Is Bruxism a Risk Factor for Dental Implants? A Systematic Review of the Literature

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ABSTRACT

Purpose: To systematically review the literature on the role of bruxism as a risk factor for the different complications on dental implant-supported rehabilitations.

Material and Methods: A systematic search in the National Library of Medicine's Medline Database was performed to identify all peer-reviewed papers in the English literature assessing the role of bruxism, as diagnosed with any other diagnostic approach (i.e., clinical assessment, questionnaires, interviews, polysomnography, and electromyography), as a risk factor for biological (i.e., implant failure, implant mobility, and marginal bone loss) or mechanical (i.e., complications or failures of either prefabricated components or laboratory-fabricated suprastructures) complications on dental implant-supported rehabilitations. The selected articles were reviewed according to a structured summary of the articles in relation to four main issues, viz., "P" – patients/problem/population, "I" – intervention, "C" – comparison, and "O" – outcome.

Results: A total of 21 papers were included in the review and split into those assessing biological complications ($n = 14$) and those reporting mechanical complications ($n = 7$). In general, the specificity of the literature for bruxism diagnosis and for the study of the bruxism's effects on dental implants was low. From a biological viewpoint, bruxism was not related with implant failures in six papers, while results from the remaining eight studies did not allow drawing conclusions. As for mechanical complications, four of the seven studies yielded a positive relationship with bruxism.

Conclusions: Bruxism is unlikely to be a risk factor for biological complications around dental implants, while there are some suggestions that it may be a risk factor for mechanical complications.

KEY WORDS: biological complications, bruxism, dental implants, mechanical complications, risk factor

INTRODUCTION

Bruxism is a motor activity that is supposed to have the potential for causing damage to the stomatognathic structures as well as to be a risk factor for dental implants survival.[1,2] In spite of the increasing knowledge on its etiology, diagnosis, and management,[3] evidence on the effects of bruxism as a cause of dental implant failure or complication is still lacking.[4] Thus, practical guidelines for the management of bruxism patients undergoing restorations on dental implants are based on expert opinions rather than on scientifically sound information.[5]

The caution that is urged when using implants to support dental prosthesis in bruxers is due to the common fear that bruxism can cause overloading and may affect osseointegration and/or compromise the integrity of mechanical components. Actually, it must be borne in mind that bruxism is an umbrella term featuring different motor muscle activities with different etiologies[6,7] and that complications around dental implants may be related with biological or mechanical damage;[8] so, there is a need to get deeper into the issue of the effects of bruxism on dental implants by performing systematic appraisals of the available literature on the argument.

Considering these premises, the present paper aims to systematically review the literature on the role of bruxism as a risk factor for the different complications on dental implant-supported rehabilitations.

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MATERIALS AND METHODS

On May 30, 2012, a systematic search in the National Library of Medicine's Medline Database was performed to identify all peer-reviewed papers in the English literature dealing with the bruxism–dental implant complication relation according to the search strategy described below. The studies included for review were assessed independently by the authors on the basis of a structured reading of article approach, which is also described in detail in the following sections.

Search Strategy and Literature Selection

A search with Medical Subjects Headings (MeSH) terms was used first. The following terms were used to identify a list of potential papers to be included in the review:

- Bruxism: A disorder characterized by grinding and clenching of the teeth. Year introduced: 1965.
- Dental implants: Biocompatible materials placed into (endosseous) or onto (subperiosteal) the jawbone to support a crown, bridge, or artificial tooth or to stabilize a diseased tooth. Year introduced: 1990.

The search was limited to papers in the English language and was then extended to the search words "bruxism" and "dental implants," according to the query ("Dental implants" [MeSH terms] or "dental" [all fields] and "implants" [all fields] or "dental implants" [all fields] and "bruxism" [MeSH terms] or "bruxism [all fields]). The search allowed identifying 77 citations, the abstracts of which were read to select articles to be retrieved in full text.

