

Fixed Partial Prosthesis Vs. Implant-Supported Single Crown

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Received: November 19, 2020; **Published:** December 11, 2020

Abstract

Introduction: To restore the natural teeth in their real form is the most basic concept of dentistry. Preservation and rehabilitation of the natural teeth have been a fundamental practice in dentistry. The first line of treatment for any compromised teeth has always been considered as endodontic treatment followed by placement of a fixed prosthesis. Dentistry has seen a paradigm shift after the advent of implants. Branemark introduced implants around 40 years back, and since then, there have been a lot of developments in that field. The use case of dental implants has broadened over the past few decades to the extent that they are now considered the most reliable replacement for a missing tooth.

The Aim of Work: This review aims at discussing the overall success rate of implants and Fixed partial dentures, comparing the technique and cost-effectiveness, which will help the clinicians and patients make a more informed decision while choosing the treatment option during replacement of a single missing tooth.

Methodology: This review is a comprehensive research of PUBMED and Google Scholar from the year 1980 to 2020.

Conclusion: Single tooth loss can be replaced with the help of either implants or a fixed partial denture. A fixed partial denture has been the standard treatment for the replacement of a single tooth for a long time. Implants replace the missing tooth without causing any damage to the adjacent tooth and hence are gaining more popularity over the years. Because of the developments in the field of surgery, implant placement is becoming easier and more popular. The cost factor between implants and FPDs have been studied in detail by a lot of researchers, and they have concluded that including the cost of retreatments, the cost of implants is comparable to that of fixed partial dentures, and a decrease in the overall implant cost will increase the overall effectiveness of dental implants.

Keywords: Fixed Partial Dentures; Implants; Immediate Implants; Abutment Teeth; Osseointegration

Introduction

To restore the natural teeth in their real form is the most basic concept of dentistry. Preservation and rehabilitation of the natural teeth have been a fundamental practice in dentistry. The first line of treatment for any compromised teeth has always been considered as endodontic treatment followed by placement of a fixed prosthesis. Elimination of apical periodontitis is the main aim of endodontics, and the ever-increasing developments in the field of microbiology help us give a better picture of the microorganisms leading to apical periodontitis. The latest developments in the field of irrigation and root canal filling further help us to clean the canals, which were earlier considered difficult. Further, the advent of adhesive restoration helps us conservatively provide the tooth with a permanent restoration leading to preservation of the natural dentition. Extraction of teeth has always been the last resort because of very limited options for a replacement like a fixed partial denture and removable prosthesis [1].

Dentistry has seen a paradigm shift after the advent of implants. Branemark, *et al.* introduced implants around 40 years back, and since then, there have been a lot of developments in that field. The use case of dental implants has broadened over the past few decades to the extent that they are now considered the most reliable replacement for a missing tooth. Today there are various companies manufacturing implants, and a lot of them claim implant replacement as a better option than the preservation of natural teeth. Replacement by an implant is a more permanent solution is generally given more preference than managing the tooth with endodontic treatment and prosthetic rehabilitation [2].

In today’s era, the choice of treatment that should be given to the patient is a very controversial subject because the exact description of a compromised tooth is not clear. The extent to which the tooth is compromised and whether to extract or preserve the natural tooth depends on the restorability of the tooth, the status of the periodontium supporting the tooth, caries rate of the patient determining the recurrence of caries, the extent of any trauma if present or a complicated endodontic treatment that may lead to failure of the tooth [3].

In this review, we talk about the overall success rate of implants and Fixed partial dentures, comparing the technique and cost-effectiveness, which will help the clinicians and patients make a more informed decision while choosing the treatment option during replacement of a single missing tooth [3].

Fixed partial denture

Fixed partial denture goes long back and has always been considered as the golden standard for replacement of a missing tooth or multiple teeth. The indications to give FPD are when a single tooth or two-three teeth adjacent to each other are missing; in these cases, FPD can be delivered by taking support from the remaining adjacent teeth while completely following Ante’s law, which suggests that the area of teeth that need to be replaced should always be less than the area of teeth-replacing them. The crown to root ratio of the abutment tooth should also be taken into consideration and should be less than 1:1.5. (Figure 1) [4].

