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Polyether ketone ketone (PEKK) framework for mandibular implant-supported complete fixed dental prostheses with All-on-four treatment concept.

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ABSTRACT

Implant supported fixed prosthesis might be impossible in some of the completely edentulous patients, because of in adequate availability of residual alveolar bone, nerve proximation. In these compromised cases nerve transposition and grafting is required to overcome the problem. An alternative approach is the All-on-four concept. In this method tilting of the distal most implants on the edentulous arches allows the placement of longer dimension implants, which results in adequate support to the prosthesis with shorter cantilever arm, which helps in improving the inter implant distance and the anchorage of the implant in the bone and the antero posterior spread of the prosthesis will be maximized.The possibility of computer-aided design/computer-aided manufacturing (CAD/CAM) has enabled the use of different materials in the field of dentistry. PEKK shows excellent physical and mechanical properties, such as low density, high strength, and acceptable wear resistance in comparison to other polymeric materials. Polyetherketoneketone (PEKK) used as a prosthetic framework for mandibular implant-supported complete fixed dental prosthesis.

Keywords Keywords:*CAD/CAM,PEKK,AL-on-four, fixed dental prosthesis.*

Introduction

The majority of people who wear complete dentures struggle with a gradual loss of stability and retention during phonetics and mastication, which is why patients are asking for fixed rehabilitation. (Sadowsky SJ 2015)

Some individuals who are entirely edentulous may not be able to get an implant-supported fixed prosthesis due to inadequate residual alveolar bone availability or nerve proximation. To solve the issue in these impaired situations, nerve transposition and grafting are needed. The All-on-four concept is an alternate strategy. (Shadid R 2012, Krennmair S 2016) · Depending on the materials chosen, the clinical implications of designing an implant-retained prosthesis might vary significantly. Certain materials have been demonstrated to transfer more strains than others, with some even increasing the amount of stress transferred to the opposing prosthesis. (Haroun F 2021, Ventura J 2016). The possibility of (CAD/CAM) made it possible to utilize of different materials in the field of dentistry. One of the most important materials in dentistry is polymer, which has superior mechanical, physical, and biocompatibility qualities. The PEKK and (PEEK) are the two most popular of (PAEK) family.(Alqurashi H2021).

All-On-Four Concept:

The "All-on-4® "treatment concept was developed by Paulo Malo with straight and angled multi-unit abutments, to provide edentulous patients with an immediately loaded full arch restoration with only four implants, four implants are placed in the maxilla or jaw's medial area to support immediate, provisional, or definitive permanent or removable prostheses. To reduce the distal cantilever and enable the replacement of more teeth, two distal implants are often positioned inclined and two mesial implants positioned perpendicular to the bone crest. (Cappare P2019). The All-on-four concept is an alternate strategy. By using this technique, the distal implants on the edentulous arches can be tilted to allow for the placement of longer implants. This gives the prosthesis enough support with a shorter cantilever arm, which enhances the inter-implant distance, the implant's anchorage in the bone, and the prosthesis's antero-posterior spread. (Shadid R 2012, Krennmair S 2016). These kinds of treatment's predictability and safety have already been discussed in the literature. (Agliardi E 2010). Depending on the surgical design, several angulations can be employed while installing the distal implant. The advantages of 30° and 45° angulation for lowering stress concentration, however, are not succinctly stated in the literature.(Liu T 2019).The prosthetic modality analysis should take into account the fact that the surgeon placed angulated distal implants in order to shorten the cantilever length.

There has been a surge in interest in the All-on-4 concept, which combines the use of inclined and axial implants to treat atrophic mandibular ridges using instantly loaded fixed restorations.(Malo P 2017). The posterior implants' distal tilting minimizes or eliminates the distal cantilevers, enhances load distribution, and permits the use of longer implants. Furthermore, there is a high chance of success in avoiding implant interference with anatomical features and bone grafting operations. (Malo P 2003).

Application of polymers and different materials for implant supported prosthesis:

In order to achieve appropriate levels of prosthetic rehabilitation, it is crucial to link patient happiness with the various material possibilities in light of the emergence of several new materials for the building of implant frameworks. (Tallarico M 2016).

The growing demand for metal-free prostheses prompted the creation of aesthetically pleasing and biocompatible ceramics. (Bankoglu Gungor M 2016). There has been a lot of interest in the application of implant-supported prostheses (ISP) with zirconia infrastructure. Its survival rate is comparable to that of metallic infrastructure in addition to its aesthetic appeal. (Mendez Carames JM 2016).

Thermoplastic resin, fiber-reinforced composites (FRC), and polyaryl ether ketones (PAEK) family which includes polyether ether ketone (PEEK) and polyether ketone (PEKK) are examples of attractive materials used today (1).

One of the most important materials gaining attention is the high-performance polymer, which has excellent mechanical, physical, and biocompatibility qualities. High-performing thermoplastic polymer was suggested to replace metal, which has a high strength-to-weight ratio and resistance to corrosion. A variety of qualities are produced by the manufacturing method. (Sadek SA 2018).

Polyetheretherketone (PEEK) and PEKK are the two components of polyaryletherketones, which are high-performance thermoplastic polymers. PEKK has been used as a substitute material for implant abutments, frameworks for partially fixed dentures, and dental frameworks for partially detachable dentures. (Klur T 2019).

Compared to unreinforced PEEK, it possesses an 80% greater compressive strength and superior long-term fatigue characteristics. Because PEKK is lightweight and works well with a variety of veneering materials, it has been employed as a framework material. PEEK is becoming more and more common because of its adaptability in manufacturing it can be hot-pressed or milled—but there aren't many publications on its clinical applications. The extreme stiffness of the aforementioned material is a drawback, particularly when used with implants. Such circumstances might occur, leading to elevated mechanical stresses inside the substance and potential fracture .(Dawson JH 2018).

In comparison to traditional polymethylmethacrylate (PMMA) and polyetheretherketone, few studies have demonstrated the anti-inflammatory properties of PEKK and reduced bacterial adherence (PEEK). (Hahnel S

2015, Moore R 1997). Regardless of the prosthetic material, prosthetic complications are more prevalent compared to biologic complications. (Malo P 2015). For fixed full-arch rehabilitations, a few studies evaluated a hybrid solution consisting of acrylic resin teeth and artificial gingiva made of PEEK infrastructure. (Mourad KE2023). However, rare data were found in the literature about PEKK as a prosthetic material (Alsadon O 2020), but no data was found regarding either the clinical and radiographic outcome of using PEKK framework for implant-supported complete fixed prostheses or reporting the prosthetic complications.

Conclusion

Using PEKK framework for implant-supported complete fixed prostheses showed low biological complications and excellent mechanical and physical qualities.

Disclosure

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