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**Practice Limited to Implant Surgery & Prosthodontics**



## Tooth-Implant-Supported Fixed Partial Dentures

*Often dismissed due to obvious biomechanical abutment disparities, the tooth-implant-supported fixed partial denture (FPD) may be either a deliberate design choice or a design of necessity, given a variety of diagnostic factors uncovered during treatment planning (bone volume, anatomic limitation, esthetics, soft tissue availability, etc.). The unexpected loss of an implant when planning for a multiple implant FPD may also necessitate its use. This issue of Prosthodontics Newsletter presents a critical and systematic look at clinical outcomes that will help guide practitioners in the appropriate use of this restorative concept.*

## Tooth-Implant-Supported vs Implant-Supported FPDs

The use of implant-supported fixed partial dentures (FPDs) has become a standard treatment option and is a safe and predictable solution for partially edentulous patients. For some patients with certain anatomic, prosthodontic and patient-specific factors, however, placing implants at both ends of an edentulous span may be contraindicated.

One proposed solution to this problem, the use of tooth-implant FPDs supported by 1 implant and 1 natural tooth, has been considered a high-risk option compared with either exclusively tooth-supported or implant-supported FPDs. The differences between natural teeth and implants in biomechanical behavior was thought to lead to an increase in biologic, mechanical

and technical complications, including peri-implant marginal bone loss, peri-apical pathology, tooth intrusion, prosthetic screw loosening, and fracture of implants and prosthetic components.

To evaluate the success of tooth-implant-supported FPDs compared with that of purely implant-supported FPDs, Alsabeeha, a private practitioner, and Atieh from the Mohammed Bin Rashid University of Medicine and Health Sciences, United Arab Emirates, conducted a systematic review and meta-analysis of the available evidence. They searched the literature for randomized controlled trials, nonrandomized controlled clinical trials and

retrospective studies that compared outcomes for tooth-implant-supported FPDs and implant-supported FPDs. Outcome measures evaluated from the 7 studies that met the inclusion criteria were

- implant failure rate (implants reported lost after placement)

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## Tooth–Implant-Supported vs Implant-Supported FPDs

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- abutment tooth failure rate
- prosthesis failure rate
- biologic complications (peri-implant marginal bone loss, abutment tooth intrusion or fracture)
- technical complications (implant-related loosening or fracture, framework fracture, porcelain veneer fracture)

Patient characteristics, along with the surgical and prosthetic techniques in the included studies, varied. Some studies included endodontically treated teeth, while others excluded them.

A meta-analysis showed no significant difference in implant failure rate between tooth–implant-supported FPDs and implant-supported FPDs. Abutment tooth failures were few. Tooth–implant-supported FPDs had a greater framework fracture rate than did implant-supported FPDs; however, the reverse was true for porcelain fracture. Neither difference reached statistical significance.

### Comment

Due to the small number of studies included in this review and the lack of homogeneity among the study populations and procedures employed, the conclusions of this review must be treated carefully. Nevertheless, while the authors acknowledge the limits of this review, the tooth–implant-supported FPD appears to be a reliable treatment option for partially edentulous patients.

*Alsabeeha NHM, Atieh MA. Outcomes and complication rates of the tooth-implant-supported fixed prosthesis: a systematic review and meta-analysis. Int J Oral Maxillofac Implants 2020;35:685-699.*

## When to Choose Tooth–Implant-Supported FPDs

The past few decades have seen dramatic advances in implant dentistry that have made possible prosthetic rehabilitation of partial or full edentulism. However, the advantages of minimally invasive surgery and economic sustainability make the use of fixed partial dentures (FPDs) supported by 1 implant and 1 natural tooth an alluring option. Although tooth–implant-supported FPDs have frequently been suggested for use in certain clinical situations, they remain controversial.

To bring some clarity to this situation, La Monaca et al from the University of Rome, Italy, conducted a systematic review of available studies that compared tooth–implant-supported FPDs with implant-supported FPDs for tooth, implant and prosthesis failure, as well as biological and technical complications. Their literature search uncovered 8 studies that met their inclusion criteria: 4 controlled clinical trials (3 with a split-mouth design); 2 prospective cohort studies; and 2 retrospective cohort studies. Follow-up ranged from 6 months to 14 years.

