DOI: 10.7860/JCDR/2026/90343.24244

Dentistry Section

Review Article

Factors Influencing Prosthodontic Complications in Metal Acrylic Resin Full Arch Implant-supported Fixed Prostheses: A Narrative Review

ANSHUL TRIVEDI[1], SUMIT AGGARWAL[2], SWETA TEOTIA[3]

ABSTRACT

Fixed full-arch implant-supported metal-acrylic resin prostheses are a well-established solution to rehabilitate fully edentulous patients due to their retrievability/repairability, versatility and cost. However, the prosthesis and biomechanical complications can significantly impact the long-term performance of the prosthesis. The objective of this narrative review was to identify key biomechanical and prosthetic factors that influence the complication rates and clinical outcomes for fixed full-arch metal-acrylic resin implant-supported prostheses. Prosthodontic-related complications occurred from multifactorial sources; identified factors that influence prosthodontic complications included the number and distribution of implants; cantilever length; anteroposterior spread; type of material used to manufacture framework; how metal and acrylic are bonded; occlusal design; and parafunctional habits. Long-term success of fixed full-arch implant-supported metal-acrylic resin prostheses are dependent upon the following biomechanically favourable conditions: implant distribution and number, controlled cantilever length, accurate fit of framework, strong metal-acrylic bond, appropriate occlusal schemes and regular maintenance protocols. Additionally, the use of digital workflow methods, Computer-Aided Design/Computer-Aided Manufacturing (CAD/CAM) frameworks and new high-performing polymer materials may improve both the fit and stress distribution in the prosthesis, but there is still a lack of strong long-term clinical evidence to support these claims.

Keywords: Biomechanical phenomena, Dental materials, Patient satisfaction, Prosthesis design, Risk factors, Treatment outcome

INTRODUCTION

Complete edentulism adversely affects masticatory efficiency, speech, facial aesthetics, oral function and overall quality of life. Implant-supported full-arch fixed dental prostheses have become a preferred treatment option over conventional complete dentures because they provide superior retention, stability, comfort and chewing efficiency which further improves the quality of life [1,2]. Metal-acrylic full-arch implant-supported fixed dental prostheses supported by four to six implants remain widely used because of their retrievability, reparability, versatility and cost-effectiveness [3,4].

Although implant-supported fixed prostheses demonstrate high survival rates, prosthetic complications remain common with mechanical complications representing the most frequently reported adverse events. These complications are multifactorial and are influenced by implant number and distribution, cantilever length, anteroposterior spread, framework design, material properties, occlusal loading and patient-related factors such as parafunctional habits [1,5]. The biomechanical interaction among implants, prosthetic components and occlusal forces plays a pivotal role in determining the long-term performance of these restorations [6].

Unlike natural teeth, dental implants lack a periodontal ligament and therefore do not provide proprioceptive feedback [6]. Consequently, occlusal forces are transmitted directly to the implant-prosthesis complex and surrounding bone, increasing the risk of mechanical complications associated with occlusal overload. In addition, differences in the mechanical properties of the rigid metal framework and the resilient Poly(methyl methacrylate) PMMA veneering material create interfacial stresses that may lead to fatigue failure, acrylic resin fracture, veneer debonding, or delamination over time [5,6].

Recent advances in Computer-Aided Design and Computer-Aided Manufacturing (CAD/CAM) technologies, digital workflows and high-performance polymer materials have improved framework accuracy and stress distribution compared with conventional fabrication techniques. However, evidence regarding their long-term clinical effectiveness in reducing prosthetic complications remains limited [5,7].

Given the multifactorial nature of biomechanical complications and the continuous evolution of implant prosthodontics, a comprehensive understanding of the factors influencing prosthetic outcomes is essential. Therefore, this narrative review evaluates the biomechanical and prosthetic factors associated with complications in metal-acrylic full-arch implant-supported fixed dental prostheses and highlights current evidence to support clinical decision-making and optimise long-term treatment outcomes.

DISCUSSION

The success of full-arch metal-acrylic prostheses is affected by length of cantilever, the number and distribution of implants, anteroposterior distance, passive fit of framework, stiffness of framework and how occlusal loads are managed.

Implant Number, Distribution and Anteroposterior Spread

Biomechanical success in full-arch implant-supported prostheses made from acrylic and metal depends on the number, position and spatial arrangement of the implants [3].

Amongst all the three factors, Anterior-Posterior (AP) spread is a very important factor, as it has a direct effect on the amount of cantilever forces and how the stresses are distributed among the different components of each prosthesis. AP spread is defined as the linear measurement (distance) from the most anterior implant to the most posterior implant in the full-arch implant-supported prosthesis. Higher levels of AP spread have been shown to increase the amount of load that an implant-supported prosthesis can carry and reduce the risk of mechanical failure [6].

