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Review Article

Comprehensive insight of prosthetic failures seen in dental implantology: A review

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ABSTRACT:
Prior to beginning treatment, substantial scientific knowledge and a clear strategy for permanent restorations are required for the diagnostic and treatment planning of single restorations and partial fixed prostheses supported by dental implants. Dental implants are a reliable and efficient treatment option for both single and multiple missing teeth, but they are also not without certain risks. These risks might be technical, mechanical, or aesthetic. Each issue related to failed dental implant prosthetics has been enumerated in this review paper.
Keywords: Complications, Prosthetic Failure, Single Unit Implant Crown, Multiple Unit Implant

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INTRODUCTION

Implant-supported prostheses that are either fixed or detachable may be used to replace missing teeth. Anatomical, aesthetic, and financial considerations, as well as the patient's preferences, are used in the clinical decision-making process to choose between the two different kinds of restorations. As failures of the prosthesis may result in failures of the total implant rehabilitation, high survival rates and low complication rates of the prostheses are a crucial requirement for the general success of therapy. Prior to beginning treatment, substantial scientific knowledge and a clear strategy for permanent restorations are required for the diagnostic and treatment planning of single restorations and partial fixed prostheses supported by dental implants. Reduce the resistance to unfavorable leverage forces during function as one of the key strategies for reducing the occurrence of biomechanical problems in single-implant restorations (SIRs) and partial fixed implant-supported prostheses (PFISPs).[1] Face aesthetics is a significant factor in the choice (i.e., the need for facial tissue support). The difficulty of the necessary surgical treatments is the next element determining the choice if both fixed and detachable prostheses are viable options. Fixed implant prostheses may need significant quantities of hard and soft tissue regeneration in cases of severe horizontal and/or vertical bone loss. Therefore, detachable implant-retained prostheses like implant- retained overdentures are less invasive treatment choices in situations where there is a requirement for facial tissue support or significant bone and/or soft tissue augmentations. According to Weinberg and Kruger, the torque imparted to the restorer during function increases by 30% for every 10 degrees of cusp inclination.[2] The torque imparted to the restoration during function may also rise by 5% for every 10 degrees that the implant's tilt increases. Additionally, a 1-mm increase in the vertical offset and a 1-mm increase in the horizontal offset of an implant restoration each introduce a 5% and 15% increase in torque during function, respectively. According to biomechanics, the functional stress put on an implant repair is focused on the coronal region of the crestal bone around the implant body. As a result, additional caution should be used when many conditions exist, such since high occlusal pressures, an implant that is

positioned laterally, and a steep cuspal inclination, as the stress is concentrated at the abutment-implant connection, where problems may arise.

SINGLE CROWNS WITH IMPLANTS FOR RETENTION

For many years, single-implant, metal-ceramic crowns were the gold standard, but now, zirconia or lithium disilicate ceramic implant crowns are being utilized effectively as an alternative. For the creation of single implant-retained crowns, leucite-reinforced glass ceramics, alumina ceramics, or resin-matrix ceramics may also be taken into account. In all, > 10% of crowns needed to be replaced in the first 10 years due to various biologic or technological issues. The most frequent technical issues with single implant-retained crowns are chipped or fractured veneering ceramic, fractured or broken abutment/prosthetic screws, and loss of retention of cemented crowns. Complete crown fracture is the primary cause of ceramic crown failure.[3]

FRACTURE OR LOOSENING OF PROSTHETIC SCREWS OR THE ABUTMENT

Abutment screw fracture is an uncommon complication, but screw loosening, with a cumulative 5-year complication rate of 8.8%, was and is currently the most common technical issue with single implant-retained crowns. Following current guidelines to lessen the risk of peri-mucositis and peri-implantitis caused by excess cement, implant-retained crowns are now more typically screw- retained than cemented.[4] Nevertheless, despite all of these advancements, a long-term, reliable solution that completely eliminates screw loosening has not yet been discovered, so this risk must be taken into account while designing a treatment plan.