The inclusion criteria for admittance in the systematic review were based on the type of the study, viz., clinical studies on humans, assessing the role of bruxism, as diagnosed with any other diagnostic approach (i.e., clinical assessment, questionnaires, interviews, polysomnography, and electromyography), as a risk factor for biological (i.e., implant failure, implant mobility, and marginal bone loss) or mechanical (i.e., complications or failures of either prefabricated components or laboratory-fabricated suprastructures) complications on dental implant-supported rehabilitations by comparing the rate of such complications in subjects with and without bruxing behaviors. After reading abstracts, 47 papers were excluded from further assessment because they were clearly not pertinent with the aim of this review, viz., they were review papers ($n = 12$), articles expressing opinions or practical guidelines ($n = 18$), papers in other languages than English ($n = 7$), investigations on fracture analysis ($n = 3$), finite element studies ($n = 2$), single-patient case reports ($n = 3$), or case series on selected patient populations ($n = 2$). The remaining 30 papers were retrieved in full text and assessed for possible admittance in the review. The full texts were assessed independently by two of the authors and consensus was reached in all cases to include/exclude papers from systematic assessment.

To search for other studies to be potentially included in the review, the Medline search was expanded: (1) to the articles related to the selected ones, based on PubMed suggestions; (2) to other keywords that were potentially identifying arguments related with bruxism (i.e., "dental occlusion" and "risk factors") and that were combined with the term "dental implants" to retrieve other articles; and (3) to the reference lists of the full-text papers.

Systematic Assessment of Papers

The methodological characteristics of the selected papers were assessed according to a format that enabled a structured summary of the articles in relation to four main issues, viz., "P" – patients/problem/population, "I" – intervention, "C" – comparison, and "O" – outcome, for each of which specific questions were constructed.[9]

For each article, the study population ("P") was described in the light of the criteria for inclusion, the demographic features of the sample, and the sample size. The study design was described in the section reserved to questions on the study intervention ("I"), and information was gathered on all methodological features of the study, viz., longitudinal or cross-sectional observational design, number of implants, type of surgical and prosthetic protocol, and follow-up period. The comparison criterion ("C") was based on the assessment of bruxism-related issues, by reporting the strategy to diagnose bruxism, to identify treatment success and the related statistical approaches adopted by the authors to assess the role of bruxism as a risk factor for dental implants. The study outcome ("O") was evaluated in relation to the influence of bruxism to the outcomes of implant-supported rehabilitations.

All the above-described features of the included studies were put into tables, which also comprehend some critical considerations about the potential points of strength and weakness of the examined studies, as well as the reviewers' response to the question "is bruxism a risk factor for dental implants?" based on data of each single study. All the studies were assessed separately by two of the authors, and in cases of divergent assessments with regards to the assignment of strengths and weaknesses, consensus was reached by discussion. The element under discussion was deleted from the tables if consensus was not reached.

RESULTS

After examination of the full-text articles retrieved from the first-step Medline search, 15 papers were excluded because they did not investigate for bruxism as a risk factor for dental implants ($n = 10$), adopted bruxism as an exclusion criterion ($n = 3$), or reported the outcomes of various rehabilitations in selected populations of bruxers ($n = 2$). The remaining 15 papers were selected for inclusion in the review. From the successive search steps (i.e., Medline-related articles, other Medline keywords, and reference lists of the included papers), six papers were added to the original list of papers, thus accounting for a total of 21 papers to be discussed in the review. The papers were then split into those assessing biological complications ($n = 14$)[10–23] and those reporting mechanical complications ($n = 7$).[24–30]

The 14 papers on biological complications accounted for a total of three thousand four hundred forty-seven implants, inserted in more than one thousand patients. The follow-up span ranged from 0 to 15 years and was not clearly specified in two studies. Only one study described data with a mean follow-up of more than 7 years.[17] None of the examined studies was designed to address specifically the role of bruxism as a potential cause for implant failure, and only one investigation was based on a clinical bruxism diagnosis,[16] yielding uncertain conclusions on the bruxism–implant failure relationship. All the other papers based bruxism diagnosis on single-item self-reported approaches or did not even report the strategy that was adopted to diagnose bruxism. A large variability of criteria was also noticed as for the definition for implant success, ranging from literature-based criteria to measures of marginal bone loss, implant stability, or implant survival. Almost half of the examined studies were descriptive reports providing uncertain[10,14,16–18,20] or negative findings[12] on the bruxism–implant failure relationship. Multiple variable regression analysis to predict implant failure was performed only in five studies, providing uncertain[21,22] or negative findings.[11,19,23] In summary, bruxism was not related with implant failures in six papers,[11–13,15,19,23] while results from the remaining eight studies did not allow drawing conclusions.[10,14,16–18,20–22] Four of the papers with uncertain findings described a higher failure rate in bruxers, identifying a trend toward a positive bruxism–implant failure relationship (Table 1).[10,18,21,22]