Bevilacqua M et al., Finite Element Analysis (FEA) found that an increase in the inter-implant distances decreases the amount of bending moment and increases the amount of stress on the distal implants [7], while Sertgöz A and Güvener B found that there is a higher level of von Mises stress within the bone-supporting the implants when the AP spread is reduced [8].

The influence of implant number, placement and distribution is summarised in [Table/Fig-1] [8-10].

Author and Year	Arch	Implant number	Placement location	Key findings
Sertgoz A and Guevener B (1996) [8]	Mandible	6 implants	Between mental foramina	Increased cantilever length resulting in higher stress at bone-implant interface. Implant length had minimal effect on stress. Focused on avoiding excessive distal extensions.
Khaneja S et al., (2016) [9]	maxilla	4 implants	Canine and second premolar region	Increased implant angulation resulting in higher stress at implant-abutment junction. Vertically aligned and longer implants are more biomechanically advantageous.
Karre S et al., (2022) [10]	Maxilla + mandible	4-8 per arch	Anterior only vs Anterior + Posterior to canine/ mental foramen	Higher complications with 4 implants; no statistical significance in location based complications. Prosthesis with 4 implants had more complications than those with 5 or more.

[Table/Fig-1]: Summary of implant number and distribution in full-arch implant-supported prostheses [8-10].

The shape of an arch can influence how implants are distributed and also how much anterior/posterior spread they can achieve when placed inside an arch [Table/Fig-2]. Square-shaped arches tend to offer wider areas for posterior implant placement than tapered arches do [8]. This type of placement allows for the ability to have greater anterior/posterior spread and correspondingly less cantilever length while also allowing for better distribution of force from axial loading. The use of a tapered shaped arch can lead to decreased capability to place posterior implants and therefore limit anterior/posterior spread as well as produce increased forces on the cantilever thus increasing the stress concentration about distal implants [8,11].

The occlusal scheme can further create biomechanical effects on the implant loading. In case of implant-protected occlusion, the axial loading will be improved because the inclination of the cusp has been reduced, the effective occlusal table width has been narrowed and any anterior or lateral contacts on the working cusps have been eliminated during function [12]. Adverse occlusal schemes, like excessive group function, high angled cusp inclines and parafunctional activities such as bruxism will result in the potential for increased lateral loading, especially in the cases of patients with less anterior/posterior spread of the arch. The overall biomechanical effect of having an unfavourable arch shape coupled with adverse occlusion will enhance the chances of creating greater bending moments causing overload conditions to the strain gauges attached to those distal implants [13].

In metal-acrylic full-arch prostheses, these stresses are further amplified due to the disparity in material properties between the rigid metal framework and the resilient acrylic resin resulting in increased interfacial stress and framework flexure [5]. Clinically, this manifest as acrylic fracture, veneer debonding screw loosening, and long-term prosthetic failure. Therefore, careful consideration of arch form, optimisation of implant distribution to maximise A-P spread, and implementation of controlled occlusal schemes are essential to minimise prosthodontic complications and ensure long-term biomechanical stability [6].

Influence of Cantilever Length on Biomechanical Stress

Cantilever length is the most significant biomechanical variable affecting the distribution of stress, as well as the potential for complications when using full arch metal-acrylic resin implant-supported fixed prosthetics [12]. Cantilevers also act like levers, providing additional mechanical advantages. Such advantages allow for the transference of angular (bending) forces between the terminal implants and the implant-supporting structures [13]. Rangert B et al., also noted that increasing the length of the cantilever produced increased force moments [14]. Thus, as the length of the cantilever increases, the likelihood of experiencing mechanical and biological complications increases [14].

FEA studies by Sertgöz A and Güvener B demonstrated that increasing cantilever length from 7 mm to 28 mm significantly elevated von Mises stress within peri-implant bone with maximum stress concentrations localised at the neck of the distal implant [8]. This exponential rise in stress highlights the critical need to control cantilever extension in full-arch implant supported prostheses [8,15].

Additionally, Bevilacqua M et al., reported that tilting posterior implants significantly reduces cantilever length and results in a reduction of stress by up to 73.5% [7]. This finding supports the biomechanical advantage of tilted implant configurations particularly in cases with limited posterior bone availability. In metal–acrylic prostheses, excessive cantilever further contributes to framework flexure and increased interfacial stress between the rigid metal framework and resilient acrylic resin predisposing to complications such as acrylic fracture, veneer debonding and screw loosening under cyclic loading [7,15].

