Should I incorporate a cantilever extension on an implant-supported fixed dental prosthesis (FDP) or not?

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A critical appraisal of a systematic review and meta-analysis: Torrecillas-Martinez L, Monje A, Lin G-H, Suarez F, Ortega-Oller I, Galindo-Moreno P, Wang H-L. (2014) Effect of cantilevers for implant-supported prostheses on marginal bone loss and prosthetic complications: Systematic review and meta-analysis. International Journal of Oral and Maxillofacial Implants. Accepted manuscript, doi: 10.11607/jomi.3660

Summary

Systematic review conclusion: Marginal bone loss does not seem to be influenced by the presence of cantilever extensions. Minor technical complications were found when a cantilever was present when compared to the control groups. The lack of scientific evidence does not permit clear conclusions to be drawn.

Critical appraisal conclusion: This meta-analysis is characterized by sparse and very low level quality of evidence, and critical methodological errors. The meta-analysis is considered worthless in terms of the focussed clinical question. Available data on the effect of implant-supported FDPs with and without a cantilever extension are scarce suggesting further research on this topic.

Implications for clinical practice: Current systematic reviews supports the use of FDPs supported by two or more implants with a short cantilever extension (one tooth either mesial or distal), as an acceptable alternative therapeutic option to avoid procedures that require more advanced surgery (e.g. sinus elevation or bone grafts), for aesthetic reasons, in anatomical compromised locations, or in cases where patients have limited financial means to afford complex treatment. However, until more evidence becomes available, this treatment modality should not be seen as the standard of care that can be generalized to all cases.

Clinical question

"In partially edentulous patients restored by implant-supported prostheses with or without cantilever extensions, are there any differences in terms of marginal bone loss and prosthetic complications?"

Review methods

Methodology

The reviewers conducted the systematic review of the literature according to the PRISMA[1] (Preferred Reporting Items for Systematic Review and Meta-analysis) statement.

Search strategy and study selection

Two independent reviewers conducted an electronic literature search of the MEDLINE-Pubmed database for relevant articles from June 2003 to January 2013. In addition, a manual search of implant-related journals from 2010 to 2013 was also performed to ensure a thorough screening of the available literature. The search was restricted to articles in English only.

Eligibility and exclusion criteria

Prospective human clinical trials studying implant-supported fixed partial prosthesis with cantilevers with at least 12 months loading were eligible for the meta-analysis. The studies had to include the following data: the extension of the cantilever, the type and number of implants supporting the cantilever, location of the implants, and the antagonist (opposing) occlusion, and the biological and prosthetic complications.

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Case reports, systematic reviews, and animal studies were excluded from the meta-analysis. Studies where no cantilever extensions or MBL were reported or where patients underwent any type of bone augmentation at the implant site were also excluded. References in the excluded studies were also checked for studies that fulfilled the inclusion criteria.

Outcome measures and data extraction

The primary outcomes analysed was the amount of radiographic bone loss around dental implants. The pooled weighted mean (WM) and the 95% confidence interval (CI) of each variable as well as the weighted mean difference (WMD) was calculated and analysed. Random effects meta-analysis of the selected studies was applied to avoid potential bias being caused by methodological differences among studies. Forest plots were produced to graphically represent the data for all included studies using the number of participants investigated as the analysis unit. Funnel plots were also examined to detect publication bias. Studies with more than one treatment arm were combined for statistical analysis. Heterogeneity among studies was assessed with the P value of the chi-square test, and $P < .05$ represented significant heterogeneity.

Main results

A total of 4 articles fulfilled the inclusion criteria for this meta-analysis. Statistical analysis revealed a low heterogeneity among studies ($P = 0.60$).

The weighted mean for the pooled data of the marginal bone loss (MBL) was 0.72 mm 95% CI (0.36 to 1.08).

Porcelain fractures was the most common prosthetic complication (39.2%). Abutment screw loosening was relatively low for the cantilever extensions in all the studies analysed. Only one study reported prosthesis decementation in 3 of 59 FDP's.[2]

Conclusion

Marginal bone loss does not seem to be influenced by the presence of cantilever extensions. Minor technical complications were found when a cantilever was present when compared to the control groups. The lack of scientific evidence does not permit clear conclusions to be drawn.

The authors reported no conflict of interest with respect to the authorship and/or publication of this review.

Commentary

Background and importance

Unilateral implant-supported FDPs with cantilever extensions are frequently used to expand therapeutic options where there is insufficient bone or compromised anatomical locations, a need exists to avoid implantation and bone grafting, and to save treatment time and costs.

Finite-element analysis show that cantilevered prostheses can produce enhanced stress concentrations at the distal bone/implant interface facing the cantilever extension potentially causing biological (e.g. bone loss) and technical (screw loosening, porcelain fracture, or implant fracture) problems.[3] A number of recent systematic reviews have reported on survival rates and the biological, technical and mechanical complications of implant-supported FDPs with cantilevers compared those without cantilevers.[4, 5, 6, 7] Current evidence indicate that the incorporation of cantilever extensions into implant-supported FDPs, is a valid and reliable treatment alternative for replacing missing teeth in partially edentulous patients, this treatment modality has a high survival rate, does not have any clinically significant effects on the peri-implant MBL at the implant next to the cantilever, and may be associated with a higher incidence of minor technical complications (screw loosening and porcelain fracture).[5, 6, 7] However, biological and technical complication was observed more frequently after 10 years.[4] In addition, there is also limited evidence to support the use of FDP with a cantilever extension supported by one implant.[7]

To date, however, controlled clinical trials on implant-supported FPDs with and without cantilever extensions are scarce, therefore survival and complication rates should be interpreted with caution.

Are the results valid?

The studies included in the review consisted of one controlled clinical trial[8] and three prospective observational studies (no controls without cantilevers).[2,9,10] Overall, the level of evidence is of a very low quality and only one study[8] fulfilled the requirement of answering the clinical question. The methodological rigor of the review is questionable due to various limitations such as: inadequate searching of bibliographic databases, grey literature was not search and no inquiry was conducted regarding unpublished studies. Furthermore the study was limited to English language only. Therefore based on these observations there is a good probability that some studies could have been omitted, such as the controlled clinical control trial by Hälg and co-workers[11], and the case-control study by Kim and co-workers[12] (Manuscript accepted 18 November 2012, Article first published online 2 January 2013). The eligibility criteria used to select article for inclusion or exclusion was not clearly defined apriori and very vague. The authors did not report whether the individual studies were evaluated for methodological quality. Considering abovementioned there are various potential sources of bias that has not been addressed.

Based on the limitations and weaknesses presented by review study, the validity of the results was inadequate for the type of question asked.

What were the key findings?

The authors of the review made a critical error by using the study by Palmer and co-workers[10] in the meta-analysis of the average marginal bone loss around implant-supported restorations with and without cantilevers. The study by Palmer did not include a control group without cantilevers in their study and is basically an observational study of implant-supported prostheses with cantilever extensions. The authors of the review erroneously used average marginal bone loss values measured on the opposite side of the implant surface facing the cantilever extension. This error rendered the meta-analysis thus worthless in terms of the focussed question.

Clinical resolution

The study question is relevant and important to clinical practice. However, the meta-analysis was worthless and did not make any contribution towards current available knowledge on this topic.

Well-designed, assessed and reported randomised clinical trials are required to study the effects of: various prosthetic designs (e.g. distal or mesial) cantilever extensions, the number of implants and implant connection supporting FDPs with cantilever extensions, and occlusal concepts on the incidence of biological and technical complications.

Disclosure

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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