Società Italiana
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# Long term outcomes of implant therapy in periodontally compromised partially edentulous patients: Ten-year results of a three arms prospective study

## *Risultati a lungo termine della terapia implantare in soggetti parzialmente edentuli con parodonto compromesso: studio prospettico con follow-up a 10 anni di differenti procedure*

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## Summary

*Ten-year results of implant therapy in 101 subjects, with and without history of periodontitis, are reported. A trend for higher frequency of implant failures and greater bone loss was found in periodontally compromised individuals. Supportive Periodontal Therapy has proven to be a key factor in enhancing long term outcomes of implant therapy.*

## Riassunto

Nel presente lavoro vengono riportati i risultati a 10 anni del trattamento implanto-protesico in 101 pazienti con o senza pregressa storia di malattia parodontale. La terapia si è dimostrata efficace nella grande maggioranza dei casi, tuttavia, l'incidenza di complicanze biologiche è stata maggiore tra i pazienti parodontali. La terapia parodontale di supporto si è dimostrata essere un fattore chiave nel mantenimento, a lungo termine, degli impianti.

## Introduction

Dental implants have been used for replacement of missing teeth in periodontally compromised patients, even though the literature regarding the long-term prognosis is scarce. Van der Weijden et al. (2005), in his review, concluded that the outcome of implant therapy in periodontitis patients may be different compared to individuals without history of periodontitis. For the 2006 EAO Consensus Conference, a systematic review (Schou et al. 2006) concluded that significantly increased incidence of peri-implantitis and peri-implant marginal bone loss were revealed in individuals with periodontitis associated tooth loss. Nevertheless, the small sample size and the

methodological quality assessment of the only two studies selected (Hardt et al. 2002; Karoussis et al. 2003) suggested to interpret the results with great caution.
In a nine- to fourteen-year follow-up study on dental implants, Roos-Jansåker et al. (2006) found out that a history of periodontitis seems to be related to higher incidence of peri-implantitis.
Three recent systematic reviews (Ong et al. 2008; Schou 2008; Heitz-Mayfield 2008) have suggested that patients with a previous history of periodontitits are at higher risk for biological complications. Evidence is stronger for implant survival than implant success. Nevertheless, methodological issues limited the potential to draw robust conclusions.
At the 6th European Workshop on Periodontology (Lindhe & Meyle, 2008), the consensus group on peri-implant diseases stated that there is evidence for history of periodontitis as risk factor for peri-implant disease: they reported that 4 previous systematic reviews and 10 of 11 studies comparing patients with a history of periodontitis with patients without a history of periodontitis showed an increased risk for peri-implant disease in patients with a history of periodontitis.
All these authors have underlined the necessity of long-term prospective studies with sufficient numbers of well-characterized patients before definitive conclusions could be drawn.
The aim of this study is to present the long-term (10 year) implant outcomes in partially dentate patients who have been treated for periodontitis compared with periodontally healthy subjects.

## Materials and methods

All patients attending the principle investigator (M.R.), a periodontist, for dental implant therapy between May 15, 1996 and May 15, 1998 were screened for possible inclusion in the study. The specialist practice receives referrals from general dental practitioners, specialists in orthodontics, and physicians mainly located in the North-West of Italy. The criteria used for excluding patients were as follows: (1) complete edentulism; (2) presence of dental implants; (3) mucosal diseases; (4) alcohol and drug abuse; (5) pregnancy; (6) uncontrolled metabolic disorders; (7) aggressive periodontitis; (8) no interest in participating into the study. Patients were informed that their data would be used for statistical analysis and gave their informed consent to the treatment. The study was performed in accordance with the principles stated in the Declaration of Helsinki.
At the time of the initial visit, age, gender, smoking habits and medical history were obtained. Moreover, the following clinical data were collected: full mouth plaque score (FMPS); full mouth bleeding score (FMBS); number of missing teeth; pocket depth (PD) measured at 4 sites on each tooth by means of a periodontal probe (XP23/UNC 15, Hu-Friedy, Chicago, USA), and rounded off to the nearest millimeter.
At the baseline, 2 groups were formed on the basis of the clinical diagnosis:
Group A: periodontally healthy patients;
Group B: periodontally compromised patients.

Moreover, patients of Group B received a score on the basis of the number and depth of periodontal pockets according to the following formula: (N. of pockets 5-7mm) + 2 (N. of pockets ≥ 8 mm). Therefore, patients scoring 25 or less were placed in the group B1 (moderate periodontitis), while those scoring more than 25 in the group B2 (severe periodontitis).

