Journal of Cranio-Maxillo-Facial Surgery 43 (2015) 2168–2174

Contents lists available at ScienceDirect

Journal of Cranio-Maxillo-Facial Surgery

journal homepage: www.jcmfs.com

Incidence of peri-implantitis and oral quality of life in patients rehabilitated with implants with different neck designs: A 10-year retrospective study

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ARTICLE INFO

Article history:
Paper received 2 June 2015
Accepted 7 October 2015
Available online 19 October 2015

Keywords:
Peri-implantitis
Neck designs
Smooth neck
Oral quality of life
Patient satisfaction

ABSTRACT

Objectives: To evaluate peri-implant bone loss, the presence of peri-implantitis, aesthetic satisfaction, and quality of life in patients with implant-based prosthetic restorations using implants with or without smooth necks, placed in different bone positions.
Materials and methods: 400 patients received 1,244 implants: 515 with smooth neck monitored over an average of 6.44 ± 2.55 years and 729 without smooth neck monitored over 5.61 ± 2.52 years. Radiographic bone loss, presence of periimplantitis, implant loss, quality of life (OHIP-14), and patient satisfaction with prosthetic esthetics were evaluated, comparing groups.
Results: 120 implants developed peri-implantitis, 15 with a 2.5 mm smooth neck and 105 without smooth neck. Patients without smooth-necked implants showed a worse quality of life with statistically significant difference ($p < 0.001$). Patient satisfaction with prostheses was higher among the group without smooth neck.
Conclusions: Implants with smooth polished necks would appear to suffer less bone loss and peri-implantitis, and lead to better patient quality of life. However, implants without smooth necks placed crestally led to higher patient satisfaction with aesthetics.

1. Introduction

The Sixth European Workshop on Periodontology (2008) confirmed that peri-implant diseases are infectious by nature. Peri-implant mucositis is an inflammatory lesion that resides in the mucosa, while peri-implantitis affects the supporting bone as well (Lindhe and Meyle, 2008). Peri-implantitis is a collective term that refers to different inflammatory reactions in the tissues surrounding an implant. Following the osseointegration of an implant, peri-implant disease is the result of an imbalance between the bacterial load and the host response (Zitzmann and Berglundh, 2008). Several authors have proposed a series of factors that may contribute to the occurrence of peri-implant disease such as smoking, poor passive fit of prosthetic structures (Isidor, 2006), occlusal trauma (Kitamura et al. 2005), microgaps between implant and abutments (Piattelli et al., 2003), implant neck surface characteristics (Peñarrocha et al., 2004), and the implant-abutment connection (Hurzeler et al., 2008). Microgaps play an important role in peri-implant inflammatory reactions (Broggini et al., 2003), while the implant-abutment connection may impact on stress transmission (Canullo et al., 2010) and bacterial infiltration (Broggini et al., 2006).

Microgaps can be colonized by bacteria, and this can affect peri-implant crestal bone remodelling as well as the long-term health of peri-implant tissues (Scarano et al., 2005; Piattelli et al., 2003). Stress, micro-movement, and bacterial infiltration originate from the marginal bone, giving rise to lesser apical migration of the biological width. With the platform switching concept, the

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http://dx.doi.org/10.1016/j.jcms.2015.10.010
1010-5182/

implant-abutment interface (IAI) is displaced horizontally toward the centre of the platform and separated from marginal bone (Canullo et al., 2010), resulting in less marginal bone resorption. In the same way, the position of a microgap between implant and abutment relative to crestal bone levels is an important factor affecting peri-implant health (Hurzeler et al., 2008; Bilhan et al., 2010; Canullo et al., 2010). It is necessary to establish peri-implant soft and hard tissue margins around the coronal portion of the implant, with a protective barrier (sealed epithelium) created by coronal soft tissue connection in order to preserve tissue stability and health.

Two-piece implants inevitably have a microgap at the interface between the two elements that can lead to significant crestal bone loss. But when this implant interface is positioned above the bone crest (supracrestally), no bone loss occurs. Greater crestal bone loss occurs when the interface is placed below the crest (subcrestally) (Hermann et al., 2000).

In this scenario, the design of the implant neck is also considered relevant to the preservation of marginal peri-implant bone (Lee et al., 2007; Bratu et al., 2009). But from another point of view, an implant neck with a roughened surface or with retention elements might result in less marginal peri-implant bone resorption than a traditional smooth-necked implant.

