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Systematic Review
Dental Implants

# Evaluation of the papilla level adjacent to implants placed in fresh, healing or healed sites: A systematic review

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*Abstract.* A better understanding of factors that can lead to papilla formation or recession, such as the type of site where the implant was placed, is of fundamental importance to the aesthetic success of the rehabilitation. The aim of this study was to perform a systematic review of the literature regarding the formation or recession of papilla adjacent to implants placed in fresh, healing or healed sites. The protocol for this study was registered in the PROSPERO database (registration number CRD 42016033784). An electronic search was performed by two independent reviewers who applied the inclusion and exclusion criteria on the PubMed/MEDLINE, Scopus, and Embase databases from January 2005 up to February 2016. The initial screening yielded 1,065 articles, from which 15 were selected for a systematic review after applying the inclusion and exclusion criteria. Nine studies compared fresh and healed sites, four studies compared healing and healed sites, one study compared fresh and healing sites, and one study analysed all three sites. The majority of studies identified by this systematic review showed no difference between groups after the longer follow-up period. The sites where the implants were placed did not have a long-term influence on papilla formation or recession.

Key words: dental implants; dental papillae; single-tooth implants.

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Dental implants for treatment of partially edentulous patients present high success rates and are well documented in scientific literature. Initially, the focus of studies was directed to important points, such as evaluation of osseointegration and marginal bone loss, which are essential to the clinical longevity of these implants[1,2].

In addition, currently, aesthetic treatment through implant-supported restorations is also considered important for the clinical success of rehabilitation[3], increasing patient satisfaction[4]. In partially edentulous patients, this factor is even more crucial, since the clinician should achieve harmonization between the prosthesis and the adjacent teeth, especially when the region in question is the anterior maxilla[3]. Therefore, the prosthesis must be manufactured respecting colour, shape, and texture of the tooth to be restored[3]. Another very important factor for an aesthetic result is the architecture of peri-implant soft tissue[5], which includes the preservation or

 

creation of gingival papilla, avoiding the formation of ''black spaces''[3,4,6]. Disparities in papilla level and fill are considered a parameter for the aesthetic result of prosthetic rehabilitation[2].

Changes in concepts of the osseointegration protocol implemented by Branemark are performed to reduce the period between tooth extraction and dental implant placement[4], which is an impact factor on the aesthetic result[7]. Different therapies are successfully used for rehabilitation[1], these being the placement of implants in fresh, healing, or healed sites. This classification can also be made based on changes observed in soft and hard tissues, according to a consensus conference held in in 2004[8]: type 1 – implant placement immediately following tooth extraction; type 2 – complete covering of the socket with soft tissue (4–8 weeks); type 3 – substantial clinical and/or radiographic bone tissue of the socket (12–16 weeks); type 4 – healed site (>16 weeks)[8]. Since these treatments are associated with bone remodelling, the interproximal papilla may suffer alterations[6].

A better understanding of factors that can lead to papilla formation or recession, such as the type of site where the implant was placed, is of fundamental importance to the aesthetic success of the rehabilitation[9]. Therefore, this study aimed to perform a systematic review of literature regarding the papilla formation or recession adjacent to implants placed in fresh, healing, or healed sites. The null hypothesis is that there is no difference in the papilla level between the implant installation sites.

## Materials and methods

This systematic review was conducted following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) statement[10]. The protocol for this study was registered in the PROSPERO (International Prospective Register of Systematic Review) database (registration number CRD 42016033784). Initially, the PICO population (P), intervention (I), comparison (C), and outcome(s) (O) question was defined: ''In partially edentulous patients, the installation of implants in fresh, healing or healed sites influences the papillary level?''

### Search strategy

The articles were searched for by two independent reviewers (R.A.M. and E.V.F.S.) on the PubMed/MEDLINE, Scopus, and Embase databases from January 2005 up to February 2016. Disagreements between them were discussed and, when unresolved, a third reviewer was consulted (M.C.G.). Only studies published in English and related to the evaluation of the papilla level adjacent to dental implants placed in fresh (immediate), healing, or healed sites were selected by inserting the keywords: ''dental papillae (Mesh term) AND dental implant (Mesh term)'' and ''dental implant (Mesh term) AND soft tissue height (non-Mesh term). Initially; the titles and abstracts were read; and after applying the inclusion and exclusion criteria; the studies were accessed for full text reading and final selection. The Cohen kappa method was used to assess the agreement between reviewers in each search step.

### Inclusion and exclusion criteria

Inclusion criteria for selecting articles were

- studies written in English;
- studies that compared interproximal papilla in dental implants placed in fresh, healing or healed sites;
- randomized, prospective and retrospective studies.

Exclusion criteria were

- studies not written in English;
- duplicated studies
- animal studies
- in vitro studies;
- cadaver studies;
- case reports;
- interviews, comments, and questionnaire studies;
- literature or systematic reviews;
- studies reporting or evaluating surgical techniques;
- studies evaluating only one site of implant placement;
- studies evaluating gingival grafts;
- studies that did not report the type of implant placement site;
- studies with insufficient data for collection of results;
- studies comparing the different gingival biotypes in the soft tissue stability;
- studies assessing non-oral implants.

### Quality of studies

The quality of the selected studies was evaluated according to the Jadad scale[11]. In this method, the studies are scored from 0 to 5, according to the randomization, double-blind method, and descriptions of withdrawals. Studies scoring less than 2 were considered ''low quality'', and between 3 and 5 were categorized as ''high-quality'' studies.

### Meta-analysis

The mean difference of the papillary distance of the mesial and distal papilla (in millimetres), the papilla index (JEMT score), and the PES (Pink Esthetic Score) between studies (continuous outcome) were performed. The calculation was performed with a 95% confidence interval using a computer program (Review Manager 5.0, Cochrane Collaboration). The calculation of the heterogeneity among the studies was performed by the $I^2$ statistic. Fixed effects were used for all calculations except for Papilla index (random effects). Forest plots were generated for data analysis with $P < 0.05$.

## Results

The initial screening yielded 487 articles on PubMed/MEDLINE, 495 on Scopus, and 83 on the Embase databases. After the removal of duplicated articles (564 studies), and after reading titles and abstracts and applying the inclusion and exclusion criteria, 18 articles were obtained for full text reading (kappa = 0.99) (Fig. 1). The reasons for the exclusion of articles after reading titles and abstracts are shown in Table 1. After reading the full text, three articles were excluded, resulting in 14 articles for the systematic review (kappa = 1.00) (Fig. 1). The reasons for the exclusion of these three articles are shown in Table 2.

The studies were classified according to the Jadad scale, and only four studies had a score higher than 3, being considered high-quality studies (Table 3). Within this classification, no study was considered double blind, since the patient will always know when the implant is placed in fresh, healing, or healed sites, resulting in lower scores on the Jadad scale.

A total of 797 implants were placed, with 291 in fresh, 144 in healing, and 362 in healed sites. After the longer follow-up period of the studies, 633 implants remained, with 247 placed in fresh, 103 in healing, and 283 in healed sites (Table 4). Studies from Somanathan et al.[15] and Schropp and Isidor[16] did not describe the number of losses of implants and/or patients according to the sites evaluated after the follow-up period. The characteristics and survival rate of implants placed are detailed in Table 5.

These implants were restored with 247 metal-ceramic and 237 all-ceramic prosthesis. These data pertain to studies that