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Assessment of Dental Implant Success in Patients with History of Periodontitis: A Systematic Review

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Abstract: A series of risk factors has been linked to the development of peri-implant disease, including: poor oral hygiene, diabetes, smoking and history of periodontitis. The microbiota associated with peri-implantitis is like that associated with periodontitis, and it was suggested that the deep periodontal pockets may act as a reservoir of bacteria and impacting the implant success rate. The objective of this work was to evaluate the parameters of implant success in patients with history of periodontal disease. A systematic review of the literature from 2004 to 2014 was carried out with an electronic search strategy in Medline, Embase, Cochrane Library and Dentistry and Oral Sciences Sources, supplemented by a manual search in journal of periodontology and implant dentistry. The strategy has found 347 papers for inclusion in the study and after the application of filters and criteria; only 4 scientific articles were selected. The total population included in these 4 studies was 1945 subjects, including 1640 with periodontal disease and 305 without history of periodontitis. Subject to the methodological quality of the articles selected, it can be concluded that the history of periodontitis is not a contraindication to implant placement, but the rate of implant success depend on the severity and form of periodontitis. Therefore, the decision making of implant therapy in patients with history of periodontal disease must necessarily include a rigorous program of supportive periodontal therapy for implant long-term stability.
Keywords: dental implant, success rate, history periodontitis.

INTRODUCTION

Periodontal diseases are multifactorial affections with inflammatory symptom in permissive hosts, and lead to damage of dental anchor apparatus, which is made of gum, periodontal ligament, cementum and alveolar bone [1].

Lesions caused by such inflammatory conditions may result in tooth loss, which replacement by dental implant will turn to be the therapeutic solution of choice.

Some risk indicators such as a poor control of plaque, diabetes, tobacco smoking and history of periodontitis have been linked to peri-implant disease [2].

Subjects with periodontitis are supposed to have increased risk of biological complications around osseointegrated implants [3, 4]. In fact, microbiota associated to peri-implantitis is similar to that for periodontitis and the deep periodontal pockets could act as a reservoir for bacteria and secondarily affect implant success rate **[**5, 6]. Moreover, a comparative study of the clinical and immunological parameters (IL-1b and TNF-α) for the periodontal and peri-implant tissues of two kinds of implant systems gave a positive correlation between these concentrations of cytokine and bone loss around teeth and implants [7].

In patients that have no history of periodontitis, implant therapeutic remains a predictable procedure for its very high success rate (90% to 95%) **[**8,9]. Host exposure to periodontitis and the latter's

biological complications around implants could affect implant success. In fact, the aggressive or progressive forms of periodontitis are more at risk of implant failure, as opposed to the chronic forms of the same pathology **[**10, 11].

Thereby, several studies have reported rates of early or late implant failure in subjects with periodontitis, who had been treated on the whole [12, 13]. However, other studies found favorable rates of implant success if patients who are properly monitored under rigorous program for periodontal supportive therapy **[**14, 18].

Several studies with lot of heterogeneous definitions for periodontitis have reported a wide variability of implant success rate in patients with a history of periodontitis.

Therefore, the purpose of the present systematic review was to evaluate the parameters of implant success treatment in patients with history of periodontal disease**.**

MATERIALS AND METHODS

This systematic review has been conducted for the following search problem: "Does history of periodontal disease compromise implant success rate?"

Eligibility criteria

The search criteria used to include the papers for full-text screening were

- studies that assess implant success with a minimum 5 years' monitoring following placement of implant;
- studies that use radiology to assess alveolar bone loss or implant loss;
- studies on patients with history of periodontal disease or being included in a program for periodontal monitoring;
- Studies that include only partially edentulous subjects of all ages.

Search strategy

In view of finding relevant articles, an electronic search strategy from 1 March 2004 to 1 March 2014 was developed and applied to MEDLINE, EMBASE, Dentistry & Oral Sciences Source and COCHRANE Library databases. This strategy has been supplemented with a manual search in specialized journals of periodontology and of implant dentistry.