The seven papers on mechanical complications accounted for a total of two thousand five hundred ninty implants inserted in more than seven hundred patients. The follow-up span had a minimum of 4 years, although it was not clearly stated in one study. None of the examined studies was designed to address specifically the role of bruxism as a potential cause for mechanical complications, and only two studies were based on clinical diagnosis of bruxism, viz., tooth wear and patients' history, finding a positive association between bruxism and mechanical complications.[25,29] The other five papers based bruxism diagnosis on single-item self-reported approaches[24,26] or did not even report the strategy that was adopted to diagnose bruxism.[27,28,30] The mechanical complications that were investigated were variable and included screw loosening, implant factures, and ceramics fractures. Multiple variable regression analysis to predict mechanical complications was performed in only two studies, which revealed contrasting findings of the absence of relationship[24] or positive relationship[25] between bruxism and mechanical failures. The other five papers were either descriptive reports or investigations based on single variable analysis, yielding a positive relationship between bruxism and mechanical complications in three studies,[27,29,30] absence of such relationship in one study,[28] and uncertain conclusions in one other study (Table 2).[26]

DISCUSSION

Specialist papers often refer to bruxism as a risk factor capable of jeopardizing the successful outcome of an implant-supported rehabilitation.[31–33] The caution that is urged when using implants to support dental prosthesis in bruxers is due to the common fear that bruxism can cause overloading and may lead to implant failure, but recent comprehensive reviews concluded that very few works addressed the issue and were thus recommending expert-based suggestions for the performance of implant-borne rehabilitations in bruxers.[2,4,5] For that reason, the present review was performed to assess

TABLE 1 Summary of Findings from Studies Assessing the Role of Bruxism as a Risk Factor for Biological Complications in Implant-Supported Restorations

