Non-surgical treatment of peri-implant pathology

M De Araújo Nobre
C Capelas
A Alves
T Almeida
R Carvalho
E Antunes
D Oliveira
A Cardador
P Maló

Authors' affiliations:
M. De Araújo Nobre, Department of Clinical Dental Research, Maló Clinic, Lisbon, Portugal
M. De Araújo Nobre, C. Capelas, A. Alves, T. Almeida, R. Carvalho, E. Antunes, D. Oliveira, A. Cardador, Department of Oral Hygiene, Maló Clinic, Lisbon, Portugal
P. Maló, Department of Implantology, Maló Clinic, Lisbon, Portugal

Correspondence to:
Miguel De Araújo Nobre
Clinical Dental Research Department
Clinica Malo
Av. Dos Combatentes
No. 43, 9° C
Edificio Green Park
1600-042 Lisbon
Portugal
Tel.: +351 217 228 100
Fax: +351 217 266 965
E-mail: clin.res.dep@clinicamalo.pt

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Abstract: *Introduction:* Peri-implant pathologies consist of 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, a protocol for the irrigation of peri-implant pockets with a chlorhexidine gel, using a plastic needle for the delivery of the product into the peri-implant pockets is described. *Study participants and methods:* Nine patients with at least one implant presenting peri-implant pathology (inflamed soft tissue associated with bone loss around the implant) were enrolled in this prospective clinical study, and followed-up 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 eight of the nine patients (and in 11 of the 13 implants) 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 aetiological 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 represents 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.

Key words: chlorhexidine; chlorhexidine gel; implants; oral hygiene; peri-implant pathology

Introduction

Peri-implant pathology consists of 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), as 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 sublethal 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, and 1 and 2% chlorhexidine concentrations took 15 s to neutralize Gram – strict anaerobic micro-organism cultures (*Porphyromona gingivalis* and *Prevotella intermédia*), and 10 min to neutralize *Staphylococcus aureus* respectively (4). The use of chlorhexidine together with mechanical treatment produces good results when treating periodontal disease (5–13), as well as in the treatment of implants (14, 15). 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 (16)] to gel or spray (with the objective of a more localized action) (17). With the constant development in this field, we reach a generation of chlorhexidine gels, more bioadhesive, as a result, enhancing its action.

Similarly, the needle for irrigation represents an important issue for both the patient's comfort and the efficacy in administrating the chlorhexidine, as it has the potential of provoking mechanical trauma to the patient (18), resulting in discomfort, pain, less compliance, and in turn, less efficacy of the treatment.

Several studies demonstrated success in the treatment of peri-implant pathologies through a non-surgical approach (19–21).

The aim of this study was to test the effect of a protocol for irrigating peri-implant pockets on peri-implant pathologies using a bioadhesive 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 nine treated patients (mean age 57 years, range 45–77 years), eight males and one female, divergent systemic conditions (two smokers, two diabetic patients and two patients suffering from angina) with 13 implants supporting nine prostheses. The first patient was treated in June 2003, and the last in October 2003, being the patients followed-up 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 for 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 ≥5 mm; bleeding on probing; absence of implant clinical mobility; bone loss between the coronal and the medium one-third of the implant; and signed written informed consent to participate in the study.

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 was read from periapical radiographs (taken at the diagnosis appointment); modified plaque index (mPlI) (24), modified bleeding index (mBI) (24), probing pocket depth (PPD) (25), distance between implant shoulder and mucosal margin (DIM) were 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) and suppuration (Supp) (26) were registered as present or absent. Mobility was assessed manually, and registered as present or absent (25) while needle tolerance was 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 ≥ 4 mm, improvement of the attachment level, no suppuration and no mobility.

All the diagnostic indexes where taken before implementing the protocol. After baseline indexes were calculated, dental plaque/calculus was removed from the infected sites. 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 toothbrush. 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.