Enough data were reported to perform meta-analyses in 4 areas:

- number of abutment failures in the 2 groups
- number of biological and mechanical complications at implant or tooth abutments in the 2 groups
- number of prosthesis failures in the 2 groups
- number of prosthetic complications in the 2 groups

The meta-analyses revealed no significant differences between tooth–implant-supported FPDs and implant-supported FPDs in abutment failures, biological complications or prosthesis failure. The most common prosthetic complications were veneer fractures, screw loosening, loss of retention, and abutment or abutment-screw fractures. Again, no significant difference was found between the 2 types of FPDs.

### Comment

While implant-supported FPDs remain the treatment of choice, tooth–implant-supported FPDs are a feasible and predictable option in clinical situations not amenable to implant-supported FPDs. They may also be an option to meet patient-centered preferences or when financial issues militate against implant-supported FPDs.

*La Monaca G, Pranno N, Annibali S, et al. Survival and complication rates of tooth-implant versus freestanding implant supporting fixed partial prosthesis: a systematic review and meta-analysis. J Prosthodont Res 2021;65:1-10.*

## Viability of Tooth–Implant-Supported Partial Dentures

Reaching definitive conclusions about the long-term viability of tooth–implant-supported fixed partial dentures (FPDs) has proved challenging. Several systematic reviews and meta-analyses attempted to answer questions about survival and complication rates of tooth–implant-supported FPDs compared with the rates of FPDs supported by implants only or by teeth only. The greatest

difficulty to developing practice guidelines has been the lack of heterogeneity among various studies, many of which have small sample sizes.

To overcome these difficulties, Ting et al from the Think Dental Learning Institute, Pennsylvania, conducted a systematic review of systematic reviews and meta-analyses addressing complications and long-term survival rates of tooth-implant-supported FPDs. They identified 5 systematic reviews and meta-analyses of at least moderate quality published through January 2017 whose focused questions or review objectives pertained to tooth-implant-supported FPDs.

Five-year survival rates for tooth-implant-supported FPDs ranged from 90.1% to 95.5%, while 10-year survival rates ranged from 77.8% to 82.1%. Survival rates for abutment teeth ranged from 89.4% to 100%; for abutment implants, 97.5% to 98%. The most frequent biological complications were periapical lesions and caries, followed by tooth fractures, loss of osseointegration, periodontal pathology and fistulas. The most frequently reported technical complications were porcelain occlusal fracture and screw loosening. Tooth intrusion in abutment teeth ranged between 0% and 5.2%; the meta-analysis in 1 review suggested that intrusion was more likely in nonrigid tooth-implant-supported FPDs.

### Comment

Reported 5-year survival rates were comparable to those of FPDs supported solely by implants and those supported solely by natural teeth; however, 10-year survival rates were lower. Survival rates were higher in reviews published from 2015 to 2017 than they were in reviews published from 2004 to 2007. As prosthesis designs, recon-

structive materials and treatment protocols improve, tooth-implant-supported FPDs should be considered a viable treatment option in selected patients.

*Ting M, Faulkner RJ, Donatelli DP, Suzuki JB. Tooth-to-implant-supported fixed partial denture: a comprehensive overview of systematic reviews. Implant Dent 2019;28:490-499.*

## FPD Chipping and Failure Rates

**P**revious studies have suggested that tooth-implant-supported fixed partial dentures (FPDs) exhibited a higher risk of long-term failure, while ceramic FPDs had a higher risk of chipping. However, available data are few, and any interaction between these 2 factors has not been investigated. To address this situation, Rammelsberg et al from the University of Heidelberg, Germany, undertook an observational cohort study to evaluate the chipping and failure rates of ceramic and metal-ceramic FPDs supported either by implants alone or by teeth and implants.

Their study included 434 FPDs placed at a university-based clinic, with an observation period ranging from

6 months to 12 years. Of the FPDs, 213 were implant-supported FPDs, 155 were tooth-implant-supported FPDs and 66 were implant-supported cantilever FPDs. Several different frameworks were employed, including high noble metal alloy, zirconia and cobalt-chromium (Co-Cr) base metal alloy. Most FPDs were located in the posterior dentition and opposed natural dentition or fixed restorations.