Study's First Author and Year	Population	Intervention	Comparison	Outcome (Bruxism Related)	Conclusions: Is Bruxism a Risk Factor?	Points of Strength	Points of Weakness
Ji, 2012[10]	45 patients (27 F, 18 M; m.a. 61.5 years; a.r. 25–88)	297 implants 50 full-arch rehabilitations with immediate loading Follow-up 1–125.5 months	Bruxism (unspecified criteria; 58 implants) Marginal bone loss – implant success (Spiekermann and Jansen's criteria) Descriptive statistics	Higher failure rates in bruxers (29.3% implants [17/58] vs 4.6% [11/239])	Uncertain	–	Risk factors not weighted Unclear criteria for bruxism diagnosis No patient-based data
Zupnik, 2011[11]	m.a. 52.4 ± 13.0; a.r. 20–81 years (no sex and age specifications)	341 implants (No specification of follow-up)	Self-reported clenching history (121 in clenchers vs 220 in nonclenchers) Implant failure (Albrektsson criteria) Logistic regression for predictive analysis	Clenching: 0.22 OR (95% C.I.: 0.04–1.41) for implant failure	No	Multiple variable assessment	Unspecified number of patients Unclear follow-up Single-item bruxism diagnosis
Luongo, 2010[12]	218 patients in good general health (104 F, 114 M; m.a. 51 years; a.r. 19–89)	273 implants (early loading in 48%) Follow-up 1 year	Bruxism history (14 patients, 6.4%) Implant failure (personal criteria) Descriptive report	No failures after loading	No	–	Single-item bruxism diagnosis Risk factors not weighted
Siebers, 2010[13]	76 patients in good general health (42 F, 34 M; m.a. 52.9 ± 13.1; a.r. 22–85 years)	222 implants (immediate loading in 50%) Full thickness flap Follow-up 1.5–7.2 years	Bruxism history (32% of patients) Implant failure (literature criteria) Association analysis (not shown)	No association between bruxism history and implant failure (data not shown)	No	–	Single-item bruxism diagnosis Risk factors not weighted Unclear presentation of bruxism data
Fischer, 2008[14]	24 patients with edentulous maxilla (16 F, 8 M; m.a. 64 years)	142 implants (95 early loading, 47 delayed loading) Full-arch rehabilitation Follow-up 5 years	Assessment of bruxism signs (unspecified criteria and number of patients) Implant failure (stability, soft tissue health, and bone radiographs) Descriptive analysis	Four implants (in two patients) failed after loading – one of the two patients had bruxism/ poor hygiene	Uncertain	–	Unclear criteria for bruxism diagnosis Risk factors not weighted
Herzberg, 2006[15]	70 patients who had undergone 81 sinus lift procedures (45 F, 25 M; m.a. 52; a.r. 32–756 years)	212 implants (2.6 implants/sinus) Simultaneous graft-implant placement in 73% of cases Follow-up 6–56.5 months	Assessment based on 160 implants (60 patients) Bruxism habits (15 patients – 39/160 implants, 24.3%) Protective mouth guard to bruxers Marginal bone loss (modified Albrektsson criteria) Chi-square test	No association between bruxism and marginal bone loss	No	–	Unclear criteria for bruxism diagnosis Risk factors not weighted Confounders for the assessment of bruxism effects (mouth guards)
Ibanez, 2005[16]	41 patients needing for full-arch rehabilitations (30 F, 11 M; m.a. 62.1 years; a.r. 38–82)	49 full-arch rehabilitations 343 implants with various loading times (immediate provisional) Follow-up 12–74 months	Clinical assessment of bruxism-related symptoms (207 implants in bruxers) Implant failure (Albrektsson criteria) Descriptive analysis	The only two implants that failed were in a bruxer (plus other risk factors)	Uncertain	Clinical, even not standardized, assessment of bruxism	Risk factors not weighted

TABLE 1 *Continued*

Study's First Author and Year	Population	Intervention	Comparison	Outcome (Bruxism Related)	Conclusions: Is Bruxism a Risk Factor?	Points of Strength	Points of Weakness