Table-I: Search strategy

Databases	Key words
Medline via Pubmed 09/03/2015) from 2004 to 014	1/(Periodontal Diseases) AND (Dental Implants) AND (Success rates) AND (History OR Past OR Antecedents OR Previous) 2/(Periodontal Diseases) AND (Dental Implants) AND (Success rates)
Embase (09/03/2015) from 2004 to 2014	(Tooth implantation or 'tooth implant) and (periodontal disease) and (follow up or prognosis Gold. The prospective study or risk factor or success) and (history or past or background or 'Previous)
Cochrane library (09/03/2015) from 2004 to 2014	(Dental implant) AND (periodontitis) AND (history OR success OR previous OR antecedents)
Dentistry & Oral Sciences Source (09/03/2015) from 2004 to 2014	(Periodontitis) AND (dental implants) AND (History OR Past OR Previous OR Antecedents)

Study selection

The titles and abstracts of the papers were screened by two independent reviewers (M.L.G & H.M.B.).When an abstract included the above-mentioned criteria or if there was doubt regarding one or more of the search criteria, the paper was selected for full reading. If any of these criteria was not fulfilled the paper was disregarded. Titles without abstracts, which appeared to be investigating the success rate of implants in patient with a history of periodontitis, were selected for full-text reading. Only papers written in the French and English language were selected.

Three authors (P.D.D, M.L.G & H.M.B) specialists in periodontology then screened the papers selected independently by the two reviewers. Disagreement regarding inclusion was resolved after discussion between the reviewers.

DATA EXTRACTION

Data were extracted in Excel spreadsheet independently by 2 specialists in periodontics (MLG and HMB. The following parameters were collected from each study:

Author, year, and language of publication, type of study, judgment criteria, demographic features of the population, parameters for implant success and form of periodontitis, follow-up time, overall results and findings.

RESULTS

Search results

The search strategy helped find 347 articles divided as follows (Figure 1):

- MEDLINE, by Pubmed interface: 130 articles.
- EMBASE: 150 articles from scientific journals, of which 4 are part of those that have also been found by Pubmed;
- The COCHRANE Library provided 22 articles;
- The DENTISTRY &Oral Sciences Source provided 45 articles.

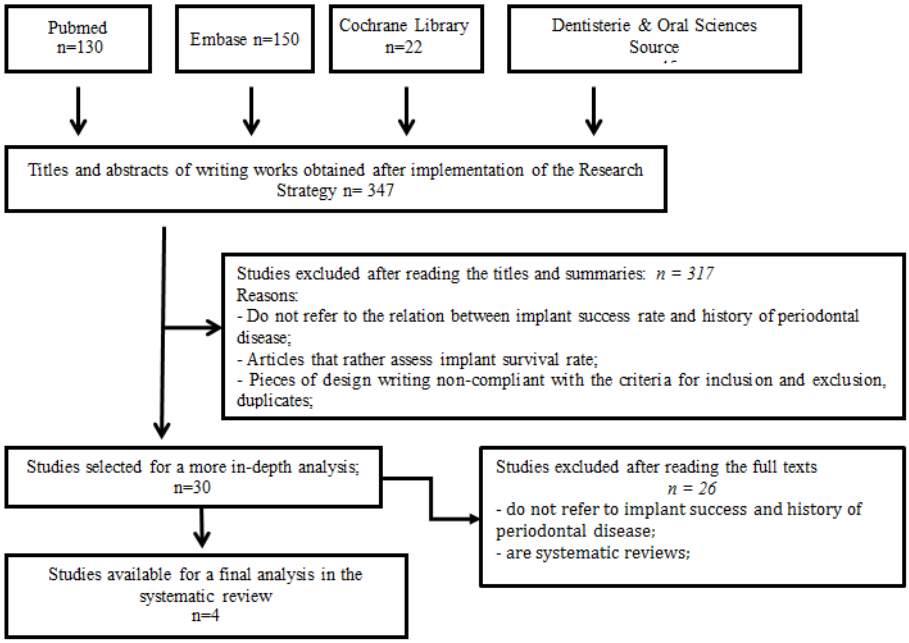

Fig-1: Flowchart of the search strategy

STUDY SELECTION

At reading the titles and abstracts selected by the 2 "reviewers" for this task, 317 have been disregarded for the following reasons:

- Do not refer to relation between implant success rate and history of periodontal disease;
- Articles that rather assess implant survival rate;
- Pieces of design writing non-compliant with the criteria for inclusion and exclusion, duplicates;
- Thirty articles were selected for a more in-depth analysis based on the reading of the *fulls texts*;
- Four studies available for a final analysis in the systematic review.

Methodological quality assessment

Quality assessment of the methodologies for all included studies was done independently by two reviewers (MLG and HMB), in keeping with the guidelines of the revised STROBE (Strengthening the Reporting of Observational studies in Epidemiology).

