A systematic review of the survival and complication rates of implant supported fixed dental prostheses with cantilever extensions after an observation period of at least 5 years

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Key words: biological complication, bone loss, cantilevers, dental implant, extensions, fractures, peri-implantitis, success rate, survival rate, systematic review, technical complication

Abstract

Objective: The aim of this systematic review was to assess the survival rates of short-span implant-supported cantilever fixed dental prostheses (ICFDPs) and the incidence of technical and biological complications after an observation period of at least 5 years.

Material and methods: An electronic MEDLINE search supplemented by manual searching was conducted to identify prospective or retrospective cohort studies reporting data of at least 5 years on ICFDPs. Five- and 10-year estimates for failure and complication rates were calculated using standard or random-effect Poisson regression analysis.

Results: The five studies eligible for the meta-analysis yielded an estimated 5- and 10-year ICFDP cumulative survival rate of 94.3% [95 percent confidence interval (95% CI): 84.1–98%] and 88.9% (95% CI: 70.8–96.1%), respectively. Five-year estimates for peri-implantitis were 5.4% (95% CI: 2–14.2%) and 9.4% (95% CI: 3.3–25.4%) at implant and prosthesis levels, respectively. Veneer fracture (5-year estimate: 10.3%; 95% CI: 3.9–26.6%) and screw loosening (5-year estimate: 8.2%; 95% CI: 3.9–17%) represented the most common complications, followed by loss of retention (5-year estimate: 5.7%; 95% CI: 1.9–16.5%) and abutment/screw fracture (5-year estimate: 2.1%; 95% CI: 0.9–5.1%). Implant fracture was rare (5-year estimate: 1.3%; 95% CI: 0.2–8.3%); no framework fracture was reported.

Radiographic bone level changes did not yield statistically significant differences either at the prosthesis or at the implant levels when comparing ICFDPs with short-span implant-supported end-abutment fixed dental prostheses.

Conclusions: ICFDPs represent a valid treatment modality; no detrimental effects can be
expected on bone levels due to the presence of a cantilever extension per se.

➔ In diesem Review wird gesagt, dass es noch keine wissenschaftliche Evidenz für die
Extensionsbrücke von einer Implantatkrone gibt.

Biological and technical complications and failures with fixed partial dentures (FPD) on implants
and teeth after four to five years of function

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Key words: Fixed partial dentures, technical complications, biological complications,
dental implants

Abstract: The aim of this study was to compare the frequency of biological and technical
complications with fixed partial dentures (FPDs) on implants, teeth and as mixed tooth-implant
supported FPDs over 4 to 5 years of function. All implants belonged to the ITIA
Dental Implant System. Group I-I (implant FPD) included 33 patients with 40 FPDs, group
T-T (tooth FPDs) 40 patients with 58 FPDs, group I-T (mixed tooth-implant FPDs) 15 with
18 FPD. Of the bridge abutments 144 were teeth and 105 were implants. The median
number of units replaced by the FPDs was 3 (range 2–14). The mean age of the patients
was 55.7 years (range 23–83). Complete failures resulted in the loss of one FPD in each
group. Two implants were lost due to fracture secondarily to development of a bone
defect. One tooth had a vertical fracture and 1 tooth was lost due to periodontitis.

Biological complications (peri-implantitis, PPD ≥5 mm and BOP¹) occurred at 9.6% (10)
of the implants. This number was, however, reduced to 5% if the threshold for definition
of peri-implantitis was set at PPD ≥6 mm and BOP¹. Biological complications occurred
in 11.8% (17) of the abutment teeth (NS compared to implants); 2.8% (4) had
secondary caries, 4.9% (7) endodontic problems and 4.1% (6) had periodontitis (PPD ≥5
mm, BOP¹). Ten out of 32 patients with a general health problem indicated a biological
complication, whereas 9 out of 53 patients with no general health problem had a
biological complication (c²: NS). Statistically significantly more technical complications
were found in FPDs on implants (c², P*0.05). The technical complications were
associated with bruxism. Out of 10 bruxers 6 had a technical complication whereas 13 out of 75 non-bruxers had such a complication (c2#.01). Extensions were associated with more technical complications (13 out of 35 with extensions versus 9 out of 81 without). In conclusion, favourable clinical conditions were found at tooth and implant abutments after 4–5 years of function. Loss of FPD over 4–5 years occurred at a similar rate with mixed, implant or tooth supported reconstructions. Significantly more porcelain fractures were found in FPDs on implants. Impaired general health status was not significantly associated with more biological failures but bruxism as well as extensions were associated with more technical failures.

