

Treatment of Lumbar Osteomyelitis Using a Novel Stand-Alone Hydrophilic Synthetic Bone Graft: Case Report of Two Severe Infections

Justin A. Iorio*

Chief/Director, Spine Surgery, St. Joseph's Health, 5719 Widewaters Pkwy, Dewitt, NY 13214, USA

***Corresponding author:** Justin A Iorio, Chief/Director, Spine Surgery, St. Joseph's Health, 5719 Widewaters Pkwy, Dewitt, NY 13214, USA

ARTICLE INFO

Received:  September 20, 2025

Published:  October 15, 2025

Citation: Justin A. Iorio. Treatment of Lumbar Osteomyelitis Using a Novel Stand-Alone Hydrophilic Synthetic Bone Graft: Case Report of Two Severe Infections. Biomed J Sci & Tech Res 63(4)-2025. BJSTR. MS.ID.009911.

ABSTRACT

Lumbar osteomyelitis presents a devastating clinical challenge, often resulting in severe deformity, disability, and high non-union rates [1,2]. Traditional autograft and allograft options are associated with significant morbidity, variability, and limited success in infected fields [3]. We report two cases of advanced lumbar osteomyelitis with multi-level spinal destruction successfully treated using titanium corpectomy cages filled exclusively with a next-generation hydrophilic synthetic bone graft (SurGenTec® Osteoflo® Hydrofiber). Case 1, a 36-year-old male with MRSA-related osteomyelitis and progressive kyphotic deformity underwent L2-S1 reconstruction; fusion was confirmed at 8 months. Case 2, a 64-year-old male with diabetes and Pseudomonas osteomyelitis underwent L3 corpectomy with T10-pelvis fixation; fusion was confirmed at 6 months. Both patients demonstrated rapid radiographic fusion despite severe infection and comorbidities. The hydrophilic graft provided stand-alone osteoconductive and osteostimulatory properties [4-6], reduced surgical morbidity, and avoided donor site complications. These cases highlight the transformative potential of hydrophilic synthetic bone grafts for anterior column reconstruction in infected spines, warranting broader clinical evaluation.

Keywords: Lumbar Osteomyelitis; Synthetic Bone Graft; Spinal Fusion; Spine Surgery; Hydrophilicity; Corpectomy; Infection

Abbreviations: MRSA: Methicillin-Resistant Staphylococcus Aureus; CT: Computed Tomography; BMI: Body Mass Index

Introduction

Lumbar discitis/osteomyelitis is a complicated disease resulting in significant pain and dysfunction. Patients presenting with acute infection may be successfully treated with antibiotics, with or without decompression and/or fusion. Surgical indications include neurological deficits, intraspinal abscess and spinal instability. Chronic or latent osteomyelitis can result in significant bony destruction, endplate erosion and spinal deformity. The management of osteomyelitis is further complicated by invasive operations, obscure bony landmarks, surgical risks and non-union/pseudarthrosis. Non-union in aseptic spinal surgery ranges from 5-50% depending on fusion level, number of levels fused, approach, technique and patient factors. However, osteomyelitis is a risk factor for even greater non-union rates, and the treatment of resultant failed fusions is complicated and expensive

from a healthcare perspective. Factors that negatively affect union include poor bone quality from osteomyelitis, patient comorbidities, and anterior column destruction. Additionally, bone graft options for the treatment of osteomyelitis may be limited and require vascularized fibular struts or harvesting of iliac crest, which is associated with donor site morbidity, pain, and longer operative duration. Allograft tissues such as demineralized bone matrix or other processed donor materials may present donor to donor variability and carry inherent risks of disease transmission. Recently developed novel synthetic bone grafts have been designed to stimulate bone formation in challenging biological environments. The synthetic bone used in these cases (SurGenTec® Osteoflo® Hydrofiber) was selected for the purpose of fusion because of its FDA-indicated use as a bone void filler for the treatment of osteomyelitis. Lumbar osteomyelitis is a destructive and life-altering condition that can result in severe pain, defor-

mity, neurological deficits, and systemic complications [1,2]. Surgical management is particularly complex due to poor bone quality, compromised vascularity, and a hostile inflammatory environment. Non-union rates are high, with failed fusions compounding morbidity and cost [1,2]. Traditional grafting options such as iliac crest autograft, vascularized struts, or allografts carry significant limitations. Iliac crest harvest adds operative morbidity and pain; vascularized struts increase operative time and complexity; and allografts present donor variability and risk of disease transmission [3].

Next-generation hydrophilic synthetic bone grafts represent a promising alternative. Their engineered surface chemistry and porosity are designed to enhance vascularization, osteoblast activity, and early bony ingrowth, even in infected and biologically compromised environments [4-6]. Here, we present two cases where a hydrophilic synthetic graft (Osteoflo® Hydrofiber) was used as the sole filler within titanium corpectomy cages in patients with severe lumbar osteomyelitis, both achieving early fusion despite comorbidities and infection.