Risk of bias

Once the STROBE scores had been determined, an overall risk of bias (low, moderate, high) was assigned for each study that had been selected. The risk was deemed to be low when all criteria were fulfilled, moderate when one or more criteria were at least partially fulfilled, and high when one or more criteria were not taken into account.

The quality assessment results for the articles are contained in Table II.

Studies with a score ≤ 9 points were regarded as of important risk of bias.

Studies with a score ≤ 9 points were regarded as of low risk of bias.

All the selected studies had low risk of bias.

Table-II: Methodological quality assessment

Nos.	Authors, Years, Countries	Objectives	Methods Of creating the cohort	Identification at the same Stage of the the disease	Inclusion/ Exclusion Criteria	Bias	Follow-up	Judgment Criteria	Criteria Objectivity	Adjustment	Final Note
1	Gatti C. *et al*. 2008 Italy	2	2	0	2	2	2	2	2	1	15
2	Gianserra R. *et .al*. 2010 Italy	2	2	0	2	1	0	1	1	1	11
3	Malo P. *et al*. 2014 Portugal	2	2	1	2	1	2	2	2	2	16
4	Swierkot K. *et al*. 2012 Germany	2	2	0	2	1	2	2	2	2	15

DATA SYNTHESIS AND ANALYSIS

Information contained in the 4 remaining articles have been extracted and summarized in Table III. All these articles are in English and were published between 2008 and 2014.

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The overall population included in these 4 studies is 1,945 subjects, 305 of them are healthy and 1,640 patients with periodontal disease, with an average age of 54.95 years for patients with severe periodontitis, 53.15 years for patients with moderate periodontitis, 45.8 years for all forms of periodontitis and 39.5 years for patients with normal periodontium

Table-III: Data synthesis and analysis

Nos.	Authors	Years	Countries	Type of study	Objective of the study	Characteristics of the sample		Parameters for implant success	Form of periodontitis	follow-up time	Results and finding
						Age	Size				
1	Gatti C *et al.* 19).	2008	Italy	Cohort	- To determine if partially edentulous patients with history of severe periodontitis (SP) have higher risk of implant failure and of peri-implantitis, compared to patients with moderate periodontitis (MP) or those with normal periodontium (NP).	≥ 18 years - SP: 56 years (35-85) - MP: 56 years (42-70) - NP: 40 years (18-61)	62 - 26 with SP - 7 with MP - 29 with NP	- Implant stability has not been assessed for withdrawn prosthesis. - Loss of peri-implant marginal bone during the last radiographic examination < 2mm with absence of pus or infections and of periodontal pockets < 5mm.	- All severe and moderate forms included.	5 years	- Patients with history of severe or moderate periodontitis have lost an average of 5 years after implants placement, more than twice the amount of peri-implant marginal bone (approximately 2.6 mm), compared to patients without history of periodontal disease (approximately 1.2mm). - There also is a trend to peri-implantitis in subjects with history of severe periodontal disease.
2	GIANSERRA R. *et al*. 20).	2010	Italy	Cohort	- To determine if patients with history of moderate (MP) or severe (SP) periodontitis may be at higher risk of prosthesis or implant failures, in comparison with patients in	- 53.9 years for SP group - 50.3 years for MP group - 39.9 years for NP group	1727 - 630 patients with severe periodontitis (SP). - 839 patients had moderate periodontitis (MP). - 258 patients didn't have periodontitis (NP).	- Implants removed have been considered as failures. - Implant stability has not been assessed for withdrawn prosthesis.	- All severe and moderate forms included.	5 years	-A history of periodontal disease may not have significant impact on implant failures up to 5 years following the implant loading.

					good health (NP)						
3	Maló P. *et al.* 21).	2014	Portugal	Cohort	- To determine the outcome of implants immediate loading after 5 years in patients with untreated periodontal disease.	52 years: (22-80) years	103 - 51: females - 52: males	- Absence of persistent infection or of radiolucent areas around the implant; - Secondary assessment criteria: level of marginal bone, and incidence of mechanical and biological complications; - Rupture or loosening of prosthetic components (mechanical complications); - Peri-implant pathologies, fistula or formation of abscess (biological complications).	- All forms included.	5 years	- 97,9% and 99.4% of survival rates at 5 yearswith an average bone loss by 0.71%, show that fixed prosthetic rehabilitation after immediate loading remains a sure and valid therapeutic alternative in patients with weakened periodontium; - need for maintaining the results with a supportive periodontal therapy (SPT).
4	Swierkot K. *et al* 22).	2012	Germany	Cohort	- To measure the prevalence of mucositis, peri-implantitis, implant success and survivals in	- For GAgP: 15 males and 20 females 39.6 (27-56) years. - For patients with normal	53 - 35 (GAgP) - 18 with normal periodontium	1) implant immobility; 2) no discomfort (pain, sensation of a foreign body, paraesthesia);	- generalized aggressive periodontitis (GAgP)	3-16 years	- These results suggest that partially partially edentulous patients that are treated for GAgP have five times more risk of implant failure, three times more risk of mucositis,