CROWN RETENTION FAILURE

The second most common problem with implant single crowns is loss of retention due to de-cementation, which occurs in 4.1% of cemented crowns after five years of use. When there are technological issues, the reparative material is crucial. Due to their superior material stability, metal-ceramic crowns don't need adhesive cementation to the substrate (the abutment) in order to get enough strength for clinical performance. For this reason, traditional cements like zinc phosphate or glass-ionomer cement are often used to cement metal-ceramic crowns. The fundamental drawback of resin cements is that they are typically transparent, have a high viscosity, and are not radio-opaque. After curing, they also show chemical attachment to the abutment substrate. As a result, extra cement is harder to remove than it would be with non-adhesive, opaque traditional cements. The veneering material has chipped or fractured: With fixed implant prostheses, chipping of the veneering ceramic is the third most prevalent problem. The rates provided have a 5-year complication rate that is 3.5% overall, with rates ranging from 3.2% to 25.5%.[5] Ceramics for veneering are silica-based, have outstanding aesthetic qualities, but have extremely poor fracture strength ratings. The likelihood of the veneering ceramic chipping is influenced by a number of elements. High chipping rates may be avoided in part by the composition of the framework material. Additionally, the mouth cavity is a highly difficult environment for dental materials to function in, especially ceramics. Ceramics age more quickly as a result of humidity, chemical assaults from acidic food and drink, and fluctuating temperatures. The likelihood of breaking or chipping rises with age. Occlusion and function also have an impact on the long-term stability of the veneering ceramic since implant restorations are subjected to far greater stresses than tooth-borne restorations. According to one analysis, monolithic lithium-disilicate implant crowns had a 91% 5-year cumulative survival rate. Before clinical recommendations on monolithic implant crowns can be given, further study and development is required.[5]

CERAMIC ABUTMENTS BREAKING

Although ceramic abutment fracture is an uncommon problem, ceramic abutments showed more fractures than metallic abutments, which a technical issue that always results in the implant repair is failing. In cases when the remains from the internal connection cannot be removed, it could be essential to remove the implant. Internally attached ceramic abutment fracture often occurs in the internal region of the implant-abutment connection. These days, an alternate method can be the pairing of zirconia abutments with titanium-base abutments that are internally attached.

COMPLICATIONS IN AESTHETICS

In some clinical circumstances, aesthetic issues may be the cause of implant therapy failure. With implants in the aesthetic zone, peri-implant mucosal discoloration brought on by implant parts or components may be a serious issue (i.e., maxillary anterior and posterior regions in patients with a high smile line). In both laboratory and clinical research, it was shown that metallic abutments and metal-ceramic implant crowns discolored the mucosa in a grey manner. The thickness of the mucosa may be related to the degree of discoloration and how it affects aesthetic results.[6] It's interesting to note that recent research have shown that zirconia's dazzling white hue also causes soft tissue discoloration, giving tissues a brighter and paler look.

MULTIPLE-UNIT DENTAL PROSTHESES THAT ARE IMPLANT-FIXED

The only available materials for multiple-unit implant-fixed dental prostheses are metal ceramics and zirconia ceramics, in contrast to single implant crowns. Zirconia performed less well than metal ceramics, the industry's gold standard for multiple-

unit fixed dental prostheses, which are regarded as the industry standard. The most common technical/mechanical issue with multiple-unit, implant-fixed dental prostheses are ceramic veneer chipping or fracture. Although less common, the ceramic framework breaking and the screws coming free are nonetheless clinically significant issues.

CERAMIC VENEERING CHIPPING

This issue is yet unresolved, much as with single-unit zirconia restorations, but monolithic zirconia, implant-fixed dental prostheses seem to provide a potential solution. Before making clinical recommendations, randomized controlled clinical studies with extended follow-up times are required.

ZIRCONIA FRAMEWORKS BREAKING

One of the most significant variables affecting the performance of zirconia as a framework material is the expansion of multiple-unit, fixed dental prostheses. In fact, no fractures were seen with partly fixed dental prosthesis; only full-arch, zirconia fixed dental prostheses fractured. It has been shown in the past that the connections' size and form are the most important factors affecting the stability of multiple-unit, zirconia fixed dental prosthesis. In comparison to earlier yttria-stabilized tetragonal zirconia polycrystal framework materials, the new varieties of monolithic transparent zirconia ceramics have lower strength values but superior aesthetic qualities. When constructing these restorations, it is important to adhere to the manufacturer's instructions for reliable results.[7]

UNSCREWING A SCREW

With both the metal-ceramic and the zirconia-ceramic, implant-supported, multiple-unit fixed dental prostheses; screw loosening is an uncommon problem.[8] There has been a documented decrease in 5-year screw-loosening rates as a result of advancements in screw designs, screw materials, and torque settings.