Irrigation protocol

A clinical case is presented in Figs 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®, 15 ml, Lisbon, Portugal) and a plastic needle (Capillary® tip, Ultradent®, Salt Lake City, UT, USA) of 0.4 mm of diameter (27 gauge) 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 that the air could be released from 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.

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 that the gel could remain in the pocket for the longest time possible.

Results

At baseline, mPlI ranged from 1 to 3 (mean = 2.2); mBI 2–3 (mean = 2.4); PPD 5–7 mm (mean = 5.2 mm); DIM −7 to 4 mm (mean = −0.7 mm); AL −2 to 9 mm (mean = 4.5 mm); five of the 13 implants presented Supp; four of the 13 implants presented bone loss to the medium third of the implant, whereas nine 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 mPlI ranged from 0 to 3 (mean = 1.2); mBI 0–2 (mean = 0.3); PPD 3–5 mm (mean = 3.5 mm); DIM −3 to 4 mm (mean = −0.1 mm); AL 0–8 mm (mean = 3.5); no suppuration was observed in any implant. There were two implants in one patient that did not respond positively to the

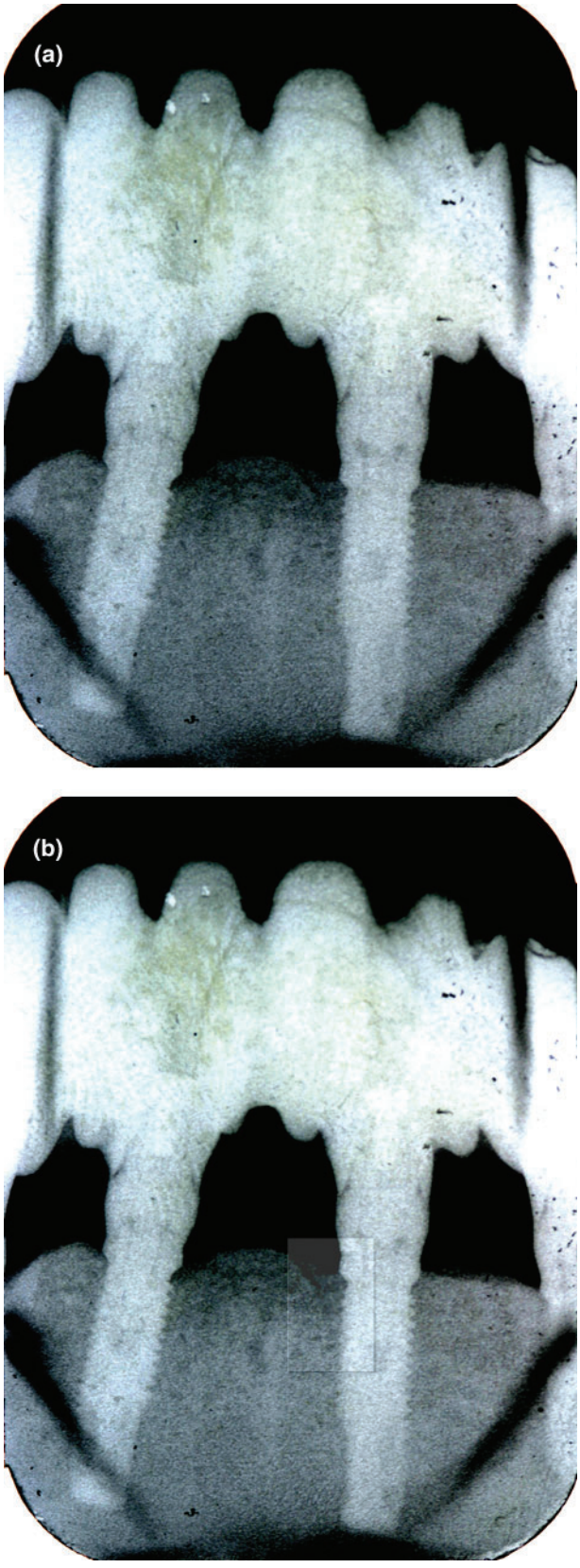

Fig 1. (a) Periapical X-ray with bone defect affecting mesial-vestibular walls of implant no. 32. (b) Same periapical X-ray with increased contrast to better visualize the bone defect.