					partially edentulous patients being treated for generalized aggressive periodontitis (GAgP) and in patients with normal periodontium.	periodontium: 9 males and 9 females of 38.6 years (25-57) old.		3) pocket depth ≤ 5mm with no bleeding on probing; 4) noperi-implant lucent areas; 5) peri-implant annual loss ≤ 0.2 mm 1 year.			and 14 times more risk of peri-implantitis, compared to individuals with normal periodontium. - Implant survival rate is 96% in patients with aggressive periodontitis and 100% in patients with normal periodontium.

DISCUSSION

This systematic literature review aimed at assessing implant success in patients with history of periodontal diseases. The work includes both observational and the selected articles, which lead to find that history of periodontal disease is an important factor of risk likely to affect implant success.

From an initial total of 347 articles found for inclusion in the study, only the final 4 scientific articles have been selected. They are cohort studies.

The overall population included in these 4 studies was 1,945 subjects, including 1,640 patients with periodontal disease and 305 without history of periodontitis. The mean age for these individuals is 54.95 years for patients with severe periodontitis, 53.15 years for patients with moderate periodontitis, 45.8 years for the other forms periodontitis and 39.5 years for patients with normal periodontium.

Quality of the selected studies has been assessed objectively and quantified using a scorecard specially developed for this study. This scorecard is open to criticism, even if it has been developed according to the latest STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) recommendations on writing reports of observational studies. To assess the methodological quality, many fact sheets have been developed. The major part of them was especially for observational studies. As a result, all methods of assessing quality of the studies have limitations, but it is important they keep a certain consistency.

So, this systematic review has some limitations related to the reduced number of articles that meet the inclusion criteria. This could be explained by the fact that most studies are made on this topic as that by NGOs *et al*. [23], Renvert *et al*. [24], Safii *et al.* [25] analyze the survival rate rather than the success rate. Evidence is stronger for implant survival than it is for implant success, although issues in relation to methodology limit the potential to draw firm conclusions. Therefore, we found no systematic review that exclusively deals with implant success rate in patients with history of periodontal disease. Heterogeneity in the results from these studies is also relative to the difference of criteria used to define implant success. These results could be more homogeneous if the parameters defined by Albrektsson [26] were taken as a reference and if all patients had the same form of periodontitis. In fact, the study by Monje. *et al*. [27] found a significantly higher rate of implant failure in patients with aggressive periodontitis, compared to patients with chronic periodontitis and those in good periodontal health. The results should however be interpreted cautiously as the time for implant monitoring does not exceed 5 years.

However, all studies agree on the importance of supportive periodontal therapy (SPT) for maintenance of good rate of implant success. Quirynen [28] shows that dental implant can work in a long term in patients with history of periodontitis, despite the existence of a few cases of implant failures. But this possibility remains obvious only in the presence of a strict program for supportive periodontal therapy.

RECOMMENDATIONS

The summarized findings from these studies recommend taking some parameters into account prior to any decision for implant therapy in patients with history of periodontal disease:

- Initial preparation that helps monitors all factors of risk and of infections by removing existing periodontopathogens at residual teeth inside the oral cavity is an effective way to prevent translocation of bacteria from residual teeth toward implants.
- For patients with history of aggressive periodontitis, a strict program for supportive periodontal therapy (SPT), which frequency will differ from one form to another, cannot follow the same therapeutic plan as that for patients with chronic periodontitis. Such supportive periodontal therapy will enable us to avoid occurrence of peri-implant disease and, as a result, to increase likelihood of implant success.

CONCLUSION

Within the limitations of the studies available for this systematic review, we conclude that history of periodontitis is not a contraindication to implant placement, but may compromise implant success rate. Thus, before making decision for implant therapy in patients with history of periodontal disease, a stiff program for supportive periodontal therapy should be set up for long-term stability of dental implants in this category of patients.

However, other prospective studies with more structured methodological quality and longer time for post-implant monitoring are needed to draw definitive conclusions.

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