Nowadays, it is impossible to speak of clinical success without looking into treatment outcomes in terms of patient quality of life, and the level of satisfaction with the aesthetics of prosthetic restoration. The most widely used instrument for evaluating the impact of dental treatments on quality of life is the Oral Health Impact Profile (OHIP), whose validity and reliability is well-established (Allen et al., 2001; Awad et al., 2000, 2003). The complete OHIP questionnaire consists of 49 questions dealing with seven domains: function, pain, physical disability, psychological disability, social disability, and handicap (Slade and Spencer, 1994). The OHIP-14 questionnaire, which was used in the present study, is a shortened, easy-to-use version made up of 14 questions that cover the same seven domains (Slade, 1997).

The aim of this work was to test the theories outlined above in a long-term retrospective study by evaluating inflammatory bone loss (peri-implant disease) arising in two groups of patients receiving implants with two types of neck design: one with a smooth neck, where the implant-abutment microgap remained above the bone crest and soft tissues, and other implant without smooth neck where the implant-abutment microgap was placed crestally at the level of the soft tissues. The study also compared patient satisfaction and oral quality of life resulting from treatment between the two groups.

2. Materials and method

2.1. Recruitment and patient characteristics

This long-term, retrospective and transversal study recruited 400 patients (146 men and 254 women), with an average age of 53.50 ± 12.14 years. Inclusion criteria were as follows: patients rehabilitated with Biotech® dental implants, model BIS or BIS Conic (Biotech International, Marseille, France) and fixed porcelain crowns with over 1 year of functional life. Exclusion criteria were: patients with metabolic bone diseases, unmanaged type I diabetes, severe osteoporosis, presence of severe active periodontitis. When patients were recalled for a check-up at the dental clinic, they were invited to participate in the study; those who agreed gave their informed consent in writing. The study protocol was approved by the University of Murcia Ethics Committee and was carried out between September 2013 and December 2014 at two centres: the University Dental Clinic (University of Murcia, Murcia, Spain) and a private clinic.

2.2. Implant samples

The 400 patients who took part had been rehabilitated with a total of 1,244 Biotech® dental implants (Biotech International, Marseille, France), which were divided into two study groups: dental implants with a 2.5 mm smooth neck (BIS Biotech®), and dental implants without a smooth neck (BIS Conic Biotech®).

All implants had been placed with traditional drilling. Implants with 2.5 mm smooth neck had been placed supracrestally; while implants without smooth neck had been placed at the level of the bone crest.

2.3. Measurement variables

Evaluations of study variables were performed transversely. They were classified into three groups by time tracking: <5 years, 5–10 years, and >10 years, to verify the homogeneity across the two groups of implants.

The variables evaluated were: the presence of peri-implantitis, radiographic bone loss, levels of aesthetic satisfaction and patient oral quality of life. The presence of peri-implantitis was assessed by clinical (changes in the level of the crestal bone in conjunction with bleeding on probing with or without concomitant deepening of peri-implant pockets and presence of pus) (Lang and Berglundh, 2011) and radiographic examination of each patient. Evaluation of radiographic bone loss used a digital radiography system (RVG Model 5100, Kodak, Rochester, NY, USA) and measurements were made using digital image analysis software (ImageJ, National Institutes of Health, USA). To assess the degree of aesthetic satisfaction, patients filled out a simple questionnaire with five grades: unsatisfied, unchanged, slightly satisfied, satisfied and extremely satisfied. The degree of patient quality of life was assessed using the OHIP-14 questionnaire.

2.4. Statistical analysis

Data were analysed using the SPSS version 12.0 statistical package (SPSS® Inc., Chicago, IL, USA). A descriptive study was made of each variable. The associations between the different qualitative variables were analysed using Pearson's chi-square test. The Student *t*-test for two independent samples was used in application to quantitative variables, in each case determining whether variances were homogeneous. Two bivariate analyses were also performed considering the binary "radiographic bone loss (mesial and distal surface values average) >3 mm" and "presence of peri-implantitis" as the outcome variables. Odds, ratios, and confidence intervals were calculated with exact conditional logistic regression. Statistical significance was established as $p \leq 0.05$.

3. Results

The sample of 400 patients included 146 men (36.50%) and 254 women (63.50%), with an average age of 53.50 ± 12.14 years (ranging between 29 and 85 years). 88.75% of the sample were non-smokers, and 91.00% did not consume alcohol. The majority did not suffer any systemic disease (Table 1).

Patients had been rehabilitated with 1,244 Biotech® dental implants (Biotech International, Marseille, France), which were classified as two groups: 171 patients (42.75%) had received 515 dental implants (41.39%) with 2.5 mm smooth neck (BIS Biotech®) and 229 patients (57.25%) had received a total of 729 dental implants (58.61%) without smooth neck (BIS Conic Biotech®) (Table 2).