Bone level changes at implants supporting crowns or fixed partial dentures with or without cantilevers

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Key words: alveolar bone loss, cantilever, controlled clinical trial, dental implants, denture, fixed, humans, marginal bone level, partial

Abstract

Objective: The aim of this study was to analyze whether or not a cantilever extension on a fixed dental prosthesis (FDP) supported by implants increased the amount of peri-implant bone loss or technical complications compared with reconstructions without cantilevers.

Materials and Methods: Fifty-four partially dentate patients with a total of 54 FDPs supported by 78 implants were enrolled in the study. Twenty-seven FDPs were with cantilever and 27 FDPs were without cantilever (control group). All FDPs were supported by one or two implants and were located in the posterior maxilla or mandible. The primary outcome variable was change in peri-implant marginal bone level from the time of FDP placement to the last follow-up visit. FDPs were under functional loading for a period of 3 up to 12.7 years. Statistical analysis was carried out with Student’s t-test. Regression analyses were carried out to evaluate the influence of confounding factors on the peri-implant bone
level change. In addition, implant survival rates were calculated and technical complications assessed.

**Results:** After a mean observation period of 5.3 years, the mean peri-implant bone loss for the FDPs with cantilevers was 0.23mm (SD _ 0.63mm) and 0.09mm (SD _ 0.43mm) for FDPs without cantilever. Concerning the bone level change at implants supporting FDPs with or without cantilevers no statistically significant differences were found. The regression analysis revealed that jaw of implant placement had a statistically significant influence on peri-implant bone loss. When the bone loss in the cantilever group and the control group were compared within the maxilla or mandible separately, no statistically significant difference was found. Implant survival rates reached 95.7% for implants supporting cantilever prostheses and 96.9% for implants of the control group. Five FDPs in the cantilever group showed minor technical complications, none were observed in the control group.

**Conclusion:** Within the limitations of this study it was concluded that cantilever on FDPs did not lead to a higher implant failure rate and did not lead to more bone loss around supporting implants compared with implants supporting conventional FDPs. In contrast to these results more technical complications were observed in the group reconstructed with cantilever.

> In dieser Studie sind an 8 Einzelimplantatkronen mit Anhängern gesetzt worden. Insgesamt konnte kein erhöhter marginaler Knochenabbau festgestellt werden, jedoch wird auf die Vermehrung von technischen Komplikationen bei dieser Art von Versorgung hingewiesen. Diese Studie trifft die Anfrage am ehesten.

**The cantilever fixed partial denture-A literature review**

*Raphael Himmel, DMD,a Raphael Pilo, DMD,B David Assif, DMD,b and Israel Aviv, DMA*

The cantilever fixed partial denture (FPD) is a restoration with one or more abutments at one end and unsupported at the other end. Forces transmitted
through the cantilevered pontics can cause tilting and rotational movements of the abutments. In a cross-arch unilateral cantilever FPD, the distal cantilevered unit is subjected to comparatively less force than the contralateral posterior abutment. The unilateral lack of terminal abutments causes lateral bending forces that activate peripheral inhibitory feedback reactions from the periodontal and/or temporomandibular mechanoreceptors. The greatest strain in distal cantilevered FPDs is recorded mesial to the most distal retainer because most fractures occur in this location. To improve the prognosis of the FPD cantilever, the number of abutments should be increased and the number of pontics decreased. The abutment teeth need long roots and acceptable alveolar support. Prepared abutments require adequate length and parallel axial walls. An equilibrated and harmonious occlusion is necessary, as well as exemplary oral hygiene. A cantilevered FPD with adequate periodontal support can replace any tooth in the dental arch, but is especially useful as an alternative to a removable partial denture. The cantilevered FPD requires at least two abutment teeth. The only documented exception permitting a single abutment is the replacement of a maxillary lateral incisor with the canine as an abutment. An alternative to the cantilevered FPD is the osseointegrated implant. As osseointegrated implants become more popular, the need for the tooth-supported cantilevered FPD may decline, but it will remain an alternative treatment modality. (J PROSTHET DENT 1992;67:484-7.)