OVERDENTURES THAT ARE IMPLANT-RETAINED

Implant-retained overdentures are seen to be a good alternative for fully rehabilitating edentulous individuals with fewer implants, less invasively, and more affordably. Furthermore, compared to fixed prostheses, implant-retained overdentures were said to decrease patient satisfaction and masticatory performance less. Overdenture failure or chipping of the veneering materials are technical difficulties of implant-retained overdentures, while implant fracture, attachment failure, and attachment housing or insert issues are mechanical complications. Again, both technical and mechanical issues are referred to as "technical complications" throughout the following. In particular for implant-supported overdentures, Payne et al expanded on and modified this protocol in 2001, including: 1. prophylaxis; 2. minor occlusal or anatomic corrections; 3. polishing; and 4. asymptomatic and peri-implant/inter-abutment mucosal enlargement that does not require excision.[9] After the first year, prosthesis screws should be tightened or replaced no more often than once a year. The activation, repair, and replacement of either a patrix or a matrix, with a maximum of five replacements during a five-year period and no more than two replacements in the first year. Denture relining, which is seen as maintenance rather than a problem, should be done every five years. Similar findings were published in 2012 by Osman et al, who came to the conclusion that the necessity for maintaining patrices and matrices was followed by the need for modifications and contouring of denture flanges.[10] Because it is not always clear from the literature how to distinguish between routine maintenance requirements and problems, these findings should be read with care.

PREVALENCE OF TECHNICAL COMPLICATIONS

Activation, loss, or fracture of the patrix or a matrix retention component is required.The most common occurrence with implant-supported overdentures in both jaws is the requirement for activation, replacement, or repositioning of a retention component, either the matrix or patrix. The repaired jaw also has a crucial function to perform. According to Andreiotelli et al., the ball and magnet groups at mandibular implant-retained overdentures showed greater problems of the retentive components (retention loss and wear, respectively).[11] According to Sadowsky et al, free-standing designs had a greater prosthetic failure rate than splinted implants, and maintenance was higher for solitary attachments at the maxillary implant-retained overdentures, supported by 4 implants.[12] The implant angulations is a crucial element in clinical scenarios that may guarantee the retention of single anchors. The usage of ball, locator, and magnet attachment types may be recommended for an implant divergence of 10–40 degrees in order to decrease the frequency of patrix/matrix repairs.[11] The implant angulations is a crucial element in clinical scenarios that may guarantee the retention of single anchors. When adopting rigid anchoring from milled bars with metal reinforcement instead of resilient stabilization given by round bars supported by four implants at maxillary overdentures, fewer interventions for the retentive components were found. Clinical research links this occurrence to the stiff anchors' capacity to withstand rotation and movement of the overdenture, slowing the rate of attachment deterioration. Additionally, a link between the kind of bar attachment and the fracture of distal extensions was noted. This problem, which is linked to occlusal overload, is more frequent in the stiff bar group.[12]

SCREW FRACTURE, SCREW LOOSENING, AND ABUTMENT LOOSENING

When rating the frequency of screw or abutment loosening at implant-retained overdentures, Cehreli et al observed comparable findings for the various attachment options in both jaws.[13] The uniform stress distribution may be compromised by an increasing inter-implant distance, leading to more often occurring abutment loosening. Additionally, Assaf et al mentioned a greater frequency of screw loosening for overdentures supported by mandibular implants that are bar-anchored as opposed to those that are ball-retained.[14] Overdenture relining/fracture or replacement (fracture of acrylic resin, broken denture tooth, fracture of framework or bar). Relevant variables impacting the likelihood of technical difficulties include the implant overdenture's design, the jaw's location, and the length of time it has been in use. Although bar fractures are an uncommon technical issue, if one occurs, the prosthesis may need to be renewed. A study of the literature found that implant overdenture bars are one of the six identified fundamental reasons for metal framework fractures.

RISK FACTORS FOR TECHNOLOGICAL DIFFICULTIES

The choice of attachment, the ideal number and placement of implant fixtures, and consideration of the clinical factors, such as the availability of prosthetic space and the opposing dentition, all need to be assessed in order to lower the risk of prosthetic complications with implant-retained overdentures.