All patients received appropriate initial therapy, consisting, depending on the cases, in motivation, oral hygiene instruction, scaling and root planning. Hopeless teeth were recorded and extracted and periodontal surgery was performed as needed after re-evaluation. Individual treatment was thoroughly discussed with the patients and established according to their personal need and desire. No implant surgery was performed before the assurance of excellent motivation and compliance from each single patient (FMPS<25%; FMBS<25%).

TPS dental implants (Institut Straumann AG, Waldenburg, Switzerland) were placed, under local anesthesia, by the same operator (MR), according to the manufacturer's instructions, in a non-submerged fashion. The implants were placed with the border of the rough surface approximating the alveolar bone crest leaving the machined neck portion in the transmucosal area, and restored by means of single crowns or partial fixed dental prostheses. Implants that required bone augmentation and/or sinus lift elevation were not included in the study. After crown/bridge cementation a baseline intraoral radiograph was obtained by using the parallel long-cone technique, and clinical data were recorded. Distance between the implant shoulder and the most coronal visible bone-to-implant contact (DIB) measured in millimeters both at the mesial and the distal aspect of each implant was registered. Baseline probing measurements were also recorded around the implants.

Patients were recalled at various intervals, depending on the initial diagnosis and the results of the therapy, for supporting periodontal therapy (SPT). Motivation, re-instruction, instrumentation and treatment of re-infected sites were performed as needed.

After 10 years, two calibrated examiners, blinded to the periodontal treatment, collected the following parameters, around teeth and implants: PD, FMPS, FMBS. The 10-year DIB values were compared with the baseline values. Moreover, mPI, BOP and sites with marginal recession > 3mm were registered at four aspects per implant. The number of lost implants and lost teeth during the follow-up period was recorded. Smoking and complete participation to the SPT (yes or no) for each patient were assessed. Sites which showed, during the SPT, radiographic bone loss ≥ 3mm and were successfully treated by regenerative approaches or adjacent to implant later removed, were recorded.

For the statistical analysis, heterogeneity between groups for age, gender, smoking status, compliance and number of implants per patients was verified with the Pearson $\chi^2$ test. A $\chi^2$ value <0.05 was accepted to identify a statistically significant difference. To evaluate the implant survival rates in the three groups of patients the Kaplan-Meier analysis with log-rank pooled per strata was adopted for all the implants and for the solid implants. Comparisons of groups of patients were made by

2 sample independent Binomial test (2 sample Gauss test and Bonferroni adjusted). ANOVA and the nonparametric ANOVA (Kruskal Wallis rank analysis of variance) were used to compare the 3 groups. All statistical analysis were performed with SPSS 13.0 (SPSS inc.) software.

## Results

One hundred and twelve patients were enrolled in the study. Eleven patients were lost at the 10-year follow-up. The final analysis was performed on 101 subjects: 28 individuals in the Group A, 37 in Group B1 and 36 Group B2. Baseline data are listed in table 1. No inter-group differences for age, gender, implant type, smoking and acceptance of SPT were found.

Table 2 reports the clinical parameters 10 years after implantation.

No implant early failure was registered. Two out of 61 (3.4%) implants were lost in group A, 7 out of 95 (7.2%) in group B1 and 9 out of 90 (10%) in group B2 (table 3, figure 1). Mean bone loss was equal to 0.75 (± 0.88) mm in group A, 1.14 (± 1.11) mm in group B1 and 0.98 (± 1.22) mm in group B2 (table 4). No statistically significant differences were found among the groups.

On a patient based analysis, implant survival rate was 97.9%, 91.4% and 91.5% for all implants and 98.7%, 95.4% and 91.5% for solid implant, respectively for group A, B1 and B2 (table 3). In group A, B1 and B2 respectively, 4.7%, 11.2% and 15.1% of sites had bone loss ≥ 3mm (table 4). Difference between groups A and B2 was statistically significant ($p<0.05$).

Differences in mean PD were found between Group B1 and A ( 3.5 ± 0.9 vs. 3.1 ± 0.5, $p<0.05$) and group B2 and A (3.8 ± 0.8 vs. 3.1 ± 0.5, $p< 0.01$).

Non-ideal SPT was found to be correlated with higher risk of implant loss in both group B1 and B2 ($p<0.05$).

## Discussion

Recent systematic reviews have consistently pointed out the necessity of studies reporting on long term data of well characterized subjects and a study sample with an appropriate size (Ong et al. 2008, Schou 2008, Heitz-Mayfield 2008). The aim of this study is to present the long-term implant outcomes in over one hundred patients with a previous history of periodontitis, recruited from a private clinic. The benefit, in accordance with the Consensus Report of 6th European Workshop on Periodontology (Lindhe & Meyle, 2008), is that subjects recruited from private or public dental clinics, rather than university clinics, provide information on the 'effectiveness' rather than 'efficacy' in implant therapy.