Bevilacqua M et al., and Sertgöz A and Güvener B concluded that using a maximum cantilever length of about 10 mm in the

Arc Shapes	Implant number & distribution	A–P spread	Occlusal consideration (IPO)	Biomechanical effect	Prosthodontic complications
Square	Wide posterior distribution; fewer implants (4–6) sufficient	High	Favourable for implant-protected occlusion; axial contacts easily achieved	Reduced bending moments; minimal cantilever forces	Minimal complications; stable framework; low risk of acrylic fracture and screw loosening
Ovoid	Moderately curved distribution: implants placed with some posterior limitation	Moderate	Requires controlled occlusion; slight adjustments in cusp inclination	Moderate stress distribution; controlled cantilever forces	Moderate risk of acrylic wear/ fracture and occasional screw loosening
Tapered (V-shaped)	Converging implant placement; limited posterior support; may require more implants (6-8) or tilted implants	Low	Strict implant-protected occlusion mandatory; eliminate lateral contacts	Increased cantilever length; high bending moments; stress concentration	High risk of acrylic fracture, veneer debonding, framework flexure, screw loosening, and peri-implant bone loss

[Table/Fig-2]: Relationship between arch shape, implant distribution, occlusion and prosthodontic complications in metal-acrylic full-arch implant-supported fixed prostheses [8,11].
A-P: Anterior-Posterior.

maxilla and 15 mm in the mandible is appropriate for the majority of patients, respectively [7,8]. However, in certain individuals who demonstrate some degree of reduction in anterior/posterior spread, have a parafunctional habit or have a poor quality of bone or demonstrate unfavourable occlusal schemes, shorter cantilevers may be preferred [7,8]. Therefore, the determination of cantilever distance should not only be based on a fixed number but rather be based on many different factors including, but not limited to, the design of the arch shape, the distribution of the implants within the arch, the design of the prosthesis and the occlusal scheme [7,15].

Framework Material, Design and Metal-Acrylic Resin Bonding

The biomechanical performance of metal-acrylic implant-supported prostheses is governed by a complex interplay between framework material properties, structural design, fabrication accuracy and the integrity of bonding with the veneering acrylic resin. These factors collectively influence stress distribution, prosthesis rigidity and long-term resistance to mechanical complications [4].

During functional activities like mastication and speech, the mandible undergoes physiological flexure which is influenced by muscle activity, bone density and anatomical configuration. This mandibular flexure can compromise framework fit and induce stress at the implant-bone interface [4,16]. Rigid frameworks that do not account for this dynamic property may inadvertently transfer excessive load to terminal implants. To counteract these effects, cross-arch stabilisation with a rigid full-arch framework has been shown to enhance force distribution and minimise cantilever effects. However, overly rigid designs can hinder natural mandibular movement [9,17]. Segmenting frameworks or using materials with controlled flexibility can help to accommodate physiological flexure while maintaining prosthetic stability. Clinically, segmental frameworks have also been shown to reduce mechanical complications in bruxers and patients with exaggerated mandibular flexure [17,18].

According to Sertgoz A and Guvener B's research on FEA of framework material, higher-modulus-of-elasticity framework materials undergo less deformation than those made from lower modulus of elasticity when subjected to occlusal loadings [8]. The use of cobalt-chromium frameworks, as opposed to titanium frameworks, has been recommended in order to improve rigidity and reduce the amount of deformation that occurs in the framework when the long span of the prosthesis is used. However, if there is an improper amount of passive fit and/or an insufficient number of implants to distribute occlusal forces among the multiple implant sites, excessive rigidity could create a concentration of stress that would create potential problems with the framework and the finished prosthesis [8].

Optimal biomechanical performance is not solely dependent on material properties, as framework design plays an equally critical role. A biomechanical analysis by Berzaghi A et al., reported that inadequate framework thickness and unfavourable cross-sectional geometry lead to increased flexure, particularly in long-span full-arch prostheses [6]. Increased flexure results in uneven load distribution, higher bending moments, and stress concentration at the implant-abutment interface [6]. To counteract this, frameworks with adequate bulk and favourable cross-sectional designs, such as rectangular or D-shaped configurations, have been shown to provide improved rigidity and resistance to deformation [8].

CAD/CAM-fabricated frameworks have demonstrated improved framework-implant fit compared with conventionally cast frameworks, contributing to improved passive fit and more predictable stress distribution. This improved adaptation minimises static stresses at the implant–abutment interface, reduces macrostrain accumulation and enhances the long-term clinical performance of the prosthesis [19].