Hier wird bei natürlichen Zähnen angegeben, dass nur ein Eckzahn als Abutment für einen Einzelkronenanhänger zum Ersatz eines seitlichen Schneidezahnes reichen würde. Sonst gäbe es keine Indikation für diese Behandlung.

**Implant-supported fixed cantilever prosthesis in partially edentulous jaws: a cohort prospective study.**

*Romeo E, Tomasi C, Finini I, Casentini P, Lops D.*

Abstract:

Background: Reconstructive procedures present a higher rate of biological costs due to the necessity of bone harvest and grafts, use of semipermeable barriers etc. On the hand, implant supported cantilever prostheses could allow a simpler rehabilitation procedure.

Aims: The aim of the present study was to assess the clinical outcome of patients treated with implant-supported fixed partial dentures (FPD) with cantilever after a mean follow-up time of 8 years.

Material and methods: The study included 45 consecutive partially edentulous patients treated between January 1994 and August 2006 with 59 partial cantilever fixed prostheses supported by 116 ITIs implants. The primary outcome variable considered was the presence of complications at the subject and bridge level; the secondary outcome variable was marginal bone loss (MBL). The frequency of complications was analyzed according to cantilever location and opposite dentition and tested by Fisher’s exact test. A multilevel regression model was constructed to analyze the factors influencing MBL with three levels: subject as the highest, and then implant and site. During the follow-up period, 11 implants showed a bone loss exceeding the limit for success, out of which two implants showed an infection of the peri-implant tissue.

Results: After an average observation of 8.2 years of cantilever prostheses loading, the implant success and survival rates were 90.5% and 100%, respectively. Besides, the prosthetic success and survival rate were 57.7% and 100%, respectively.

Discussion: None of the predictors included in the multilevel model presented a significant impact on the bone loss between baseline and the follow-up examination.

Conclusions: The authors concluded that the prognosis of implant-supported FPDs and marginal bone loss at implants were not influenced by the position or the length of the cantilever, the location of the bridge and type of opposite dentition. Implant-supported
fixed cantilever prosthesis can be considered a suitable treatment choice.

In dieser Studie scheinen 9 Einzelimplantate mit Einzelkronen und Anhängern versorgt worden zu seien. Im Detail wird aber nicht auf diese im Vergleich zu denen mit z.B. 2 oder 3 Implantaten eingegangen, sondern diese werden als Extensionsbrücke in den Pool integriert.


**Mechanical and technical risks in implant therapy.**

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PURPOSE: To systematically appraise the impact of mechanical/technical risk factors on implant-supported reconstructions. MATERIAL AND METHODS: A MEDLINE (PubMed) database search from 1966 to April 2008 was conducted. The search strategy was a combination of MeSH terms and the key words: design, dental implant(s), risk, prosthodontics, fixed prosthodontics, fixed partial denture(s), fixed dental prosthesis (FDP), fixed reconstruction(s), oral rehabilitation, bridge(s), removable partial denture(s), overdenture(s). Randomized controlled trials, controlled trials, and prospective and retrospective cohort studies with a mean follow-up of at least 4 years were included. The material evaluated in each study had to include cases with/without exposure to the risk factor. RESULTS: From 3,568 articles, 111 were selected for full text analysis. Of the 111 articles, 33 were included for data extraction after grouping the outcomes into 10 risk factors: type of retentive elements supporting overdentures, presence of cantilever extension(s), cemented versus screw-retained FDPs, angled/angulated abutments, bruxism, crown/implant ratio, length of the suprastructure, prosthetic materials, number of implants supporting an FDP, and history of mechanical/technical complications.
CONCLUSIONS: The absence of a metal framework in overdentures, the presence of cantilever extension(s) > 15 mm and of bruxism, the length of the reconstruction, and a history of repeated complications were associated with increased mechanical/technical complications.

The type of retention, the presence of angled abutments, the crown-implant ratio, and the number of implants supporting an FDP were not associated with increased mechanical/technical complications. None of the mechanical/technical risk factors had an impact on implant survival and success rates.

