PEEK: A Unique Choice With A Wide Spectrum Use

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ABSTRACT

Talk of technology is nothing new in dentistry, yet to be informed of the latest trends is of paramount importance. With the advent and embracing of technology in the field it is necessary to be well equipped with the knowledge of various modern materials .PEEK is one such material, whose wide array of applications is increasing day by day. This article makes an attempt to understand the popularity and the potential uses of PEEK.

Keyword: - *PEEK,THERMOPLASTIC,POLYMER*

1. Introduction

In this ever changing world it is necessary to adapt to latest choices. With so many advances in new materials and products, it becomes inevitable to have a sound knowledge of the latest materials in use. After its introduction in dentistry in the early 1980's PEEK (poly ether ether ketone) has not stayed limited as a material but has become a phenomenon.
PEEK has been used for a wide variety of applications ranging from components for cars, aircraft, and industrial pumps to sterilisable surgical instruments and medical implants. Poly Ether Ether Ketone (PEEK) is a colorless organic thermoplastic polymer in the Poly Aryl Ether Ketone (PAEK) family. It was originally introduced by Victrex PLC and later by Imperial Chemical Industries (ICI) in the early 1980s.PEEK is aesthetic, light weight, biocompatible with good strength and is compatible with the latest digitalization methods which make it a novel and unique choice in dentistry.

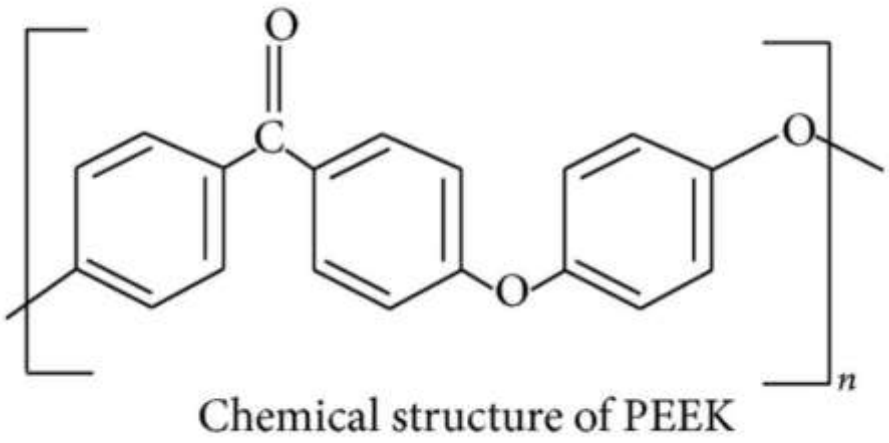
2. HISTORY

PEEK, was originally developed in the late 1970s by the US aerospace industry. In the late 1990s, a highly pure and implantable grade of PEEK known as PEEK-OPTIMA was commercialized by Invibio Biomaterial Solutions and adopted by the medical industry. In 1992, PEEK was used for dental applications. In recent years PEEK is being increasingly employed as an effective biomaterial for implantable medical devices. In dentistry PEEK is being utilized in Precision attachment cases (the PEEK frame acts as the matrix itself while the patrix is incorporated at the distal ending of the fixed crowns and bridges), Full and Partial Removable Dentures and over Dentures, anterior and posterior crowns and bridges, also now it is being utilized as dental implant material.

3. CHEMICAL STRUCTURE

It is a colorless organic thermoplastic polymer in the poly aryl ether ketone (PAEK) family. It is obtained by step-growth polymerization by the di alkylation of bisphenolate salts. The Young's modulus is 3.6 GPa and its tensile strength 90 to 100 MPa. It is highly resistant to biodegradation.

ADVANTAGES



Chemical structure of PEEK

FIGURE 1:CHEMICAL STRUCTURE

- Compatible with digital designing and milling to match patient's anatomy
- Strong and lightweight for improved patient comfort
- May be used by patients with allergy to metals(metal free)
- No thermal or electrical conductivity, irritation, redness for the user
- Tough and durable with a melting temperature of 340°C
- No abrasion of the antagonist
- Pure material- proven purity in global implanted devices
- High comfort of wear due to low weight and immediate absorption of body heat
- Very low solubility and water absorbency, enabling wearing of removable dentures for a longer time without any problems.

4. APPLICATIONS IN PROSTHODONTICS

Crowns and Bridges

It is a practical alternative to the use of metal in crowns and bridges. It is utilized because of its tailor able modulus of elasticity, excellent flexural strength and its ability to bear high loads. Also recommended because it does not cause wear of antagonist and has reduced biofilm formation.

PEEK IN REMOVABLE PARTIAL DENTURE

After ages of usage of traditional materials like chrome cobalt for traditional prosthesis, PEEK has become a viable and effective alternative. It is lighter in weight and due to its more esthetic appearance is more pleasing to the patient. Also it discourages bacterial growth, hence leading to an improved periodontal status. Other positive factors are absence of allergic reactions and metallic taste, good polishing qualities and good

wear resistance. It is odorless and the white colored framework is more acceptable to the patient than a display of metal.

PEEK IN IMPLANTS AND MAXILLOFACIAL PROSTHESIS

PEEK has been embraced in the fields of implants and maxillofacial prosthesis due to many of its attributes. It is highly biocompatible and does not create allergies as seen in titanium. High strength, good osteocompatibility and inertness make it a material of choice in these applications. It can be coated with bioactive materials. There is reduced biofilm formation, thus leading to less plaque accumulation. The elastic modulus of PEEK is 3.6 GPa, which is closer to that of bone, Its modulus can be modified by reinforcing it with carbon fibers, to achieve a modulus of 18 GPa, similar to that of cortical bone. PEEK abutments allow chair side modification and also can be used in the aesthetic zone of the maxilla. PEEK has helped provide a lighter weight, better adjusted and more functional prostheses in maxillofacial patients.

LIMITATIONS

- Diminished radiopacity
- Limitation of available sizes in case of implants
- Cost factor
- Further studies need to be undertaken on its usage
- In case of processing very high temperatures are required

FIGURE 2:PEEK CROWN

5.CONCLUSIONS

Dentistry began with routine extractions and has now progressed to

the very futuristic robotics. As dentists who are both scientists and artists it is much needed that the latest trends and technologies be tested and utilized to keep at pace with the changing world.

PEEK is already in use for a wide variety of applications and further research may open up newer avenues for its usage. Further clinical trials are required to explore this material and to suggest improvements.

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