In addition to material, design and fabrication, the durability of metal–acrylic prostheses are highly dependent on the quality of bonding between the metal framework and the veneering acrylic resin [5]. This interface is primarily governed by micromechanical retention and is significantly influenced by surface treatment protocols. Studies included in the present review demonstrated that airborne-particle abrasion of the metal surface increases surface roughness and enhances mechanical interlocking, thereby improving bond strength between metal and acrylic resin [5].

Furthermore, Malo P et al., emphasised that incorporation of retentive elements such as loops, meshwork and beads within the framework increases the available bonding surface area and further reinforces mechanical retention [19].

Suboptimal adhesion at metal framework and veneering acrylic resin may result in complications such as delamination, acrylic veneer fracture, prosthetic failure, particularly under cyclic occlusal loading conditions [1]. Cevik P et al., concluded that the use of high-rigidity framework materials, optimised structural design, precise CAD/CAM fabrication and effective surface treatment strategies for metal-resin bonding are essential to achieve favourable stress distribution and ensuring longevity of metal -acrylic implant-supported prosthesis [20]. A comparison of commonly used framework materials in full-arch implant-supported prostheses is presented in [Table/Fig-3] [2,21-23].

Occlusal Load and Force Distribution

Occlusal loading is a primary factor that determines the success of the prosthetic success of the rehabilitation of the full-arch implant-supported fixed complete denture prosthesis. An implant-supported prosthesis does not have a periodontal ligament, therefore occlusal forces are transferred directly to surrounding bone and to the prosthetic components [6]. An implant-supported prosthesis provides axial loading that are based on the design of the implant and the fixed prosthetic component, thus generating a more even distribution of forces along the long axis of the implant when compared to non axial and lateral

Authors name	Materials	Elastic Modulus (GPa)	Advantages	Limitations	Clinical implications
Delucchi F et al., 2021 [2]	**Zirconia**	~200–210	High flexural strength, superior aesthetics, low plaque affinity	Susceptibility to catastrophic fracture, limited reparability	Preferred in esthetically demanding full-arch rehabilitations with careful occlusal planning
Barbin T et al., 2020 [21]	**Cobalt-Chromium (Co–Cr)**	~200-220	High modulus of elasticity, superior flexural strength, excellent corrosion resistance	Increased rigidity may lead to higher stress transmission to peri-implant bone.	Indicated for long-span full-arch prostheses requiring high structural rigidity and minimal deformation
Tribst JPM et al., 2022 [22]	**Titanium (Ti)**	~100-115	Favourable biocompatibility, low density, excellent corrosion resistance	Lower stiffness compared to Co-Cr, potential for increased framework flexure	Suitable for cases requiring improved stress distribution and reduced load transfer to implants
Zeroual R et al., 2023 [23]	**PEEK**	~3-4	Low elastic modulus, shock-absorbing capacity, favourable biomechanical compatibility	Reduced rigidity, requires veneering for aesthetics, limited long-term clinical evidence	Beneficial in cases with high occlusal load or parafunctional habits to attenuate stress transmission

[Table/Fig-3]: Comparison of framework materials used in full-arch implant-supported prostheses [2,21-23].
GPa: Gigapascal;PEEK: Polyetheretherketone.

forces, which impose an impetus of bending moments onto the crestal bone, the neck of the implant, the abutment screw and the framework component [19]. Occlusal schemes can minimise the amount of stresses transmitted to the components of the fixed prosthesis, therefore improving long-term function, such as utilising implant-protected occlusion, reducing the width of the occlusal table, reducing the inclination of the cusp, utilising simultaneous bilateral centric contacts and eliminating contacts with equidistant (i.e., cantilever or overhang) portions during eccentrically positioned excursions of the mandible [24]. The occurrence of occlusal overload in metal-acrylic resin-based fixed complete prosthesis can accelerate the wear of the acrylic resin, fracture of the denture tooth, debonding of a veneer, loosening of an abutment screw, and complication-related to the framework [1,6]. Therefore, occlusal planning must not only be an adjustment made just before the final placement of the definitive prostheses but it should be considered a part of the prevention of biomechanical complications associated with the rehabilitation [24].

The key components of occlusal design for use with metal-acrylic resin-based full-arch implant-supported fixed prostheses are delineated in [Table/Fig-4] [6,24,25].