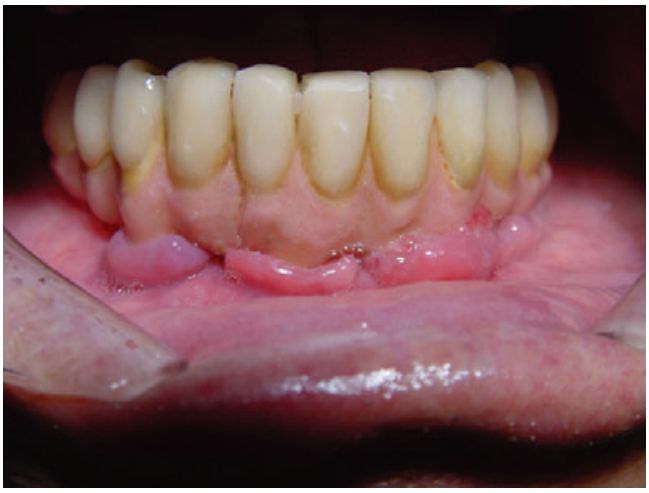

Fig 2. Intra-oral image with prosthesis in place.

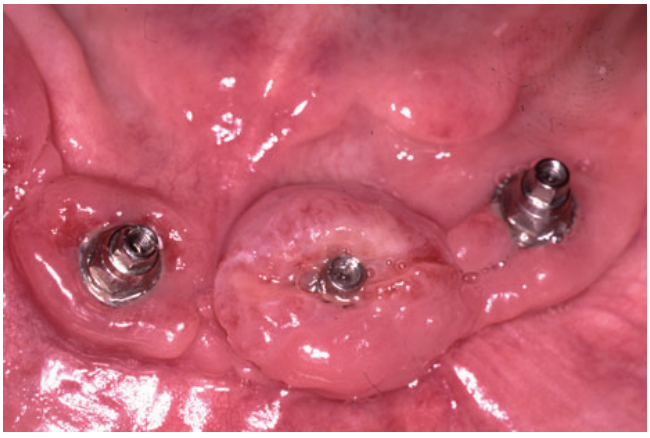

Fig 3. Intra-oral image of implants. Note the soft tissue's hyperplasia.

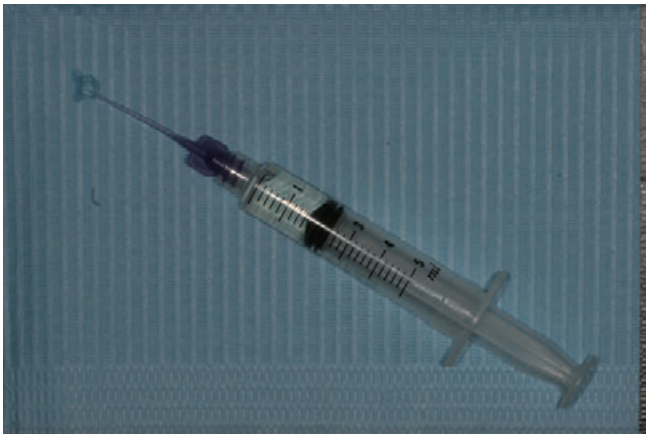

Fig 4. Disposable syringe, plastic needle and chlorhexidine gel.

protocol, being classified as non-successful. For the two implants that did not meet the success criteria, surgical treatment was referred.

