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Editors' Introduction: The Role of Bioactive Materials in the Future of Spine Surgery

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Welcome to this special issue of the *International Journal of Spinal Surgery*, dedicated to exploring the dynamic landscape of bioactive materials in spinal surgery. Advances in spine surgery have historically focused on innovations in surgical technique and spinal instrumentation. However, we believe the future of new therapeutic discoveries has already begun to move in a new direction. This special issue delves into the forefront of research and clinical application, showcasing the pivotal role that bioactive materials play in shaping the future of spinal surgery while creating value and improving the quality of patient care.

EVOLUTION OF SPINAL SURGERY

The history of spinal surgery is a tale of remarkable progress, driven by a relentless pursuit of improved patient outcomes and enhanced surgical techniques. From the early days of spinal fusion to the contemporary era of minimally invasive procedures, each chapter in this evolution has been marked by the quest for materials that not only provide structural support but also actively contribute to the healing process. Bioactive materials, with their ability to interact with the biological environment, represent a paradigm shift in this journey.

UNDERSTANDING BIOACTIVE MATERIALS

Bioactive materials possess a unique capacity to engage with living tissues, fostering integration and promoting regenerative responses. In the context of spinal surgery, this capacity holds immense promise. Articles in this issue explore a diverse array of bioactive materials, ranging from traditional bone grafts to cutting-edge biomimetic scaffolds. Some of these materials act on traditional cellular pathways for bone healing such as

osteoclast and osteoblast regulation; others take novel tactics by manipulating the body's immune system response to shape a more favorable host environment for bone healing. By sharing these contributions, we aim to provide an in-depth overview of the current state of knowledge in the field and pave the way for future innovations.

There are many clinical implications of utilizing bioactive materials in spinal surgery; improved osseointegration, reduced complications, and accelerated healing are just a few of the proposed benefits discussed in this issue. Articles in this issue detail clinical trials and case studies, shedding light on the tangible advantages witnessed by surgeons adopting bioactive materials. The potential impact of bioactive materials in value creation is also addressed: improving postsurgical outcomes, enhancing the quality of life, and reducing the overall cost of care delivery.

CHALLENGES AND FUTURE DIRECTIONS

While the promise of bioactive materials is undeniable, challenges remain. Standardization, long-term biocompatibility, and scalability are among the hurdles that remain unanswered. While one of the articles in this issue addresses the economic value of bioactive materials, the long-term gains proposed are often not realized by the same surgeons and payors facing short-term cost pressures. This issue critically examines these challenges, offering insights into ongoing research endeavors aimed at overcoming these obstacles. Moreover, our contributors explore the potential synergies between bioactive materials and emerging technologies, such as 3-dimensional printing and nanotechnology, which are charting a course for the future of spinal surgery.

CONCLUSION

This special issue introduces key concepts in the evolving landscape of bioactive materials in spinal surgery. From foundational principles to cutting-edge innovations, the perspectives presented here offer a broad overview of the current state of the field. As guest editors, we are excited to contribute to a dialogue that propels spinal surgery into an era of future innovation—one where bioactive materials stand as key protagonists in the narrative of healing, restoration, and improved patient outcomes. We anticipate that this collection will serve as a catalyst for further exploration, inspiring novel research and fostering collaborations that will shape the future of spinal surgery.

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