Parameters	Occlusal Design (IPO)	Selective Grinding Details	Clinical Significance
Centric contacts	Light, simultaneous bilateral contacts	Adjust premature contacts using articulating paper (8-12 μm); achieve even distribution	Prevents overload on individual implants
Anterior contacts	Light contact or slight clearance	Reduce heavy anterior contacts	Prevents overloading of anterior implants
Posterior contacts	Primary load-bearing contacts	Maintain broad, even contacts; eliminate high points	Enhances axial load distribution
Working side (lateral)	Shallow group function or minimal contacts	Selective Grinding of steep cusps; reduce lateral interferences	Minimises lateral forces
Non working side	No contact	Completely eliminate interferences during excursions	Prevents harmful lateral stress
Protrusive movement	Minimal anterior guidance	Reduce steep incisal guidance; flatten contacts	Reduces anterior overload
Cantilever region	No occlusal contact	Remove all contacts distal to terminal implant	Prevents lever-arm stress
Cuspal inclination	Reduced (flat cusps)	Flatten steep cusps selectively	Reduces shear forces
Occlusal table width	Narrowed	Reduce buccolingual width	Decreases force magnitude
Occlusal scheme	Implant-Protected Occlusion (IPO)	Achieved through selective grinding + occlusal adjustment	Ensures long-term prosthesis stability

[Table/Fig-4]: Occlusal design principles for implant-protected occlusion in metal-acrylic resin full-arch implant-supported fixed prostheses.

Prosthodontic Complications

The most frequent type of complication associated with metal-acrylic resin full-arch implant-supported prostheses are mechanical in nature. A mechanical complication refers to a mechanical failure. However, biological and aesthetic complications may occur and are reported in the literature. Yilmaz B et al., published a study showing the occurrence of mechanical complications (i.e., screw loosening and fractures of a full arch implant-supported metal-acrylic resin complete denture prosthesis) in subjects rehabilitated with either fixed or removable prostheses using the same types of materials [1]. Due to the reduced fracture toughness and fatigue characteristics of acrylic resin-based components compared to ceramic and/or solid monolithic frameworks, acrylic resin-based components are more likely to fracture, wear and debond [4,5].

A number of commonly reported mechanical complications of metal-acrylic resin complete denture prostheses include fracture of the acrylic (veneer) tooth, fracture of the denture tooth, fracture of the acrylic (base) component of the denture, veneer component debonding from the base, screw loosening, wear of prostheses, and deterioration of occlusal surfaces. In most cases, posterior teeth are the most frequently fractured teeth due to an increased load placed upon posterior teeth (i.e., occlusal forces) when the length of the cantilever is too long or when the occlusal contacts are not controlled properly [1,15].

Although technical complications associated with metal-acrylic resin complete denture prostheses occur at a higher frequency as compared to other materials, most of these complications can be repaired without compromising the implants' long-term success [1]. One advantage of using metal-acrylic resin complete denture prostheses is their ability to be repaired when a complication occurs. However, multiple occurrences of prosthetic mechanical complications may suggest that there may be a mechanical overloading, inadequate support for the implants, excessive length of the cantilever(s), not a proper passive fit between components, and/or an unfavourable distribution of occlusal force(s) being placed on the prosthetic components [24]. Therefore, prevention of any mechanical complication requires that the clinician implement favourable design principles for the prosthesis, support the prosthesis with a rigid framework, maintain occlusal scheme, regularly maintain the prosthesis and repair any early mechanical signs of potential failure [26]. These reported biological/mechanical/aesthetic/overall complication rates associated with metal-acrylic resin complete denture prostheses are shown in [Table/Fig-5] [3,26-29].

Implant Survival and Clinical Outcomes

Several studies by Bozini T et al., (2011), Fischer K and Stenberg T (2013) and Barootchi S et al., (2020) have indicated that full-arch fixed restoration (metal-acrylic) prostheses, supported by implants, have very good survival rates, thus confirming the predictability of this treatment for rehabilitation purposes for complete arch treatment [3,28,29]. Yilmaz B et al., found that implant survival rates were good, however, mechanical complications such as

Author and Year	Type of prosthesis	Biological complications	Mechanical complications	Aesthetic complications	Overall complication rate
Jemt T et al., 2006 [26]	FP-3 prostheses	Mucositis (11%), peri-implantitis (7%)	Chipping/fractures (9%), screw loosening (12%)	Aesthetic chipping 2%	~30%
Bozini T et al., (2011) [3]	Hybrid prostheses	Few peri- implant mucositis (2.5%)	High: Prosthetic screw loosening (15%), fracture (7%)	Rare	22%
Papaspyridakos P et al., (2012) [27]	Full-arch fixed	Peri-implantitis , mucositis (33.6%)	Screw loosening , fracture (20.1%)	N/A	~43%
Fischer K and Stenberg T (2013) [28]	Fixed full-arch	Peri-implantitis (3%), mucositis (5%)	Porcelain fracture (25%)	5%	35%
Barootchi S et al., (2020) [29]	FP-3 zirconia vs hybrid	Peri-implantitis: (~8%)	Zirconia fracture (2%), Screw loosening (3%)	Veneer chipping in hybrid prostheses	18-25%