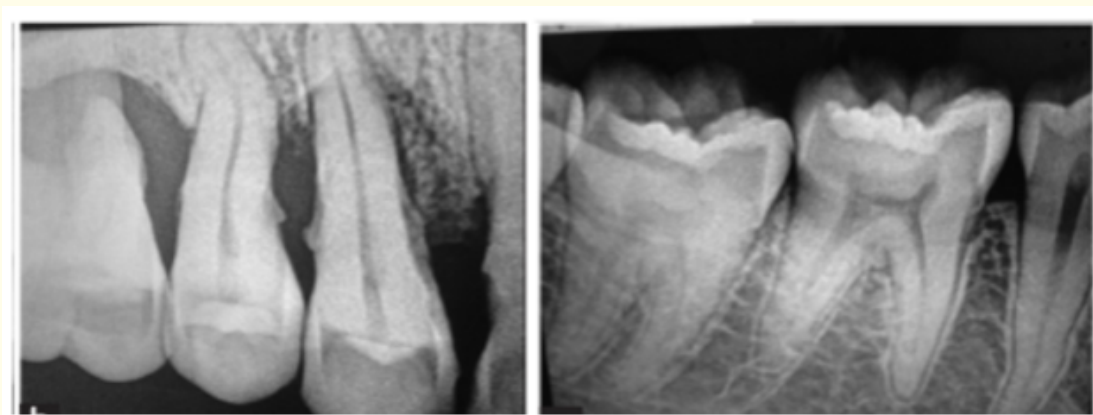


Figure 1: A; Non-Acceptable Crown Root Ratio for Abutment Selection, B; Acceptable Crown Root Ratio [4].

The general contraindications of FPD are a crown to root ratio of more than 1:1.5, extreme bone loss around the abutment tooth leading to the mobility of the tooth, and a cantilever type of FPD where only a single abutment tooth is used. (Figure 1) The choice of abutment teeth is also very important in the overall success rate of Fixed partial dentures; long-standing literature review concludes that teeth that are endodontically compromised, or root canal treated, or teeth where direct or indirect pulp capping has been done, should not be chosen as abutment teeth [5]. Although FPDs are less invasive in terms of surgical procedure, to obtain full functionality and better esthetics, a lot of tooth structure is compromised, which may lead to the exposure of pulp, periodontal bone loss, and less than sufficient tooth structure remaining, predisposing the tooth to trauma [3] (Figure 2 and 4).



Figure 2: Preparation of Central Incisor and Canine for Full Coverage Restoration in Order to Replace the Lateral Incisor [3].



Figure 3: Severe Loss of Tooth Structure Leading to the Extraction of the Tooth. Tooth Structure Remaining is Not Enough for Retention [3].

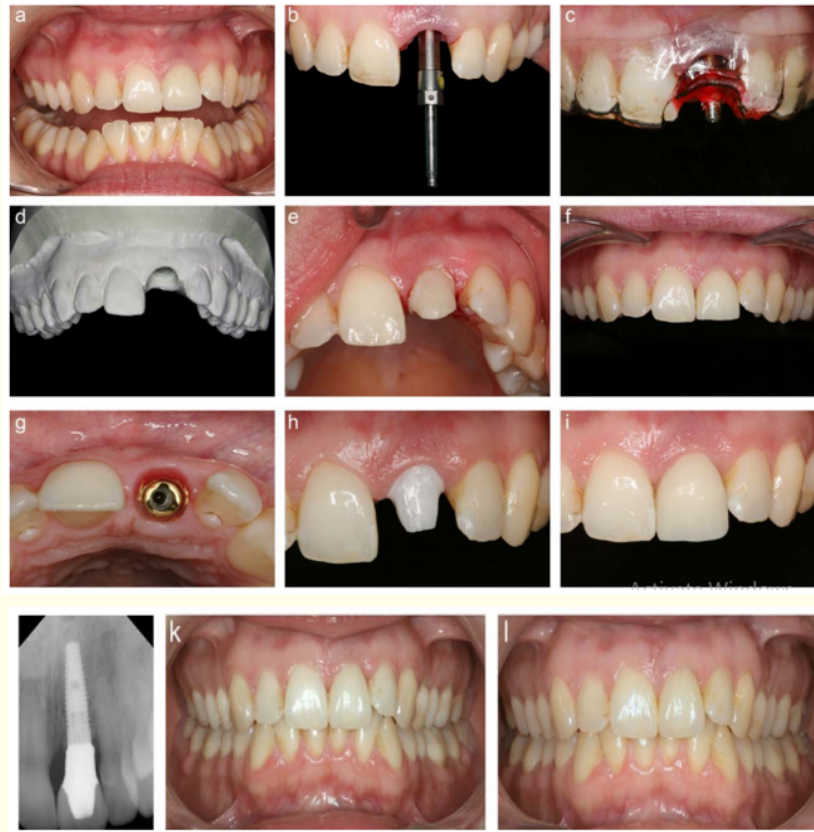


Figure 4: (A-F) Steps of Immediate Implant Placement Followed by Placement of a Provisional Crown on the Day of the Surgery by the Help of Intraoperative Impression Technique, Individual Copy Abutment; (G-I) Placement of Final Zirconia Crown After one Week of the Surgery; J- Radiographical View of the Implant; K- One Year Follow up of the Case; L- 5 year follow up of the case [11].