Nedir, 2004[17]	236 patients (145 F, 91 M; a.r. 18–89)	528 implants with various procedures Follow-up 7 years	Bruxism habits (72 implants, 13.6%) Implant failure (Buser criteria and Cochran criteria) Descriptive analysis	Two out of three implant failures were in a bruxers (plus other risk factors: age of 81, poor hygiene, and smoking)	Uncertain	–	Unclear criteria for bruxism diagnosis Risk factors not weighted
Henry, 2003[18]	51 patients with edentulous lower jaw (23 F, 28 M; m.a. 62.3 ± 9.2; a.r. 43–79 years)	153 implants Full-arch immediate loading (manufacturer protocol) Follow-up 1 year	Bruxism signs before treatment (6/51 patients) Bruxism signs during treatment (additional 11 patients) Marginal bone loss Descriptive analysis	Four out of seven subjects reporting implant failures were bruxers (plus other risk factors) One out of six before-treatment bruxers lost all implants	Uncertain	–	Unclear criteria for bruxism diagnosis Lack of correspondence between bruxism–patient failures reported in table ($n = 4$) and text ($n = 5$) Risk factors not weighted
Eckert, 2001[19]	63 patients (28 F, 35 M)	85 wide-platform implants Follow-up 0–734 days (median 280)	Bruxism history (7 implants, 9.1%) Implant failure (loss of implants) Cox hazard analysis	Bruxism: hazard ratio 1.7 ($p = .56$)	No	Risk factors weigh	Single-item bruxism diagnosis
Ekfeldt, 2001[20]	54 patients with edentulous maxilla (32 F, 22 M; a.r. 41 to >70 years)	151 implants in the study group (patients with multiple failure) 150 implants in the control group (patients with no failures)	Diagnostic signs of bruxism (7/27 patients of the study group) Implant failure (loss of implants) Descriptive analysis (case-control design)	Bruxism attributed as cause of implant failure in 4/27 patients (clinicians' opinion)	Uncertain	–	Unclear criteria for bruxism diagnosis Risk factor assessment based on clinicians' beliefs
Glauser, 2001[21]	41 patients with edentulous lower jaw (22 F, 19 M; m.a. 52; a.r. 19–72 years)	127 immediately loaded implants (various jaw regions) Provisional immediate restorations until the end of follow-up Follow-up 1 year	Assessment of bruxism (unspecified criteria) Implant failure (stability, absence of pain, and infections) Single and multiple variable logistic regression	41% failure rate out of 22 implants in bruxers versus 12% out of 105 implants in nonbruxers (at patients' level: $p = .086$; at fixture level: $p = .002$) – OR = 0.20	Uncertain	Multiple variable assessment	Unclear criteria for bruxism diagnosis
Wannfors, 2000[22]	40 patients (28 F, 12 M; a.r. 31–78 years)	Implants in one-stage sinus lift surgery (20 patients, 76 implants) versus implants in two-stage sinus lift surgery (20 patients, 74 implants) Implants also in nongrafted areas Follow-up 1 year	Bruxism history (unspecified number of subjects) Implant failure (stability) Single and multiple variable regression analysis	6 patients out of 17 with failures in one-stage surgery were bruxers versus 4/23 in two-stage surgery Correlation between bruxism and implant failure at fixture level ($p < .05$), no correlation at the individual level ($p > .05$) – OR = 3.0	Uncertain	Multiple variable assessment	Single-item bruxism diagnosis
Lindquist, 1996[23]	47 edentulous patients (33 F, 14 M; m.a. 51 years)	273 implants Follow-up 12–15 years	Tooth clenching (unspecified criteria for diagnosis) Marginal bone loss Multiple variable linear regression	No correlation between tooth clenching and marginal bone loss	No	Multiple variable assessment	Unclear criteria for bruxism diagnosis No tooth clenching data presentation Unexplained contrasting findings with respect to a previous observation point (Lindquist and colleagues, 1988)[44]