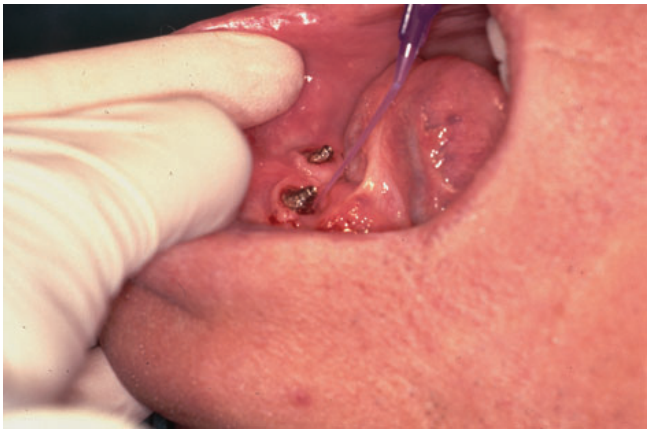

Fig 5. Irrigation of peri-implant pocket with chlorhexidine gel and the plastic needle.

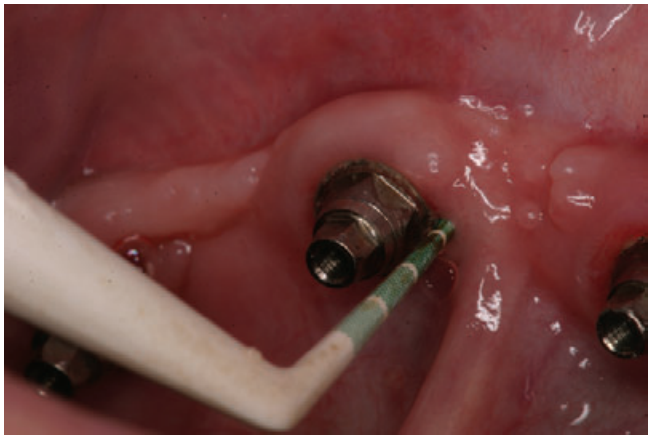

Fig 6. Probing pocket depth measurement (=3 mm) after treatment.

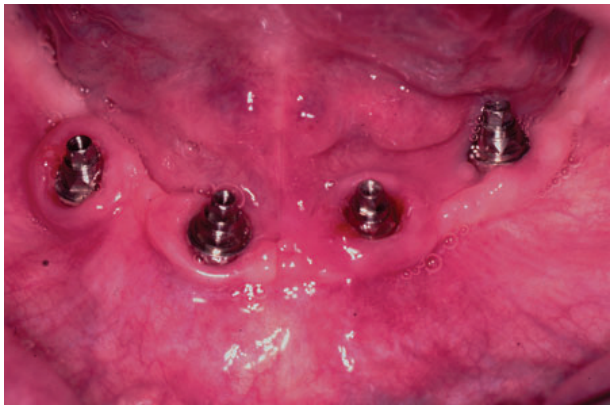

Fig 7. Intra-oral clinical image after treatment.

Taking into consideration that these two implants did not meet the success criteria, and analysing the clinical parameters for the remaining 11 implants, the results are as follows: mPlI ranged from 0 to 1 (mean = 0.8); mBI was 0; PPD 3–4 mm

Table 1. **Pretreatment diagnosis**

No.	Position of implants	Pretreatment 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**

No.	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 because of negative response to the protocol applied.

(mean = 3.4 mm); DIM −3 to 4 mm (mean = −0.6 mm); AL 0–8 mm (mean = 2.7 mm).

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): mPlI ranged from 1 to 2 (mean = 1.3); mBI 0–2 (mean = 0.6); PPD 3–4 mm (mean = 3.5 mm); DIM −4 to 4 mm (mean = −0.6 mm); AL 0–8 mm (mean = 2.8 mm). 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 because of 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 aetiological 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 mPlI, 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 aetiological cause of the disease will persist, not

Table 3. **One-year follow-up diagnosis**

No.	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	–	–

Table 4. **Mean values of clinical parameters measured**

	Baseline	Post-treatment	One-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

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 pretreatment and post-treatment diagnosis, because of 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 because of 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 eight of the nine patients (and 11 of the 13 implants), representing a good result in treating the compromised implant with an easy to use protocol. The two 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 aetiological factor (dental plaque), and as a result 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, 19–21, 31).

The clinical indexes after 1 year of follow-up tend to approach but stabilize below those of the pretreatment 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 way similar to 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.

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