TYPE OF ATTACHMENT

The selection of attachment types that a therapist prefers might be influenced by a variety of factors. However, each attachment system has a unique set of clinical requirements and indications. The primary parameters that should determine the implant attachment of choice are the amount of prosthetic space already presents the inter-implant distance, the implant location and angulation, and the number of implants. Additionally, these characteristics may influence the frequency of complications and maintenance needs. The outcome of improperly positioned implants is that the prosthesis' insertion route and fit will not be ideal, which will increase the likelihood that a matrix modification or patrix wear will be required. The preceding criteria should be used to choose the attachment type (i.e., existing prosthetic space, inter-implant distance, implant position, angulation, and the number of implants).

NUMBER OF IMPLANTS FOR SUPPORT

Van Steenberghe et al. (1987) were the first to suggest that mandibular overdentures may be supported by two implants.[15] Since then, there has been substantial research on mandibular overdentures to determine the ideal amount of supporting or retaining implants. According to two consensus conferences, the "gold standard" therapy for edentulous patients is a mandibular overdenture supported by two implants. Overdentures supported by a single implant are also advised by several writers because to their financial benefit and capacity to increase patient satisfaction. However, because of the space taken up by the attachment housings and the reduced amount of acrylic resin, it is necessary to assess the issues related to the single implant overdenture treatment option, such as the risk of potential vascular damage and increased risk of implant overdenture fracture. However, according to the research, maxillary overdentures should have at least four supporting dental implants for optimal long-term results, compared to one or two implants for mandibular overdentures.

MANDIBLE VERSUS MAXILLA

Overdentures for the mandible and maxilla were first used in dentistry more than 30 years ago. Due to their higher happiness with full dentures, patients with maxillary complete edentulism seek implant treatment less often than patients with mandibular complete edentulism. As a result, the teeth on maxillary implants are positioned anteriorly and inferiorly to the remaining ridge, giving the face a more angulated appearance. Maxillary overdentures are vulnerable to adverse loads because of this less-than-ideal tooth location and anatomical variations, which leads to shorter survival rates and greater complication rates than for mandibular implant-retained overdentures. Palatal covering is strongly advised, particularly when there are less supporting implants, since there have been more prosthetic issues recorded with maxillary implant-retained overdentures without it. Because the maxillary masticatory mucosa is thicker than the mandibular mucosa, the abutment heights are higher, which causes the lever arms to be larger. This may be connected to the fact that maxillary implant-retained overdentures have more abutment-related complications than mandibular implant-retained overdentures. Additionally, the mandible's hinge-like structure, shock-absorbing qualities, and bone features lessen the possibility of force-related issues with mandibular implant-retained overdentures. Overall, maxillary overdentures have been shown to have a greater prevalence of technical issues.

PROSTHETIC SPACE THAT IS AVAILABLE AND OPPOSING TEETH

In comparison to implant-supported fixed dental prostheses, the components supporting implant-retained overdentures often need greater vertical and horizontal prosthetic space. When implant-retained overdentures are a treatment option, the jaws must have adequate room for the attachment, the housings/bar clips, and the thickness of the prosthesis. Insufficient prosthetic space will result in improper attachment and prosthesis dimensions. The inter-arch space cannot yet be directly correlated with

overdenture survival and success rates because to the dearth of available data. The appropriate placement of bar clips is compromised if the inter-implant distance is less than or equal to 8 to 10 mm, and as a result, clip loosening happens more often. The opposing dentition may further increase the risk of problems with implant-retained overdentures.

SYNTHETIC SUBSTANCE

Base fracture is a common technical issue when treating implant overdentures; as a result, the design and materials are very important to the final results. In order to avoid technical difficulties with implant-retained overdentures, denture-base reinforcement is advised since it increases the rigidity of the implant overdenture and reduces denture-base deformation. Metal, high performance polymers, glass and carbon fibers, as well as metal, are the materials utilized to strengthen denture bases. The cobalt-chromium framework continues to be the industry benchmark for framework construction. High performance polymers are being researched because they may be advantageous because to their reduced weight, better aesthetics, and superior bonding ability to acrylic denture-base materials. However, additional information is required before any suggestions about these more recent materials can be made.

CONCLUSIONS

Technical problems cannot be avoided in any form of implant-retained prosthesis, as this review of the literature on fixed and detachable implant- retained prostheses reveals. The therapy for implants may fail due to technical issues. A thorough preoperative diagnostic work-up, which includes establishing the prosthetic aim with the help of a wax-up or set-up and the related ideal, prosthetic-oriented three-dimensional implant location, is essential to lowering the likelihood of this failure. Additionally, choosing the best kind of prosthesis, together with the appropriate implant materials and components, is crucial for the clinical long-term success of the reconstruction.

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