Note: all comments, extrapolated data, and points of criticism are referred to the study of bruxism–dental implant relationship.
a.r. = age range; C.I. = confidence interval; F = female; M = male; m.a. = mean age; OR = odds ratio.

TABLE 2 Summary of Findings from Studies Assessing the Role of Bruxism as a Risk Factor for Mechanical Complications in Implant-Supported Restorations

Study's First Author and Year	Population	Intervention	Comparison	Outcome (Bruxism Related)	Conclusions: Is Bruxism a Risk Factor?	Points of Strength	Points of Weakness
Schneider, 2012[24]	70 patients (43 F, 27 M; m.a. 50.7 years; a.r. 19.8–76.6)	100 implants with different crown-to-implant ratio Follow-up 6.2 years (range 4.7–11.7)	Self-reported bruxism (17 patients, 24.3%) Mechanical complications (wear, fracture, and screws loosening) Biological complications Cox regression analysis	Bruxism did not predict mechanical or biological complications	No	Multiple variable assessment	Single-item bruxism diagnosis OR for bruxism not shown
Malò, 2011[25]	221 patients (124 F, 97 M; m.a. 56.8 years; a.r. 34–84)	995 implants 4 groups of patients based on edentulous areas Follow-up 5 years	Bruxism (anamnesis plus tooth wear; unspecified number of bruxers) Mechanical complications (fractures, abutment, or screw loosening) Logistic regression	Bruxism is a risk factor for mechanical complications (OR 60.9; C.I. 21.4–173; $p = .000$)	Yes	Multiple variable assessment	Unspecific criteria for bruxism Unspecified number of bruxers
Wahlstrom, 2010[26]	46 patients (33 F, 13 M; m.a.59; a.r. 36–84 years)	116 implants with delayed loading Follow-up 61.3 months (range 40–84)	Self-reported bruxism (31% of patients) Mechanical complications (suprastructure or implants) Implant loss Descriptive report	Four implants lost in two patients were in two bruxers Frequency of veneer fractures not related with bruxism	Uncertain	–	Single-item bruxism diagnosis No risk factors weigh
Kinsel, 2009[27]	152 patients (85 F, 67 M)	729 implants	Bruxism (43/152 patients) Fracture of ceramics Chi-square test	15/43 (34.9%) patients with signs of bruxism had metal ceramic fracture(s) versus 20/109 (18.3%) patients without bruxism ($p = .030$) At dental unit level bruxers had fractures in 59/312 (18.9%) versus 35/686 (5.1%) in nonbruxers ($p < .001$) Protective effect of oral appliances	Yes	Sample size	Unclear criteria for bruxism diagnosis No multiple risk factor analysis Single variable analysis
Tawil, 2006[28]	109 patients (65 F, 44 M; m.a. 53.6; a.r. 22–80 years)	262 short implants supporting different kinds of rehabilitations Follow-up 53 months	Bruxism habits (22.6% bruxers, 5.9% occasional bruxers, and 71.4% nonbruxers) Mechanical complications (screw loosening, fractures) Implant loss Fischer exact test	No differences in complications between bruxism groups ($p = .51$)	No	Attempt to "grade" bruxism	Unclear criteria for bruxism diagnosis Risk factors not weighted Single variable analysis
De Boever, 2006[29]	105 patients (57 F, 48 M; m.a. 59.1 ± 13.5; a.r. 25–86 years)	283 implants for 172 rehabilitations Follow-up 62.5 ± 25.3 months	Bruxism habits (visible wear facets and patients' history – 23 patients, 22%) Mechanical complications (minor, moderate, and major intervention) Chi-square test	Mechanical complications: 17/43 (39%) reconstructions in bruxers versus 29/126 (23%) in nonbruxers – $p < .001$	Yes	Clinical diagnosis of bruxism	Risk factors not weighted Single variable analysis
Brägger, 2001[30]	85 patients (53 F, 32 M; m.a. 55.7 years; a.r. 23–83)	105 implants supporting mixed teeth-implant rehabilitations Follow-up 4–5 years	Bruxism (10 patients, 8.8%) Mechanical and biological complications Chi-square test	Mechanical complications: 6/10 (60%) in bruxers versus 13/75 (17.3%) in nonbruxers – $p < .001$	Yes	–	Unclear criteria for bruxism diagnosis Risk factors not weighted Single variable analysis

Note: all comments, extrapolated data, and points of criticism are referred to the study of bruxism–dental implant relationship.
a.r. = age range; C.I. = confidence interval; F = female; M = male; m.a. = mean age; OR = odds ratio.

systematically the literature on the effects of bruxism on dental implants.

From a methodological viewpoint, it must be pointed out that none of the current standard of reference tools for reporting systematic reviews could be adopted. Indeed, while tools were proposed over the years as recommended guidelines for designing clinical trials[34] and to strengthen the reporting of observational studies in epidemiology,[35] being also at the basis of the introduction of checklists for appraising the quality of systematic reviews, at present no standard of reference instrument exists for performing reviews on the cause-and-effect relationship between the two phenomena. So, in the design phase of this review, efforts were made to maximize the external validity of findings,[36] for example, by setting no limits on the quality of the approaches adopted to diagnose bruxism, on features of the implant-related parameters for defining success or complication, on the study design (i.e., case-control, longitudinal, and retrospective), on the follow-up of implant-supported restorations, and on the publication time. Previous reviews already suggested that the literature on bruxism is characterized by a variety of diagnostic approaches and, importantly, by a low level of specificity, viz., the assessment of bruxism was seldom the main focus of the investigation.[1,6,37] This review was not an exception with respect to other bruxism reviews' findings of poor homogeneity of the study designs and populations, as well as the strategies to diagnose bruxism and to identify implant-related complications, so that meta-analyses of data could not be performed. With the exception of three investigations,[16,24,25] all studies were based on self-reported questionnaires, mainly containing a single bruxism item within a comprehensive history questionnaire or even did not report the strategy to diagnose bruxism. So, the within-study specificity and between-study homogeneity of criteria to diagnose bruxism were a matter of concern. Also, none of the examined studies was specifically designed to address the role of bruxism as a risk factor for dental implants, and the search for the pertinent literature was complicated by the need for screening a high number of papers in the dental implant literature not having bruxism assessment as their main outcome variable. Thus, it should be kept in mind that, despite the comprehensive search strategy adopted for the papers' selection and retrieval, one cannot exclude the possible exclusion of some papers that could not be detected due to their low specificity for the assessment of bruxism–dental implant complication relationship.

