Opinion
Volume 12:02, 2023

Journal of Spine

ISSN: 2165-7939 **Open Access**

Techniques for Modifying the Surface of Polyetheretherketone for Use as a Material for the Spinal Interbody Fusion Cage to Elicit a Biological Response: A Survey

Seerif Yusain*
Department of Spine Surgery, Navy Medical University, Shanghai 200433, China

Introduction

Spinal interbody fusion is a widely used surgical procedure for treating various spinal disorders, such as degenerative disc disease, spondylolisthesis, and spinal instability. The success of fusion relies on achieving a solid bone union between adjacent vertebrae. To facilitate this process, spinal interbody fusion cages are utilized as an implantable device to provide stability, promote alignment, and enhance fusion outcomes. In recent years, there has been significant interest in developing fusion cages with materials that can elicit a biological response, thereby optimizing the fusion process. This comprehensive review aims to explore the various materials used in spinal interbody fusion cages to promote a biological response and improve clinical outcomes [1,2].

Spinal interbody fusion cages are typically placed within the intervertebral space to restore disc height, decompress neural structures, and promote fusion between adjacent vertebrae. The choice of materials in fusion cage design plays a crucial role in determining the implant's efficacy in achieving spinal fusion. The development of fusion cages with materials capable of eliciting a biological response has gained substantial attention due to their potential to enhance fusion rates, reduce complications, and improve patient outcomes [3].

Description

The biological response within the interbody space involves the interaction between the implant material, adjacent vertebral endplates, and surrounding tissues. The desired response includes osteointegration, angiogenesis, and the recruitment of osteogenic cells, ultimately leading to bone formation and fusion. By selecting appropriate materials, fusion cages can positively influence the biological response, thereby promoting a more robust and rapid fusion process [4].

Clinical studies evaluating fusion cages with materials capable of eliciting a biological response have demonstrated promising results. Enhanced fusion rates, reduced pseud arthrosis rates, and improved clinical outcomes have been reported. However, further research is warranted to optimize the design, surface modifications, and material selection for fusion cages, as well as to assess their long-term effects and efficacy in diverse patient populations. Titanium and its alloys are widely used in spinal fusion cages due to their favourable mechanical properties, biocompatibility, and corrosion resistance. They have been shown to promote bone ingrowth and Osseo integration, leading to improved fusion outcomes. Surface modifications, such as the application of bioactive coatings or Nano topography, can further enhance the biological response of titanium-based fusion cages [5,6].

Conclusion

Developing spinal interbody fusion cages with materials that elicit a biological response is an exciting area of research. Titanium and its alloys, PEEK, bioactive glass, and calcium phosphates are among the materials used to optimize the biological response in fusion cages. Surface modifications further enhance their osteogenic potential. As research progresses, fusion cages with improved biological response properties hold significant promise for enhancing spinal fusion outcomes and improving patient quality of life.

Acknowledgement

None.

Conflict of Interest

None.

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***Address for Correspondence:** Seerif Yusain, Department of Spine Surgery, Navy Medical University, Shanghai 200433, China, E-mail: seerify@gmail.com*

Received: 03 April, 2023, Manuscript No. jsp-23-101765; **Editor Assigned:** 05 April, 2023, PreQC No. P-101765; **Reviewed:** 17 April, 2023, QC No. Q-101765; **Revised:** 22 April, 2023, Manuscript No. R-101765; **Published:** 29 April, 2023, DOI: 10.37421/2165-7939.2023.12.586

How to cite this article: Yusain, Seerif. "Techniques for Modifying the Surface of Polyetheretherketone for Use as a Material for the Spinal Interbody Fusion Cage to Elicit a Biological Response: A Survey." *J Spine* 12 (2023): 586.