

The bar –frame work misfit:Review article

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ABSTRACT:

Implant overdenture with Attachment were used to improve the stability and function of the prostheses and increases patient satisfaction. A passive fit between the metal framework and the bar attachment is required for successful restoration. Framework-bar misfit is a common problem observed in overdentures, which might result in prosthetic and biological complications. In the present article was reviewed the literature concerning on the causes, complication and overcome of misfit.

Key word: implantoverdenture, bar attachment, misfit

INTRODUCTION:

Implant assisted overdentures have been widely used to increase low retention and stability of complete dentures⁽¹⁾ and also improves neuromuscular activity and adaptation and thereby substantially improves masticatory function in edentulous patients.⁽²⁾ used implants with Attachment to the improves the stability and

function of the prostheses and increases patient satisfaction. ⁽¹⁾

The commonly used abutment types for connections between the denture and interforaminal implants are (Bar-clip, Ball attachments, Locator, Magnets and Telescopic crowns), which offer different biomechanical features.⁽³⁾

The bar-clip retention system provides the highest retention for the prostheses.⁽⁴⁾ When compared to the other attachments. This system also provides a more favorable stress distribution due to splinting. Still, the rotation of the clip over the bar allows the forces from chewing to be better distributed in the implants and in the denture bearing area.⁽⁵⁾ The long-term success of overdentures with a bar-clip system is closely related to the passive fit between the bar- framework and the implants.⁽⁶⁾ A passive fit between the metal framework and the bar/implants is required for successful restoration.⁽⁷⁾ Passive fit of prosthetic

Acceptable levels of fit:

In 1983, Brånemark was the first to define passive fit and he proposed that it should exist at the 10 μm level to enable bone maturation and remodeling in response to occlusal loads.⁽¹¹⁾ In 1985, Klineberg and Murray suggested that castings with discrepancies greater than 30 μm -over more than 10% of the circumference of the abutment interface were unacceptable.⁽¹²⁾ In 1991, Jemt defined

frameworks on dental implants has been considered to be critical to avoid more problems.⁽⁸⁾ The other authors defined passive fit as the absence of strain development following framework insertion.⁽⁹⁾ Also, the Passive fit is assumed to be one of the important prerequisites to maintain bone level around the implants. It should be simultaneous and even contact between the whole inner surface of frame work with all implant abutments without inducing any strain on the supporting implant components and surrounding bone structure in the absence of occlusal loads.⁽¹⁰⁾

passive fit as levels that did not cause any long-term clinical complications and suggested misfits smaller than 150 μm were acceptable. It was proposed that an unacceptable level of framework misfit existed when greater than half-a-turn was needed to completely tighten the gold screw after its initial seating resistance was encountered. Although the preceding values were reported and

subsequently highly quoted, they are of empirical origin.⁽¹³⁾

Methods for evaluating framework fit:

Methods for evaluating implant framework fit can be categorized according to the assessment method.

Clinical Assessment: There are different methods to evaluate the fit of the framework; but, none of these methods is accepted as the standard test. The accuracy of these methods can be affected by implant distribution and number, margin location, framework rigidity, eyesight, lighting, angle of vision, and experience of the dentist.⁽¹⁴⁾

The alternate finger pressure technique is a simple technique to detect a gross misfit by applying pressure in an apical direction alternatively at each end of the framework to detect the presence of any fulcrum.⁽¹⁵⁾

2. Laboratory Assessment:

The lab technician should check the fit of framework on the cast before the dentist tries it in the patient's mouth. A framework that does not fit on the master cast will not fit in the mouth. Several different methods may be used

to assess the fit of framework in the laboratory.⁽¹⁴⁾

Photogrammetric technique: it was introduced by Lie and Jemt to analyze the fit of implant frameworks. This technique measures the three dimensional orientation of the abutment cylinders on the implant analogs. It involves the use of a small standard camera with a wide angle lens modified and it can measure a gap as small as 30 μm . It is a technique sensitive procedure that requires standardization of the position of the camera.⁽¹⁶⁾

b-Coordinate measuring machine: this machine consists of a probe which can travel in the X,Y,Z axes and record the dimension of the framework or inter-implant analogue distances and height when it touches a surface. The distance that the probe travels is calculated by computer software and transformed into measurable data.⁽¹⁷⁾

Strain gauge analysis: strain gauges consist of fine wires or foils arranged in

a grid pattern which are attached to the framework. They are also sensitive to

temperature.⁽¹⁸⁾

Finite element analysis (FEA): is a computer-based technique for calculating strength and behavior of structures. It is a good tool to evaluate the behavior of peri implant structure

and stresses affecting screws and implant bone interface caused by metal framework fitting and occlusal loading.⁽¹⁹⁾

Factors affecting the framework fit accuracy

Several authors have found that routine procedures such as impression making, cast pouring, framework waxing, investing, polishing, and veneering will induce misfit of several

hundreds of microns, which might be missed clinically.^(20,21) Consequently, vertical, horizontal, and angular misfits of significant magnitude can be potentially introduced.

a- Impression materials:

They are used to record a negative form of the intraoral structure for the fabrication of stone casts that replicate the intraoral structure where the prosthesis is fabricated. Ideal dental

implant impression should produce an accurate impression, resist tearing, enough working time, biocompatible, easy to use, dimensionally stable, compatible with die materials⁽²²⁾

b- Impressions technique:

Kim et al. compared the accuracy of implant impression in-vitro and found that the non-splinted technique showed less three dimensional linear displacements than the splinted technique during impression making

while the splinted technique showed less three dimensional linear displacement than the non-splinted group during cast fabrication.⁽²³⁾ The other study evaluated the accuracy of pick-up impressions made with an

acrylic resin splint and without on a model with four internal connection implants using polyether impression