A study was conducted by Creuger, *et al.* where he included 26 studies analyzing a 15-year follow-up of fixed partial dentures. The study concluded that in the span of 10 years, the overall survival rate for FPDs was 90%, which decreased to around 75% over 15 years. Failure of FPD was categorized as loss or replacement of the FPD. The main issue with survival studies has been the lack of definition of the survival and failure criteria, which led to misinterpretation of the results [6].

A meta-analysis study was done by Scurria's Medline [7], which identified the trend of multiple studies combining them together to come to a common conclusion. Clinical studies that have been done recently and long follow-up data are not present, or a relevant conclusion is absent can benefit from a meta-analysis by combining their respective results. Scurria included all the studies published in English from the year 1966 to 1996 and performed a meta-analysis to conclude that a success rate of around 85% was seen at the end of 10 years for FPDs, which dramatically decreased at the end of 15 years, reducing the success rate to around 75%. These results were in accordance with that of Creuger's study [6]. Later, the definition of failure was broadened, and failure criteria now included FPD, which needed replacement, and also dentures that had technical issues; this inclusion changed the success rate to 87% and 69% at the end of 10 and 15 years, respectively [6]. Another study conducted by Walton [8], where he studied a total of 515 Metal fused to ceramic FPDs, came to a similar conclusion as the previous studies. The factors that lead to an increased failure rate or were associated with the failed cases

were pier abutments or teeth that were nonvital and were used as abutments. Another meta-analysis conducted by Zhang, *et al.* further confirmed a higher survival rate of all-ceramic FPDs compared to metal-ceramic FPDs [9].

Implant therapy

The development of implants and the concept of osseointegration brought a huge breakthrough in clinical dentistry. Before the advent of implants, to replace even a single missing tooth, two adjacent teeth had to be compromised, which later led to the endodontic complication of the abutment tooth. To avoid this complication, single tooth replacement using an implant and a single crown became a more desired treatment option amongst patients as well as clinicians [10]. Because of the increased inclination of patients towards better esthetics, implants are preferred for replacing a single tooth. The earlier concept of delayed placement of the implant prosthesis has now been changed almost completely, and now the immediate placement of a prosthesis is allowed. Extraction followed by immediate implant placement has also been advocated more now as it leads to better preservation of bone and soft tissue [11].

The design of implants has also seen a noticeable evolution; the previous implants either had very minimal roughness or were extremely rough, which has now changed to moderate roughness on the surface of the implant in the range of 1 - 2 micrometers. The surgical procedures for implant placement have also been made simple by shifting the trend towards flapless surgery, making it easier for general practitioners to place implants [12].

Success rate of single tooth implant

A Survey of dental implants has not been carried out for a very long time, and hence the database does not have a lot of studies on the success rate of implants or a comparison of implants vs. fixed partial dentures. Various survival rate tables like Kaplan-Meier have come to conclude that implant replacement is a predictable option to replace a single missing tooth. Lindh, *et al.* conducted a meta-analysis which comprised of 66 studies done between 1986 to 1996 on single and multiple implants. Cases in which threaded cylindrical implants were used and followed up for one year were included in the study. The failure of implants was defined, and the overall success rate of all studies was calculated. The success rate of single implants was in the range of the 90th percentile except in one study where the success rate was 91.3% at the end of 3 years. The main reason for failure that was seen was incompetent prosthesis for the replacement of a single tooth. Most of the failures seen have been noticed in the first year of implant placement. Another study conducted by Eckert and Wollan [13], where they studied 1170 implants, concluded that the success rate was more than 90% in all the regions of the oral cavity except the lower posterior region. There was a higher failure rate of almost 22.5% when cement-retained implants were used. Another trend which was noticed was a higher rate of implant failures before the year 1991, which indicated that the increased rate of failures, which was seen earlier, maybe a consequence of old prosthesis, which was reformed later, increasing the success rate. Screw retained implants gave better results than cement-retained implants. (Figure 5) failure of retention because of screw reopening also reduced from around 45 to 3% [14].