Over the course of the observation period, 17 FPDs failed due to

- loss of implant ( $n = 6$ )
- loss of abutment tooth ( $n = 5$ )
- loosening of an abutment screw ( $n = 1$ )
- extended chipping of veneer ( $n = 5$ )

Survival probability was 96% at 5 years and 91% at 10 years, with no significant differences among the 3 types of FPDs. Although no catastrophic framework fractures occurred, a high incidence of chipping was observed. While this outcome was not affected by the type of FPD, a significant difference was found among the different framework materials and veneer types; zirconia frameworks with complete veneers had a much higher probability of chipping at 5 years than did high

**Table 1.** Effect of prosthesis characteristics on chipping hazard.

	FPDs	Chipping
<b>Support</b>		
Implant-implant	213	31
Tooth-implant	155	16
Implant cantilever	66	14
<b>Material</b>		
High noble metal alloy, complete veneer	225	40
Co-Cr, complete veneer	35	2
Zirconia, complete veneer	43	16*
Zirconia, partial veneer	63	1
Zirconia, monolithic	68	2

\*Statistically significant hazard ratio difference from reference (high noble metal alloy).



noble metal alloy or Co–Cr base metal alloys (Table 1).

## Comment

Neither the type of FPD nor the framework material used had any significant impact on survival, but the use of zirconia frameworks with complete veneers carried a significant risk for chipping. Using monolithic zirconia frameworks or partial veneers reduced the likelihood of chipping.

*Rammelsberg P, Meyer A, Lorenzo-Bermejo J, et al. Long-term chipping and failure rates of implant-supported and combined tooth–implant-supported metal-ceramic and ceramic fixed dental prostheses: a cohort study. J Prosthet Dent 2021;126:196-203.*

## Survival Rate of Tooth–Implant-Supported FPDs

Using fixed partial dentures (FPDs) to replace missing teeth in partially edentulous patients represents a significant improvement over the use of removable dentures. While implants are frequently used to support FPDs, these restorations come with several drawbacks, including reduced tactile perception and lower levels of chewing coordination. One possible solution to this problem involves FPDs supported by both an implant and a natural tooth. However, the available evidentiary analyses may be unreliable because they used a mix of prospective and retrospective studies.

To remedy this situation, von Stein-Lausnitz et al from Charité–Universitätsmedizin Berlin, Germany, conducted a systematic review and

**Table 2.** Survival rates of tooth–implant-supported fixed partial dentures.

	<i>n</i>	Survival rate
<b>After 5 years</b>		
Prosthesis	86	90.8%
Implant	95	94.8%
<b>After 10 years</b>		
Prosthesis	60	82.5%
Implant	68	89.8%

meta-analysis of prospective clinical studies to determine the clinical performance of tooth–implant-supported FPDs with regard to rates of survival and complications. They searched all material published over a 30-year period ending in 2018 for randomized controlled trials or prospective clinical studies enrolling ≥10 partially edentulous patients with ≥2 adjacent missing teeth restored with tooth–implant-supported FPDs and followed for ≥3 years. To be counted as surviving, the restoration had to be present at follow-up without any need to remove the restoration, implant or abutment tooth; cases requiring endodontic treatment of the abutment tooth were considered failures.

Only 8 published studies, all prospective cohort studies, met the inclusion criteria. Seven studies reported on rigid FPDs; 1 reported on both rigid and nonrigid FPDs. The majority of the 185 prostheses consisted of 3 units and were located in the posterior mandible. In 4 studies reporting results after a 5-year follow-up, estimated survival rates for the FPD and the implant were 90.8% and 94.8%; in 3 studies reporting results after a 10-year follow-up, corresponding

survival rates were 82.5% and 89.8% (Table 2). Six failures occurred in endodontically treated teeth.

## Comment

Three- and 4-unit tooth–implant-supported FPDs demonstrated acceptable survival rates through 5 and 10 years. Based on currently available evidence, rigidly constructed superstructures are the preferred alternative. However, studies with follow-ups beyond 10 years are needed to determine whether tooth–implant-supported FPDs are an acceptable long-term solution.

*von Stein-Lausnitz M, Nickenig H-J, Wolfart S, et al. Survival rates and complication behaviour of tooth implant-supported, fixed dental prostheses: a systematic review and meta-analysis. J Dent 2019;88:1031-1067.*

## In the Next Issue

### Proximal contact stability adjacent to fixed implant restorations

*Our next report features a discussion of this issue and the studies that analyze them, as well as other articles exploring topics of vital interest to you as a practitioner.*

Do you or your staff have any questions or comments about **Prosthodontics Newsletter**? Please write or call our office. We would be happy to hear from you.

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