

# Does bruxism contribute to dental implant failure?

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**A critical appraisal of a systematic review:** Zhou Y, Gao J, Luo L, Wang Y. Does bruxism contribute to dental implant failure? A systematic review and meta-analysis. *Clinical Implant Dentistry and Related Research* 2015 doi: 10.1111/cid.12300  
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## Summary

**Systematic review conclusion:** The meta-analysis suggests that bruxism is a contributing factor towards the occurrence of dental implant technical/biological complications and plays a role in dental implant failure. Prostheses in bruxers presented with a higher failure rate compared to non-bruxers.

**Critical appraisal conclusion:** The results suggest that bruxism could be associated with implant complications biological and/or technical). The findings also suggest that the likelihood that a biological (implant failure) or a mechanical (prosthesis failure) complication could occur was almost four times greater in bruxers compared to non-bruxers. Prostheses are more likely to fail (porcelain chipping and fractures, screw loosening and fractures) in bruxers compared to non-bruxers. These findings should however be interpreted with caution due to the poor level of evidence presented in this review.

**Implications for clinical practice:** Current expert opinion suggests that clinicians adopt a cautious approach based on measures that can assist in reducing the harmful effects of occlusal forces that are developed and transmitted to peri-implant bone and implant assisted prostheses during tooth-grinding and tooth-clenching. Measures that should be taken in consideration are the surgical (bone quality, number, size and position of implants), prosthetic (timing of loading, flatter cuspal planes, greater freedom of movement at the occlusal contact areas, splinting and avoiding cantilevers and non-axial loads) and preventive (use of a hard protective occlusal splint during night-time) aspects of implant therapy.

## Clinical question

*Is there a relationship between bruxism and dental implant failure?*

## Review methodology

The authors conducted a systematic search of the MEDLINE (PubMed) and EmBase database in November 2013 (start and end date not indicated) without time and language restrictions. Potential studies had to meet the following eligibility criteria to be included in the review: (i) participants receiving dental implant treatment; (ii) presence of bruxism (clenching or grinding of the teeth, and bracing or thrusting of the mandible) (iii) dental implant failure (biological and/or biomechanical); and (iv) studies had to be designed as cohort studies (bruxers vs non-bruxers); and follow-up of the

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prosthesis at least 1 year in function. Laboratory and animal studies as well as duplicated studies were excluded from the meta-analysis. A hand searching off all the relevant references of included studies were also conducted to identify further potential studies. The primary outcome measured was technical failure (fracture: porcelain/screw/ implant; loosening: screw/implant; losing of retention/ implant). The quality of retrieved cohort studies was assessed using the Newcastle-Ottawa Scale (NOS) tool.<sup>1</sup> Selection of studies, data extraction and assessment of methodological quality was performed independently by two reviewers. Disagreement was resolved through consulting a third reviewer.

Due to different units of analysis used in the primary studies, collected data were classified into two groups based on number of prostheses (Group A) or number of patients (Group B). Within each group a subgroup analysis was performed for primary studies reporting on outcomes: (i) ceramic chipping and fractures; (ii) implant loss; and (iii) other mechanical failures such as screw loosening and fractures, respectively. Odds ratio (OR) with 95% confidence interval (CI) was pooled to estimate the relative effect of bruxism on dental implant failures (complications). Statistical analysis was performed using the fixed effects model. Where heterogeneity was high, the random effects model was used. The Cochran's Q and I<sup>2</sup> statistic was used to test heterogeneity across studies.

## Main results

### Study characteristics

Seven cohort studies were included in this meta-analysis. In Group A, 1788 prostheses were placed in patients, and 509 prostheses were in bruxers. In Group B a total of 445 participants were included of which 81 patients had a history of bruxism. Most participants were older than 50 years old. The mean duration of follow-up time for each study ranged from 1 to 10 years.

The NOS assessment suggests that the included studies had acceptable quality. Thus according to this assessment the representativeness of the exposed/non-exposed cohort, outcome assessment, length of follow-up time, and adequacy of follow up were of good quality and had low risk of bias.