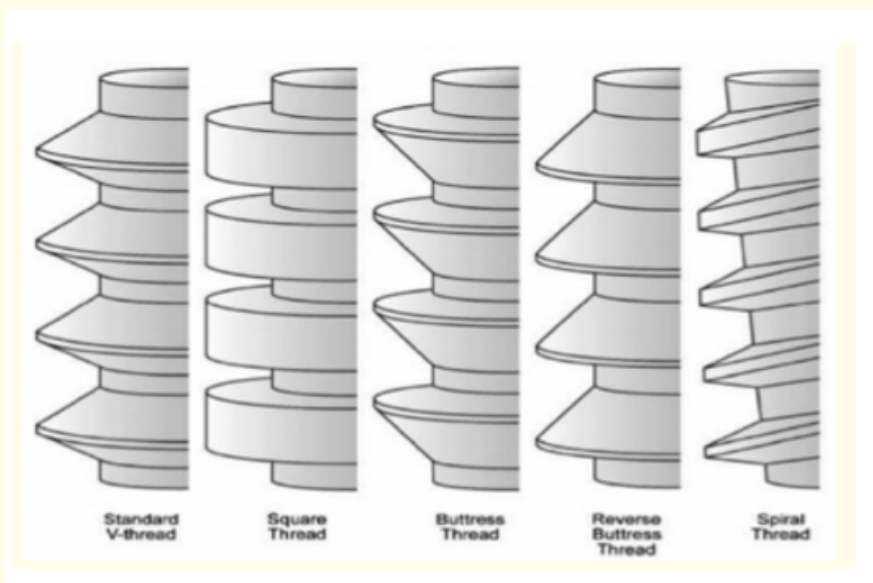


Figure 5: Various Thread Designs of Screw Retained Implants [15].

Another meta-analysis was conducted by Goodacre, *et al.* where they included the studies between 1981 to 1997. This analysis spoke about the type of complications that can happen because of the type of prosthesis, length of the implant, quality of bone. The single crown implants had a higher success rate of almost 97% compared to any other implants placed. Implant failure that was seen was associated with loosening of the screw, which later reduced after the titanium implants were replaced by gold alloy implants, and the counter-torque device started being used. Naert, *et al.* conducted a 12 yearlong study where they studied the success rate, prosthesis used, and biological outcomes of an implant. Failures seen were noticed in the first six months or at stage II of the implant. The success rate seen was 93%, and the success rate of the prosthesis was 95%. There was a small amount, almost 0.71 mm, of bone loss seen in the initial phase [16]. Implant placement, therefore, offered a more predictable outcome at the management of a single missing tooth over Fixed partial dentures [3].

Indications and contraindications of implants

The general indication of implant placement depends hugely upon the type of abutments that are present and whether a fixed partial denture can be given or not in such cases.

Indications	Contraindications
Periodontally compromised abutment teeth	Developing patients where development of the maxilla and mandible is still going on
Abutment tooth with large pulp chambers posing a higher risk for pulp exposure later.	Very compromised periodontium
Nonvital abutments	Gingiva with thin biotype and increased scalloping present in esthetic areas (Figure 6)
Abutments that have undergone luxation or trauma	Root flaring is seen in the adjacent tooth (which can be corrected by orthodontic treatment)
Pier abutments	Patients with autoimmune disease or uncontrolled diabetes mellitus
The soft and hard tissue of the implant site should be sound and should have a full set of bone and soft tissue.	Patients who are heavy smokers and are not motivated to stop smoking.
Mesiodistal dimension surgically and restorative should be minimum of 6mm	
The vertical dimension of 10 - 12mm surgically	

Table 1: Indications and contraindications for Implant placement [3].



Figure 6: Gingiva with thin Biotype and High Scalloping Present in the Esthetic Area. Implant Placement in Such Cases May Lead to Margination of the Tissue [3].

Cost comparison between implants and fixed partial dentures

Even though Implant replacement may be considered as a more conservative approach because the adjacent teeth are not harmed as compared to fixed partial dentures in which the adjacent teeth are also compromised, the higher cost of implants sometimes makes it a second option for a lot of patients. Kim., *et al.* conducted a study where he studied the cost-effectiveness of implants as compared to a three-unit fixed partial denture in patients requiring single tooth replacement in the year 2010 [17]. In a study conducted by Bragger, *et al.* where he took into consideration the cost of the physician, material cost, and costs covering the complication. Bragger concluded that when all the costs were taken into consideration, FPDs costed more than implant surgery. Kim concluded that the total cost of implant surgery, including replacement, came out to be less than that of FPD, and if the cost of the implant was lowered to 80% of the current price, the overall difference in expenses between implant and FPD would come down to around 20%. They concluded that if the price of the implant is lowered, the overall usage and effectiveness of implants will increase, and it will become a more feasible option for replacement of a single missing tooth [18].

Conclusion

Single tooth loss can be replaced with the help of either implants or a fixed partial denture. A fixed partial denture has been the standard treatment for the replacement of a single tooth for a long time. Implants replace the missing tooth without causing any damage to the adjacent tooth and hence are gaining more popularity over the years. Because of the developments in the field of surgery, implant placement is becoming easier and more popular. The cost factor between implants and FPDs have been studied in detail by a lot of researchers, and they have concluded that including the cost of retreatments, the cost of implants is comparable to that of fixed partial dentures, and a decrease in the overall implant cost will increase the overall effectiveness of dental implants.

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Volume 20 Issue 1 January 2021

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