One of the greatest difficulties is the definition of the various degrees of the disease, because international definition of chronic periodontitis has only little value for establishing case definition for study purposes (Page & Eke 2007). Nevertheless, an attempt was made during this research to differentiate not only between periodontally healthy and compromised subjects, but also between various degrees of peri-

odontal involvement, based on the number and depth of the periodontal pockets at the initial visit.

Periodontal therapy was effective in promoting plaque control in all the groups of patients. At time of first visit, patients presented high values of FMPS and FMBS with a significant difference among the 3 groups. All patients revealed an improvement in the plaque control, with a statistical significant difference between baseline and 10-year values, even though plaque and bleeding on probing were registered before the final session of motivation, reinstruction and instrumentation. In spite of the lack of differences among the 3 groups at the 10-year evaluation in FMPS, bleeding on probing was, nevertheless, statistically more frequent among patients with severe periodontitis (B2).

Two types of implants were used, i.e. full body screw and hollow screw/cylinder. These latter types have not been in use for several years, now. For this reason, failure rate was reported separately for the 2 types of implants. It is confirmed the hollow implants present a higher incidence of complications. For full body implants individuals with severe periodontitis presented a higher failure rate than healthy patients, even though with limited statistical significance.

Mean bone loss at 10 years is around 1 mm, with no differences among the groups. It should be noted, however, that more implants were removed in perio patients, reducing the overall number of sites with complications which were measured at the end of the study.

Due to the lack of an international non equivoque definition of "perimplantitis", the number of sites with a Bone Loss of 3 mm or more was, instead, collected on the mesial and distal aspect of each implant. The percentage of sites with a BL ≥ 3mm varied among the 3 groups. As expected, it was limited for group A, more pronounced for group B1 and higher for group B2. From a statistical point of view, a significant difference was found between group A than group B2 (tab. 3 and fig. 2).

On the basis of this research, patients with a history of periodontitis should be informed that they are more at risk for peri-implant disease. Moreover, in this study, periodontally compromised patients, who did not completely adhere to the SPT, were found to have a higher implant failure rate. Therefore, the clinical implications should be based on the fact that SPT has proven to be a key factor in enhancing long term outcomes of implant therapy. This underlines the value of the SPT in particular in subjects with susceptibility to periodontal disease in order to control reinfection and limit failures.

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*Table 1. Clinical parameters at time of first visit*

| | N of Patients | | | Age | Mean N of missing teeth | mFMPS | mFMBS |
|---|---|---|---|---|---|---|---|
| | Total | males | females | | | | |
| Group A | 32 | 13 | 19 | 45 ± 13.0 | 8,0 ± 4.7 | 37.0%† ± 15.3 | 29.2%¨ ± 13.4 |
| Group B1 | 42 | 16 | 26 | 49 ± 15.3 | 9,6* ± 5.9 | 45.0%† ± 12.7 | 36.7%¨ ± 12.0 |
| Group B2 | 38 | 21 | 19 | 44 ± 8.6 | 6,4* ± 3.2 | 58.7%† ± 18.1 | 53.0%¨ ± 19.6 |

**Statistically significant difference between B1 and B2(p<0.05).*
*†Statistically significant differences between all the groups (p<0.05).*
*¨Statistically significant differences between B2 and A and between B2 and B1 (p<0.0001).*

*Table 2. Clinical parameters 10 years after implantation*

| | Dropouts | mFMPS | mFMBS | Mean N of lost teeth | Adhesion to SPT | |
|---|---|---|---|---|---|---|
| | | | | | Yes | No |
| Group A | 4 | 23.2% ±10.0 | 19.1%* ±11.3 | 0.9 ± 1.2 | 24 | 4 |
| Group B1 | 5 | 24.1% ± 12.4 | 21.0%* ±8.2 | 1.3 ± 1.6 | 26 | 11 |
| Group B2 | 2 | 25.2% ± 9.8 | 26.6%* ±12.9 | 1.5 ± 1.7 | 29 | 7 |

**Statistically significant difference (p<0.05) between group B2 and group A and between group B2 and B1.*

*Table 3. 10-year implant survival rates (SR) for all implants and for solid screws*

| | Patients | Implants | Implants lost | SR All implants | SR Solid screws | SR All implants (patient-based) | SR solid screws (patient-based) |
|---|---|---|---|---|---|---|---|
| Group A | 28 | 61 | 2 | 96.6% | 98.0% | 97.9% | 98.7% |
| Group B1 | 37 | 95 | 7 | 92.8% | 94.2% | 91.4% | 95.4% |
| Group B2 | 36 | 90 | 9 | 90.0% | 90.0% | 91.5% | 91.5% |