A statistically significant relationship was found between bruxism and dental implant related failures (biological implant failure and mechanical prostheses complications). In group A (prostheses is unit of analysis) the total pooled OR of bruxers versus non-bruxers for all subgroups was 4.72 (95% CI: 2.66–8.36,  $p = 0.0001$ ). In group B (patient is

unit of analysis), the total pooled OR of bruxers versus nonbruxers for all subgroups was 3.83 (95% CI: 2.12–6.94,  $p = 0.0001$ ).

Subgroup analysis for outcomes (i) ceramic fractures or chipping; (ii) implant loss; and (iii) other mechanical failures (i.e. screw loosening or fracture) showed the same relationship in both group A and B. All the outcomes in the subgroup analysis were statistically significant except implant loss in Group B ( $p = 0.30$ ).

Among all the complications, ceramic (or porcelain) chipping (or fracture) had a higher failure rate than the others.

## Conclusion

The meta-analysis suggests that bruxism is a contributing factor towards the occurrence of dental implant technical/biological complications and plays a role in dental implant failure. Prostheses in bruxers presented with a higher failure rate compared to non-bruxers.

*The authors declared that there was no potential conflict of interest with respect to the authorship and/or publication of this review.*

## Commentary

### Background and importance

Bruxism is an umbrella term used for clenching and grinding of teeth occurring without a functional purpose (non-functional motor activity). It can occur during sleep (sleep bruxism) or during wakefulness (awake bruxism). It is considered as one of the most frequent of the many parafunctional activities that has a potential for causing damage to the stomatognathic system.<sup>2</sup> Bruxism is often cited as a risk factor for implant failure, both biological and mechanical, on the basis that the forces transmitted to the parts of the implant system during bruxing activities can result in overloading of the mechanical and biological components of the implant system, resulting in occlusal surface wear fracture, loosened screws, or abutment and implant fracture.<sup>3,4,5</sup>

Much still remains unclear, conflicting and controversial about the definition, etiology, and diagnosis, of bruxism and its relationships with the stomatognathic system, and with dental implants and its superstructures in particular.<sup>5,6,7</sup> Most authors agree that bruxism is primarily a disorder of central origin (e.g., sleep arousal responses, stress, anxiety) with a lesser importance placed on the role peripheral origin (e.g., occlusal factors). It is hypothesized that one or more factors (stress, anxiety, genetics, neurochemical responses, sleep arousal response, factors linked to quality of sleep, oral and

dental anatomy) may, in different ways and to different degrees contribute to increasing frequency, duration and intensity of normal masticatory muscle activity during sleep or wakefulness, thus resulting in increased loading forces and cycles.<sup>8</sup> It also hypothesized that the increased loading forces on implants and their superstructures in bruxers combined with the reduced proprioceptive feedback and give from the absence of periodontal ligament around implants could cause biological and mechanical complications, thus resulting in implant and prostheses failure.<sup>6,9</sup>

A recent systematic review suggests that bruxism may be a risk factor for mechanical complications in implant prostheses (porcelain chipping and fractures, screw loosening and fractures), but unlikely to be a risk factor for biological complications around implants.<sup>10</sup>

### Are the results valid?

This review presented with several limitations increasing the risk of bias that may potentially influence the quality of the data. The primary study designs and research methodology were generally of a very low quality based on investigating non-representative samples, characterized by analyzing convenient cohort groups in academic institutions [prospective (4) and retrospective (3)], small sample sizes, lacking control groups and no sampling strategy. Such flaws could affect the external validity of the findings and the consistency of the data.

Cohort studies are generally easily affected by various biases compared to experimental research designs.

Participants in the included studies varied with regards to type of implant and prostheses. Prostheses varied from CAD/CAM designed full arch prostheses to single tooth restorations and screw retained or cement-retained. The type of implant system used, number of implants, in which jaw they were placed and the loading protocol also varied significantly within and between studies.

