5	3	8	No	Medium third
10	42	No	1	0	3	-1	2	No	Coronal third
11	36	No	0	0	3	-1	2	No	Coronal third
12	42	No	1	0	3	-3	0	No	Coronal third
13	44	No	1	0	3	-3	0	No	Coronal third
Means:		--	1.2	0.3	3.5	-0.1	3.5	--	--

* Implants withdrawn from the study due to negative response to the protocol applied

The definitive version of this article can be purchased at www.blackwellpublishing.com
 Int J Dent Hyg 2006; 4:84-90

Table 3: 1 year follow-up diagnosis

N°	Position of implants	Diagnosis							
		Gingival inflammation	mPII (0-3)	mBI (0-3)	PPD (mm)	DIM (mm)	AL (mm)	Supp	Bone loss
1	32	No	1	0	3	-3	0	No	Coronal third
2	42	Yes	2	2	4	-4	0	No	Coronal third
3	34	No	1	0	3	4	7	No	Medium third
4	21	No	1	0	3	-3	0	No	Coronal third
5	34	Yes	2	1	4	4	8	No	Medium third
6	44	Yes	2	1	4	4	8	No	Medium third
7	12	No	1	0	4	-1	3	No	Coronal third
8	42	No	1	0	4	-1	3	No	Coronal third
9	36	No	1	0	3	-1	2	No	Coronal third
10	42	Yes	1	1	3	-3	0	No	Coronal third
11	44	Yes	1	1	3	-3	0	No	Coronal third
Means:		--	1.3	0.6	3.5	-0.6	2.8	--	--

The definitive version of this article can be purchased at www.blackwellpublishing.com
Int J Dent Hyg 2006; 4:84-90

Table 4: Mean values of clinical parameters measured			
	Baseline	Post treatment	1 year follow-up
mPII (0-3)	2.2	1.2	1.3
mBI (0-3)	2.4	0.3	0.6
PPD (mm)	5.2	3.5	3.5
DIM (mm)	-0.7	-0.1	-0.6
AL (mm)	4.5	3.5	2.8

Uncorrected version

Figures:



Fig. 1a: periapical x-ray with bone defect affecting mesial-vestibular walls of the implant #32.



Fig. 1b: same periapical x-ray with increased contrast to better visualize the bone defect.



Fig. 2: Intra-oral image with prosthesis in place.

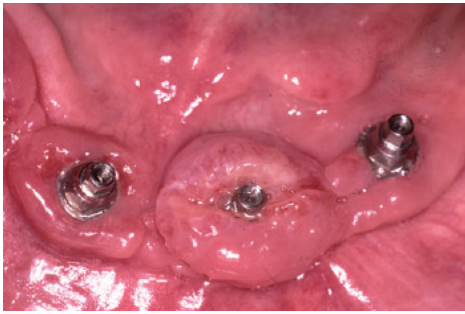


Fig. 3: Intra-oral image of implants. Note the soft tissue's hyperplasia.



Fig. 4: Disposable syringe, plastic needle and chlorhexidine gel.



Fig. 5: Irrigation of peri-implant pocket with chlorhexidine gel and the plastic needle.



Fig. 6: Probing pocket depth measurement (= 3mm) after treatment.

The definitive version of this article can be purchased at www.blackwellpublishing.com
Int J Dent Hyg 2006; 4:84-90



Fig. 7: Intra-oral clinical image after treatment.

Uncorrected version