[Table/Fig-5]: Summary of reported prosthodontic and biological complications in full-arch implant-supported prostheses [3,26-29].
FP-3: Fixed Prosthesis-3 ; N/A: Not Applicable.

acrylic fractures and screw loosening were frequently observed despite the low incidence of implant failure [1]. At the same time, Ramanauskaite A et al., reported that fixed implant/supported full-arch resin prosthetic units had low implant failure rates, indicating that long-term prognosis is also very good [30].

Nevertheless, it is important to distinguish between Prosthetic survival rate and Implant survival rate. The implant survival rate may still be high because a person may require numerous maintenance works (e.g., repair) to keep the prosthesis functioning properly [24]. Although acrylic fractures and screw loosening do not cause the loss of the implant, but reduces the patient satisfaction and increase the maintenance time, chair-side time and overall cost of maintaining the prosthesis over time [5]. However, implant survival rate acts as a key indicator for the success of metal-acrylic full-arch prostheses based on the number of prosthetic complications, the frequency of repairs, the stability of the occlusion, the patient comfort and their maintenance requirements [27,31,32]. A comprehensive assessment of these factors provides a more accurate measure of the long-term success and predictability of implant-supported full-arch metal-acrylic restorations [1,33].

The most up-to-date systematic reviews (published between 2020 and 2025) can be found in [Table/Fig-6] below and are intended to serve as a resource for clinicians interested in learning more about Full-arch fixed restoration (metal-acrylic) prostheses; including biomechanical considerations related to framework material selection, type of prosthesis and bonding method, as well as maintenance protocols [2,5,34].

Author & year	Study design	Influence studied	Conclusion
Delucchi F et al., (2021) [2]	Systematic review (clinical and cohort studies)	Framework materials in full-arch prostheses	Framework material significantly influences biomechanical performance; metal frameworks provide higher rigidity, while alternative materials require careful design optimisation.
Estrin N et al., (2023) [34]	Systematic review and meta-analysis (RCTs and clinical studies)	Prosthesis type (metal-acrylic vs metal-ceramic)	Metal–acrylic prostheses showed higher prosthodontic complication rates, although implant survival was comparable.
Pereira AL et al., (2023) [5]	Systematic review (PRISMA; in vitro studies)	Metal surface treatment for metal–acrylic bonding	Airborne-particle abrasion combined with 10-MDP primer provides the highest bond strength due to synergistic micromechanical and chemical adhesion.

[Table/Fig-6]: Systematic reviews published between 2020 and 2025 on implant-supported full-arch prostheses [2,5,34].
PRISMA: Preferred reporting items for systematic reviews and meta-analyses; RCT: Randomised controlled trial; CAD/CAM: Computer-aided design/Computer-aided manufacturing; PEEK: Polyetheretherketone; 10-MDP: 10-Methacryloyloxydecyl dihydrogen phosphate

CONCLUSION(S)

Metal-acrylic full-arch implant-supported fixed dental prostheses continue to represent a predictable and cost-effective treatment modality for the rehabilitation of edentulous patients. Mechanical complications remain more prevalent than implant failure, underscoring the importance of meticulous treatment planning, precise fabrication and regular maintenance. Advances in digital technologies have the potential to further enhance the prosthesis accuracy and clinical performance. Nevertheless, additional long-term prospective clinical studies are required to strengthen the evidence base and support the development of standardised clinical guidelines.

REFERENCES

[1] Yilmaz B, Lee DJ, Amer R, Rastogi V, Braegger U, Johnston WM. Evaluation of prosthetic complications with metal-acrylic resin implant-fixed complete dentures: A medium- and long-term retrospective analysis with up to 13 years of follow-up. Int J Prosthodont. 2023;36(6):697-703.

[2] Delucchi F, De Giovanni E, Pesce P, Bagnasco F, Pera F, Baldi D, et al. Framework materials for full-arch implant-supported rehabilitations: A systematic review of clinical studies. Materials (Basel). 2021;14(12):3251.