In an attempt to increase the homogeneity of the assessed papers and to strengthen the validity of suggestions coming from this review, the studies were arbitrarily split into a group of papers assessing the biological complications on dental implants ($n = 14$) and a group of papers assessing the mechanical complications on restorations ($n = 7$). Unfortunately, a large variability of study features was observed, even within studies of the same group of papers. For example, no specific information could be retrieved on the role of bruxism in patients with different implant-supported restorations, with different occluding surfaces, and undergoing different surgical and prosthetic techniques. Also, the concurrent presence of other risk factors that are commonly assessed in the dental implants literature (e.g., smoking habits, age, sex, bone density, and oral hygiene) and that were seldom controlled for, while assessing the bruxism-related complications rate is a very important confounding factor.

Considering the above premises, there are not enough elements to suggest that bruxism is a risk factor for biological complications around dental implants. The examined papers supported the absence of a relationship between bruxism and implant failures[11–13,15,19,23] or did not provide clear conclusions on the issue.[10,14,16–18,20–22] Notwithstanding that, it must be pointed out that two of the five papers that weighed risk factors by using a multiple regression analysis to predict implant failure evidenced a significant correlation between bruxism and implant failures at fixture levels, even if not at the patients' level.[21,22]

As for the mechanical complications, there is some evidence that bruxism may be a risk factor for fractures of ceramics[27] and, in general, for the need for technical interventions on implant-supported restorations.[25,29,30] Two other papers reported the absence of relationship between bruxism and mechanical complications,[24,28] and one investigation reported uncertain findings.[26] Notwithstanding that, even though four out of seven studies suggested a relationship between bruxism and mechanical complications, it must be pointed out that three of the four positive studies were based on single variable association analysis[27,29,30] and that one of the two papers of this group that adopted multiple variable regression analysis found that bruxism did not predict mechanical complications.[24]

According to the above, bruxism is unlikely to be a risk factor for biological complications around dental implants, while it is more likely to be a risk factor for mechanical complications. The above suggestions need to be confirmed with appropriately designed studies addressing specific clinical questions (i.e., is bruxism a cause/risk factor for implant failure or mechanical complications?). A possible strategy involved the appraisal of failed implants as, considering the very high percentage of success characterizing the implant literature,[38] it is unlikely that observational or longitudinal studies will provide enough unsuccessful cases for an assessment of risk factors which is based on statistically sound grounds. To this aim, a retrospective analysis of a case (i.e., failures)-control (i.e., successes) type with multiple variable analysis of risk factors may be a suitable strategy to get deeper into the issue. In any case, it must be borne in mind that the quality of diagnostic approaches to bruxism in the implant literature was shown to be very poor and that a better appraisal of the literature on bruxism diagnosis is fundamental to improve the validity of findings.[39] Some promising strategies have been recently introduced for the quantification of the jaw muscles' electromyographic activity related with bruxism,[40,41] and dental implants' researchers and clinicians are strongly encouraged to adopt strategies to measure bruxism-related jaw muscles' activity in order to gather more reliable data on the effects of bruxism on implant-supported rehabilitations. Bruxism is an umbrella term that groups together various motor activities, viz., clenching and grinding, potentially having different effects on the stomatognathic structures due to the different forces they exert and loads they transmit.[42] Keeping this in mind, the role of occlusion as a force transmitter to the teeth and dental implants should be also assessed,[43] as the influence of factors such as the occlusal design and the presence of nonaxial loads on implant-supported rehabilitations cannot be underestimated as risk factors for implant complications in subjects with bruxism.

CONCLUSIONS

In conclusion, based on the systematic review of the available literature, bruxism is unlikely to be a risk factor for biological complications around dental implants, while there are some suggestions that it may be a risk factor for mechanical complications. Overall, the quality and specificity of the reviewed literature are very poor, thus suggesting caution in the interpretation of the conclusions and underlining the need for appropriately designed investigations.

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