Assunaco et al. they found that open tray impressions with splinted impression coping produced better results compared with open tray without splinting and closed tray impression.⁽²⁵⁾ Del Acqua et al reported in his study that both splinted and un-splinted open-tray impressions are more accurate compared with closed-tray impression. When there are three or less implants, most studies showed no difference between closed-tray and open tray impression techniques⁽²⁶⁾ Digital impression techniques at the implant level have become available and have played an important role in the development of a fully digital workflow

c. Cast materials:A

definitive cast is the positive reproduction of the intraoral structure recorded by the impression material. Desirable qualities of cast materials are accuracy, dimensional stability, ability to reproduce fine details, strength, resistance to abrasion, ease of adaptation

material. It was found that splinting impression copings with acrylic resin produced more accurate casts⁽²⁴⁾

for implant restorations⁽²⁷⁾ and could offer some advantages over traditional implant impression procedures with elastomeric impression materials, such as reduced risks of distortion during impression and cast fabrication, improved patient comfort and acceptance⁽²⁸⁾. One recent study showed that angulated implants diminish the accuracy of the impressions created with an active wave front sampling technology based digital impression system.⁽²⁹⁾ The iTero System (Cadent iTero, Cadent Ltd) was introduced in 2007 using parallel confocal imaging technology to capture the digital impression.⁽³⁰⁾

to the impression material, color for contrast, and safety⁽³¹⁾ than definitive casts made from traditional transfer and pickup techniques.⁽³²⁾ The Encode restorative system provides an alternative method for cast fabrication by means of digitally coded healing

abutment to transfer the information about implant diameter and position to a robotcast, which places a corresponding implant analog in the definitive cast.

d. Implant framework fabrication technique:

Conventional casting: technique shows technical complications caused by misfit between the prosthetic structure and the abutment.⁽³³⁾ The fit of a cast implant framework is affected by pattern fabrication material, investment material, investing technique and casting⁽³⁴⁾ Base metal alloys such as cobalt-chrome (Co-Cr) and nickel-chrome (Ni-Cr) are less expensive compared with noble alloys and have superior physical properties. However, they are difficult to cast, finish, and polish. For base metal casting accuracy, titanium (Ti) alloy casting is more accurate than Ni-Cr and Co-Cr alloys, and Co-Cr alloy casting is

Complication of misfit

There are many complications could be caused by a misfit in the prosthetic metal framework. They may include mechanical complications: are such :The misfit in implant connections can result in intense oblique loads and concentration of stresses at prosthetic and implant structures.⁽³⁷⁾ as fractures in

However, the initial results with this system demonstrated that definitive casts were less accurate.

worse than Ni-Cr. Single base alloy casting are not acceptable for implant frameworks and additional refinements to improve their fit are needed before they can be inserted⁽³⁵⁾

Potential distortion can be created at any step of the fabrication process. Errors are due to changes occurring during indirect procedures, including taking impressions, gypsum casts, waxing frameworks, investing wax patterns, and casting frameworks. If all the materials are carefully handled, then the compounded errors are still relatively small.⁽³⁶⁾

veneering material, framework, fixation screws and abutment screws, as well as loosening of the screws. The Other biological complications were also observed, such as gingival inflammation, pain, fistula and per implant bone loss⁽³⁸⁾ The stresses on prosthetic structures and

bone tissue are not only observed when occlusal loads are applied. Stresses are also created when ill-fitting prostheses are installed⁽³⁸⁾, and the values of these generated stresses vary with the stiffness of the framework material⁽³⁹⁾. Also, microbial proliferation.it will cause ;Perimucositis- a reversible

Outcomes of framework misfit:

For multiple-unit implant assisted dental prostheses, it is critical that a passive fit be achieved between the superstructure and the bar/ implants. Failure to meet this requirement may result in biologic and technical complications⁽⁴¹⁾. Due to the rigidity of the connection between osseointegrated implants and surrounding bone, any stress caused by framework misfit will be transmitted to implant components and implant bone interface⁽⁴²⁾When misfit of the cast bar occurs, cutting and reconnecting the bar segments through soldering or welding is performed in an attempt to achieve a passive fit⁽⁴³⁾. also the lack of accurate adaptation of the denture base to the bar superstructure can be avoided by Electrical Discharge Machining and

inflammation of the soft tissues surrounding functional implants. Peri-implantitis- an inflammatory reaction with the loss of supporting bone in the tissues surrounding a functional implant. Finally the microbial proliferation leads to crestal bone loss.⁽⁴⁰⁾

spark erosion which can be used to improve the fit of overdenture framework, but this procedure is costly and sensitive technique⁽⁴⁴⁾The inaccuracies of framework fabrication have been greatly minimized by techniques that eliminate distortion-introducing steps, such as computer-aided design/ computer-assisted manufacture. Computer numeric controlled (CNC) milling has proven to be a reliable and consistent fabrication method for titanium implant frameworks.⁽⁴⁵⁾

A finite element study showed that the presence of 111 µm vertical gaps had a significant impact on stress distribution in implant components and surrounding bone. The presence of a cantilever or excessive force increased the effect of

the misfit. When passive fit is achieved a lower peak stress is produced in each component due to widely distributed stress in all components. Also, when the

prosthesis has a misfit, the gold screw and the abutment screw bore more stress than when a passive fit is present.

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Conclusions:

1-The Passive fit is considering one of the important prerequisites to maintain bone level around the implants.

2-Framework-bar misfit is more stress to bone and causes some complications that lead to failure in implant.

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