[3] Bozini T, Petridis HP, Garefis K, Garefis P. A meta-analysis of prosthodontic complication rates of implant-supported fixed dental prostheses in edentulous patients after an observation period of at least 5 years. Int J Oral Maxillofac Implants. 2011;26(2):304-18.

[4] Sirandoni D, Leal E, Weber B, Noritomi PY, Fuentes R, Borie E. Effect of different framework materials in implant-supported fixed mandibular prostheses: A finite element analysis. Int J Oral Maxillofac Implants. 2019;34(6):e107-e114.

[5] Pereira AL, de Mendonça LM, Troconis CCM, Barão VAR, Carreiro AFP. Which metal surface treatment improves the bond strength between metal alloys and acrylic resin in removable partial dentures? A systematic review. J Prosthet Dent. 2023;130(5):e345-e352.

[6] Berzaghi A, Testori T, Scaini R, Bortolini S. Occlusion and biomechanical risk factors in implant-supported full-arch fixed dental prostheses-narrative review. J Pers Med. 2025;15(2):65.

[7] Bevilacqua M, Tealdo T, Pera F, Menini M, Mossolov A, Drago C, Pera P. Three-dimensional finite element analysis of load transmission using different implant inclinations and cantilever lengths. Int J Prosthodont. 2008;21(6):539-42.

[8] Sertgöz A, Güvener S. Finite element analysis of the effect of cantilever and implant length on stress distribution in an implant-supported fixed prosthesis. J Prosthet Dent. 1996;76(2):165-169.

[9] Khaneja S, Agarwal S, Tripathi S, Agarwal S. The influence of implant length, angulation and abutment angulation on stress distribution pattern: A three dimensional finite element analysis. Res Rev J Dent Sci. 2016;4(3):104-12.

[10] Karre S, Kattadiyil MT, Lozada JL, AlHelal A. Complications associated with metal resin fixed complete dentures based on implant distribution. J Prosthodont. 2023;32:125-131.

[11] Sagat G, Yalcin S, Gultekin BA, Mijiritsky E. Influence of arch shape and implant position on stress distribution around implants supporting fixed full-arch prosthesis in edentulous maxilla. Int J Oral Maxillofac Implants. 2010;25(3):494-502.

[12] Şahin S, Çehreli MC, Yalçın E. The influence of functional forces on the biomechanics of implant-supported prostheses- a review. J Dent. 2002;30(7-8):271-82.

[13] Drago C. Cantilever lengths and anterior-posterior spreads of interim, acrylic resin, full-arch screw-retained prostheses and their relationship to prosthetic complications. J Prosthodont. 2017;26(6):502-07.

[14] Rangert B, Jemt T, Jörneus L. Forces and moments on Branemark implants. Int J Oral Maxillofac Implants.1989;4(3):241-47.

[15] Drago C. Ratios of cantilever lengths and anterior-posterior spreads of definitive hybrid full-arch, screw-retained prostheses: Results of a clinical study. J Prosthodont. 2018;27(5):402-408.

[16] Law C, Bennani V, Lyons K, Swain M. Mandibular flexure and its significance on implant fixed prostheses: A review. J Prosthodont. 2012;21(3):219-24.

[17] Becker CM, Kaiser DA, Jones JD. Guidelines for splinting implants. J Prosthet Dent. 2000;84(2):210-14.

[18] Gao J, Li X, He J, Jiang L, Zhao B. The effect of mandibular flexure on the design of implant-supported fixed restorations of different facial types under two loading conditions by three-dimensional finite element analysis. Front Bioeng Biotechnol. 2022;10:928656.

[19] Malo P, de Araújo Nobre M, Lopes A, Moss SM, Molina GJ.A longitudinal study of the survival of All-on-4 implants in the mandible with up to 10 years of follow-up. J Am Dent Assoc. 2011;142(3):310-20.

[20] Cevik P, Schimmel M, Yilmaz B. New generation CAD-CAM materials for implant-supported definitive frameworks fabricated by using subtractive technologies. Biomaterials Research. 2022;26(1):1-13.

[21] Barbin T, Silva LDR, Velôso DV, Borges GA, Presotto AGC, Barão VAR et al. Biomechanical behavior of CAD/CAM cobalt-chromium and zirconia full-arch fixed prostheses. J Adv Prosthodont. 2020;12(6):329-37.

[22] Tribst JPM, Campanelli de Morais D, Melo de Matos JD, Lopes GDRS, Dal Piva AMO, Souto Borges AL, et al. Influence of framework material and posterior implant angulation in full-arch all-on-4 implant-supported prosthesis stress concentration. Dent J (Basel). 2022;10(1):12.