The diagnostic criteria for bruxism were inadequately defined or lacking in several of the included primary studies and therefore a serious limitation. Different diagnostic strategies were used in the primary studies. At present validated diagnostic criteria exist only for sleep bruxism and should be based on polysomnography recordings in a controlled laboratory setting.<sup>7</sup> No definitive validated criteria as yet, exists for measuring bruxing activities during wakefulness. Other diagnostic complexities such as the frequency, degree of intensity and duration of bruxism was not recorded in the primary studies, thus the effect thereof

could not be assessed in this review.

The presence of co-morbid conditions such as physical or psychological conditions, smoking, use of drugs, type of prostheses, occlusion scheme, opposing dentition and presence of cantilevers in prosthetic restorations were not taken into consideration. These confounding variables may have a potential influence on the frequency, intensity and duration of bruxism and/or the prevalence of biological and technical complications (failures) with dental implants and/or prostheses.

On the positive side, the results showed consistency in the estimates of effect in the two groups as well as the subgroups, irrespective of the heterogeneity in study design, variety of patients and taking the sensitivity analysis into consideration. On the negative side, heterogeneity may introduce ambiguity into the synthesis of the evidence. Poor study design, heterogeneity of participants, inconsistency and inaccuracies in the research methodology, and lack of controlling confounding factors potentially increases the risk of bias resulting in poor quality of evidence and thus reducing the validity of the results. The findings from this review should therefore be interpreted with caution.

### What were the key findings?

Disregarding the poor quality of the evidence and based on the estimated odds ratios, the following key findings can be made regarding the relationship between bruxism and implant complications/failures (biological and/or technical). The results suggest that bruxism could be associated with implant complications biological and/or technical). In general, the likelihood that a biological (implant failure) or a mechanical (prosthesis failure) complication could occur was almost four times greater in bruxers compared to non-bruxers. Prostheses are more likely to fail (porcelain chipping and fractures, screw loosening and fractures) in bruxers compared to non-bruxers. These findings should however be interpreted with caution within the context of the poor level of evidence available and presented in this review.

### How are the results of this review applicable in clinical practice?

The estimates of OR (the likelihood or odds that an outcome (implant or prosthesis failure) will occur given a particular exposure (bruxism or non-bruxism) were very consistent in both groups and subgroup analysis. This consistency across studies of various types in a variety of patients may increase the applicability of the findings in clinical practice.

However, current expert opinion suggests that clinicians

adopt a cautious approach based on measures that can assist in reducing the harmful effects of occlusal forces that are developed and transmitted to peri-implant bone and implant assisted prostheses during tooth-grinding and tooth-clenching. Measures that should be taken in consideration are the surgical (bone quality, number, size and position of implants), prosthetic (timing of loading, flatter cuspal planes, greater freedom of movement at the occlusal contact areas, splinting and avoiding cantilevers and non-axial loads) and preventive (use of a hard protective occlusal splint during nighttime) aspects of implant therapy.”

### Clinical Resolution

The research data is fragmented by the heterogeneity of study populations, diverse confounding exposures, varying diagnostic strategies for bruxing, different surgical and prosthetic implant interventions, and poor study design, thus influencing the quality of the evidence. However, the consistency in the findings within and across primary studies increases the confidence in the estimates of OR that bruxism may be associated with increased biological and mechanical failures or complications in implants and the prostheses respectively. These findings should however be interpreted with caution within the context of the poor level of evidence available and presented in this review. Bruxism remains a potential risk factor; therefore clinicians should adopt a cautious approach when planning for implant-assisted prostheses in bruxers.

This review has illustrated the vast need for well-designed studies for both the etiology of bruxism and its purported relationship with implant failure.

### Disclosure and Disclaimer

Dr Johan Hartshorne is trained in clinical epidemiology, biostatistics, research methodology and critical appraisal of research evidence. This critical appraisal is not intended to, and do not, express, imply or summarize standards of care, but rather provide a concise reference point for dentists to

aid in understanding and applying research evidence from referenced early view or pre-published articles in top ranking scientific publications and to facilitate clinically sound decisions as guided by their clinical judgement and by patient needs.

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