In diesem review werden kürzere Anhänger-Brücken nicht mit einem erhöhten mechanischem/technischem Risiko für Implantate assoziiert. Unklar ist ob dies auch für Einzelkronen gilt.


Prosthetic treatment planning on the basis of scientific evidence.

Pjetursson BE, Lang NP.

The objective of this report is to summarize the results on survival and complication rates of different designs of fixed dental prostheses (FDP) published in a series of systematic reviews. Moreover, the various parameters for survival and risk assessment are to be used in attempt to perform treatment planning on the basis of scientific evidence. Three electronic searches complemented by manual searching were conducted to identify prospective and retrospective cohort studies on FDP and implant-supported single crowns (SC) with a mean follow-up time of at least 5 years. Patients had to have been examined clinically at the follow-up visit. Failure and complication rates were analyzed using random-effects Poisson regression models to obtain summary estimates of 5- and 10-year survival proportions. Meta-analysis of the studies included indicated an estimated 5-year survival of conventional tooth-supported FDP of 93.8%, cantilever FDP of 91.4%, solely implant-supported FDP of 95.2%, combined tooth-implant-supported FDP of 95.5% and implant-supported SC of 94.5% as well as resin-bonded bridges 87.7%. Moreover, after 10 years of function the estimated
survival decreased to 89.2% for conventional FDP, to 80.3% for cantilever FDP, to 86.7% for implant-supported FDP, to 77.8% for combined tooth-implant-supported FDP, to 89.4% for implant-supported SC and to 65% for resin-bonded bridges. When planning prosthetic rehabilitations, conventional end-abutment tooth-supported FDP, solely implant-supported FDP or implant-supported SC should be the first treatment option. Only as a second option, because of reasons such as financial aspects patient-centered preferences or anatomical structures cantilever tooth-supported FDP, combined tooth-implant-supported FDP or resin-bonded bridges should be chosen.

Sehr interessantes Review, welches verschiedene Behandlungsmöglichkeiten erläutert, bei fehlenden Zähnen. Anhänger an Einzelkronen werden nicht erwähnt.


Survival and complication rates of implant-supported fixed partial dentures with cantilevers: a systematic review.

Zurdo J, Romão C, Wennström JL.

OBJECTIVE: The objective of the present systematic review was to analyze the potential effect of incorporation of cantilever extensions on the survival rate of implant-supported fixed partial dental prostheses (FPDPs) and the incidence of technical and biological complications, as reported in longitudinal studies with at least 5 years of follow-up.

METHODS: A MEDLINE search was conducted up to and including November 2008 for longitudinal studies with a mean follow-up period of at least 5 years. Two reviewers performed screening and data abstraction independently. Prosthesis-based data on survival/failure rate, technical complications (prosthesis-related problems, implant loss) and biological complications (marginal bone loss) were analyzed. RESULTS: The search provided 103 titles with abstract. Full-text analysis was performed of 12 articles, out of which three were finally included. Two of the studies had a prospective or
retrospective case-control design, whereas the third was a prospective cohort study. The 5-year survival rate of cantilever FPDs varied between 89.9% and 92.7% (weighted mean 91.9%), with implant fracture as the main cause for failures. The corresponding survival rate for FPDs without cantilever extensions was 96.3-96.2% (weighted mean 95.8%). Technical complications related to the supra-constructions in the three included studies were reported to occur at a frequency of 13-26% (weighted mean 20.3%) for cantilever FPDs compared with 0-12% (9.7%) for non-cantilever FPDs. The most common complications were minor porcelain fractures and bridge-screw loosening. For cantilever FPDs, the 5-year event-free survival rate varied between 66.7% and 79.2% (weighted mean 71.7%) and between 83.1% and 96.3% (weighted mean 85.9%) for non-cantilever FPDs. No statistically significant differences were reported with regard to peri-implant bone-level change between the two prosthetic groups, either at the prosthesis or at the implant level.

**CONCLUSION:** Data on implant-supported FPDs with cantilever extensions are limited and therefore survival and complication rates should be interpreted with caution. The incorporation of cantilevers into implant-borne prostheses may be associated with a higher incidence of minor technical complications.