[23] Zeroual R, Bahedi O. The use of polyetheretherketone (PEEK) in implant prosthetics: A detailed review of the literature. J Clin Adv Dent. 2023;7:34-40.

[24] D'Amico C, Bocchieri S, Sambataro S, Surace G, Stumpo C, Fiorillo L. Occlusal load considerations in implant-supported fixed restorations. Prosthesis. 2020;2(4):252-65.

[25] Jankar A, Bangar B, Gajare S, Langote P, Chavan B, Channe V. Occlusion principles in implant-supported prosthesis- A literature review. Int J Curr Adv Res. 2023;12(5):2036-38.

[26] Jemt T, Johansson J. Implant treatment in the edentulous maxillae: A 15-year follow-up study on 76 consecutive patients provided with fixed prostheses. Clin Implant Dent Relat Res. 2006;8(2):61-69.

[27] Papaspyridakos P, Chen CJ, Chuang SK, Weber HP, Gallucci GO. A systematic review of biologic and technical complications with fixed implant rehabilitations for edentulous patients. Int J Oral Maxillofac Implants. 2012;27(1):102-10.

[28] Fischer K, Stenberg T. Prospective 10-year cohort study based on a randomized, controlled trial (RCT) on implant-supported full-arch maxillary prostheses. Part II: Prosthetic outcomes and maintenance. Clin Implant Dent Relat Res. 2013;15(4):498-508.

[29] Barootchi S, Askar H, Ravidà A, Gargallo-Albiol J, Travan S, Wang HL. Long-term clinical outcomes and cost-effectiveness of full-arch implant-supported zirconia-based and metal-acrylic fixed dental prostheses: A retrospective analysis. Int J Oral Maxillofac Implants. 2020;35(2):395-405.

[30] Ramanauskaite A, Becker K, Wolfart S, Lukman F, Schwarz F. Efficacy of rehabilitation with different approaches of implantsupported full-arch prosthetic designs: A systematic review. J Clin Periodontol. 2022;49(Suppl 24):272-90.

[31] Agarwal S, Trivedi A, Kusum CK, Goswami R, Mowar A. A three-dimensional finite element analysis of effect of abutment materials on stress distribution around peri-implant bone in immediate and delayed loading conditions. J Clin Diagn Res. 2022;16(6):ZC55-ZC60.

[32] Najeeb S, Zafar MS, Khurshid Z, Siddiqui F. Applications of polyetheretherketone (PEEK) in oral implantology and prosthodontics. J Prosthodont Res. 2016;60(1):12-19.

[33] Tyagi M, Trivedi A, Mowar A. A case report depicting an implant-supported prosthetic rehabilitation of an immunocompromised patient with a bilateral subtotal maxillectomy defect secondary to mucormycosis. Int J All Res Educ Sci Methods. 2022;10:1470-76.

[34] Estrin N, Nam K, Romanos GE, Saragossi J, Iacono VJ, Bassir SH. Clinical outcomes of metal-ceramic versus metal–acrylic resin implant-supported fixed complete dental prostheses: A systematic review and meta-analysis. Int J Prosthodont. 2023;36(3):354-65.

PARTICULARS OF CONTRIBUTORS:

1. Associate Professor, Department of Prosthodontics and Crown and Bridge, Subharti Dental College and Hospital, Swami Vivekanand Subharti University, Meerut, Uttar Pradesh, India.
2. Professor, Department of Prosthodontics and Crown and Bridge, Subharti Dental College and Hospital, Swami Vivekanand Subharti University, Meerut, Uttar Pradesh, India.
3. Postgraduate Student, Department of Prosthodontics and Crown and Bridge, Subharti Dental College and Hospital, Swami Vivekanand Subharti University, Meerut, Uttar Pradesh, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Sweta Teotia,
Department of Prosthodontics and Crown and Bridge, Subharti Dental College and Hospital, Swami Vivekanand Subharti University, Meerut-250005, Uttar Pradesh, India.
E-mail: teotiasweta2900@gmail.com

PLAGIARISM CHECKING METHODS: [Jain H et al.]

- Plagiarism X-checker: Jun 23, 2026
- Manual Googling: Jul 23, 2026
- iThenticate Software: Jul 25, 2026 (1%)

ETYMOLOGY: Author Origin

EMENDATIONS: 6

AUTHOR DECLARATION:

- Financial or Other Competing Interests: None
- Was informed consent obtained from the subjects involved in the study? NA
- For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: **Jun 20, 2026**
Date of Peer Review: **Jul 13, 2026**
Date of Acceptance: **Jul 28, 2026**
Date of Publishing: **Sep 01, 2026**