*Table 4. 10-year results: mean bone loss and mean number (N) of sites with BL of 3 mm or more*

| | mBL mm | Mean N of sites with BL ≥3mm (all implants) | Mean N of sites with BL ≥3mm (solid implants) |
|---|---|---|---|
| Group A | 0,75 (± 0,88) | 4.7%* | 4.0%* |
| Group B1 | 1,14 (± 1,11) | 11.2% | 11.1% |
| Group B2 | 0,98 (± 1,22) | 15.1%* | 15.1%* |

*Fig. 1 Failure rates for all implants and solid screws in the three groups*

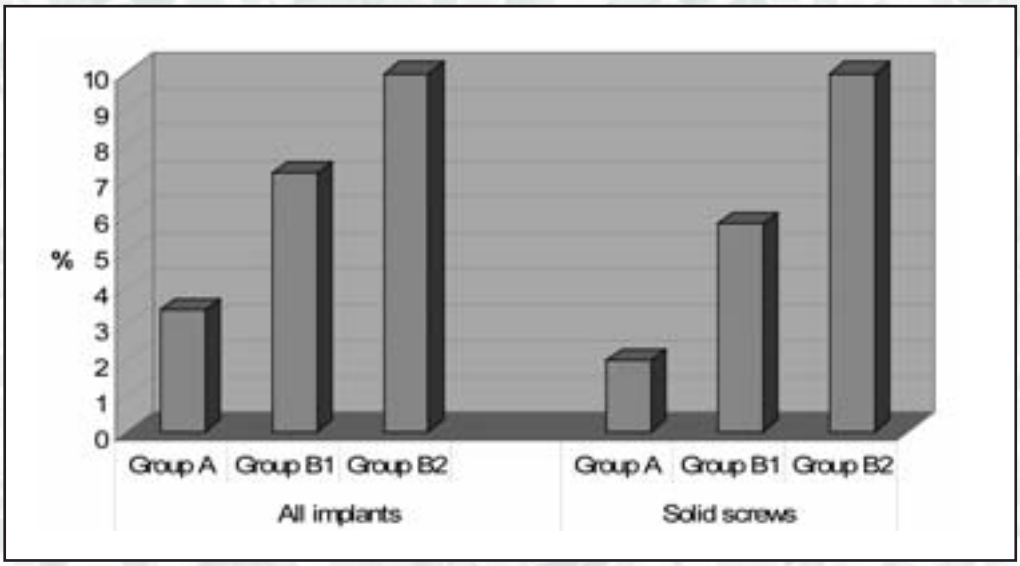
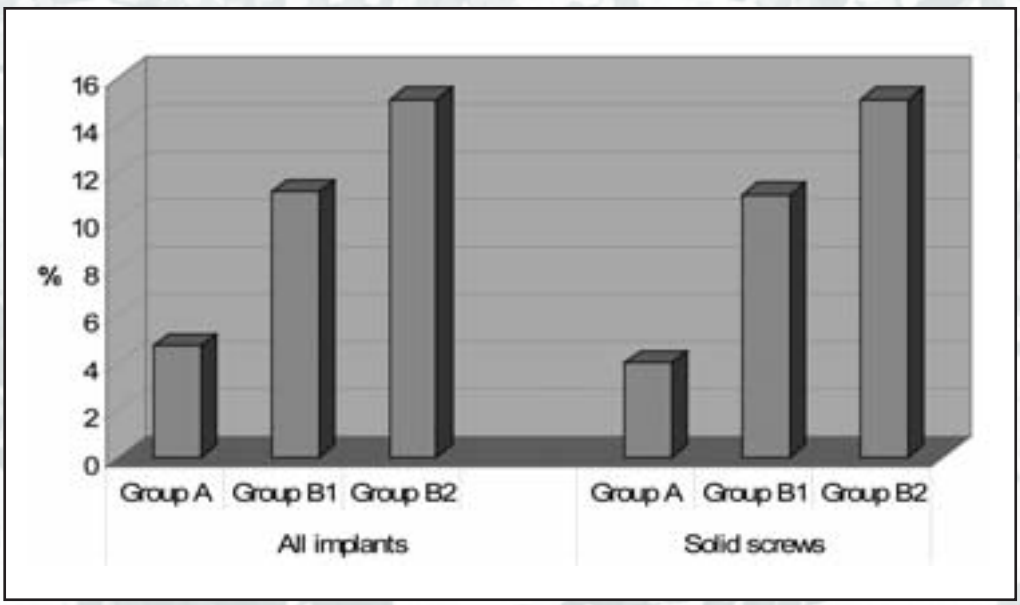



*Fig. 2 Incidence of sites with bone loss greater than 3 mm in the three groups*



# XIV CONGRESSO INTERNAZIONALE