Case Description

The patient is a 36-year-old male (BMI 18) with a history of ongoing intravenous drug abuse presenting with severe spinal deformity, inability to stand upright, and protracted pain. The patient's disability has progressed to the point of inability to perform activities of daily living. On physical examination, the patient demonstrates approximately 60 degrees of lumbar which is rigid on range of motion testing. Weakness of the bilateral quadriceps, anterior tibialis and gastrocnemius is present on manual muscle testing. Lumbar CT imaging is significant for severe destruction of the L3, L4 and L5 vertebral bodies (Figures 1a & 1b). The patient was indicated for 3-level lumbar corpectomy from a posterior approach with fixation from T10 to pelvis. Intraoperative cultures were positive for methicillin-resistant *Staphylococcus aureus*. A titanium corpectomy cage filled with (SurGenTec Osteoflo® Hydrofiber) (Figure 2) was placed from L2 to S1 for anterior column stabilization (Figure 3a). Osteoflo® Hydrofiber was reconstituted with saline only and used stand-alone. Postoperative x-ray (Figures 4a & 4b) imaging confirmed appropriate deformity correction and CT imaging at 8 months confirmed fusion (Figure 3b) from L2-S1 through the corpectomy cage.

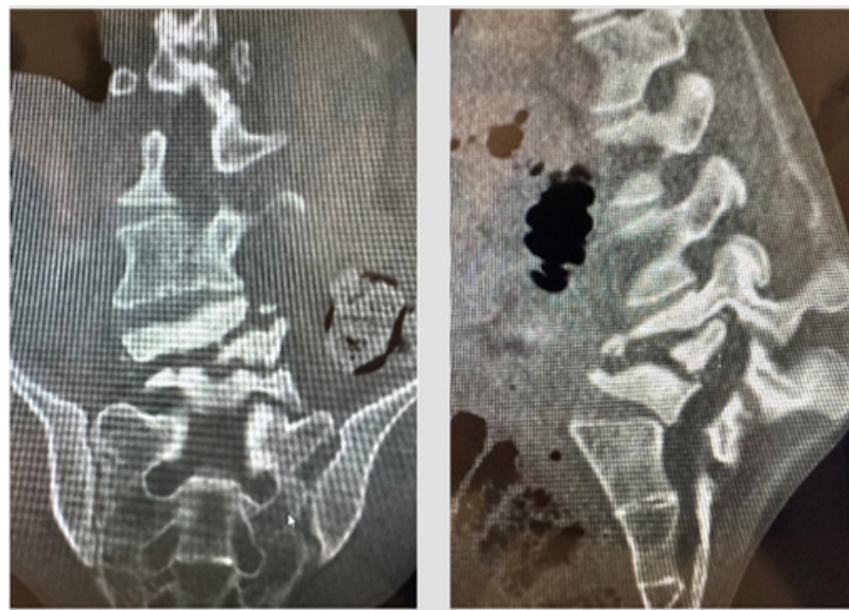


Figure 1a and 1b: Coronal and sagittal CT with severe vertebral body destruction of L3, L4 and L5.

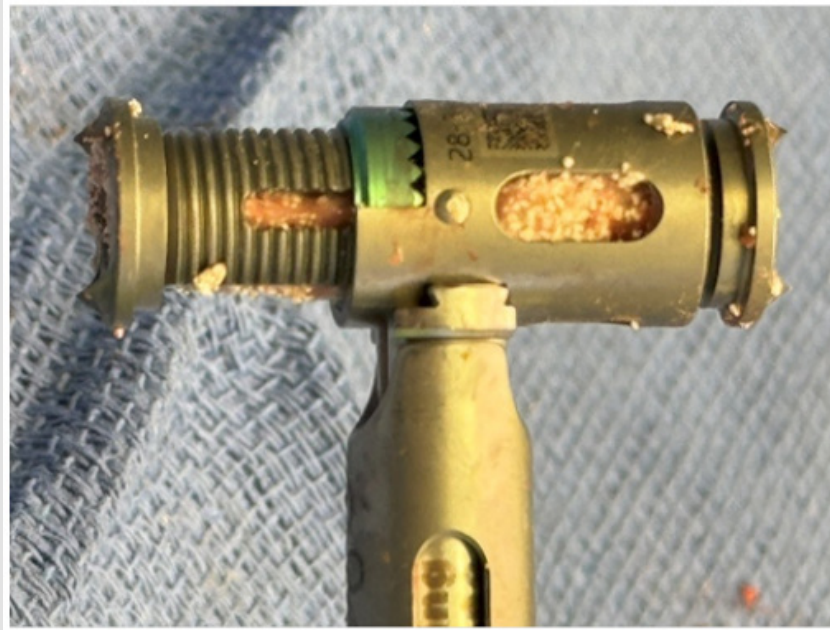


Figure 2: Expandable corpectomy cage with synthetic bone graft demonstrating filling of the entire cage during expansion.

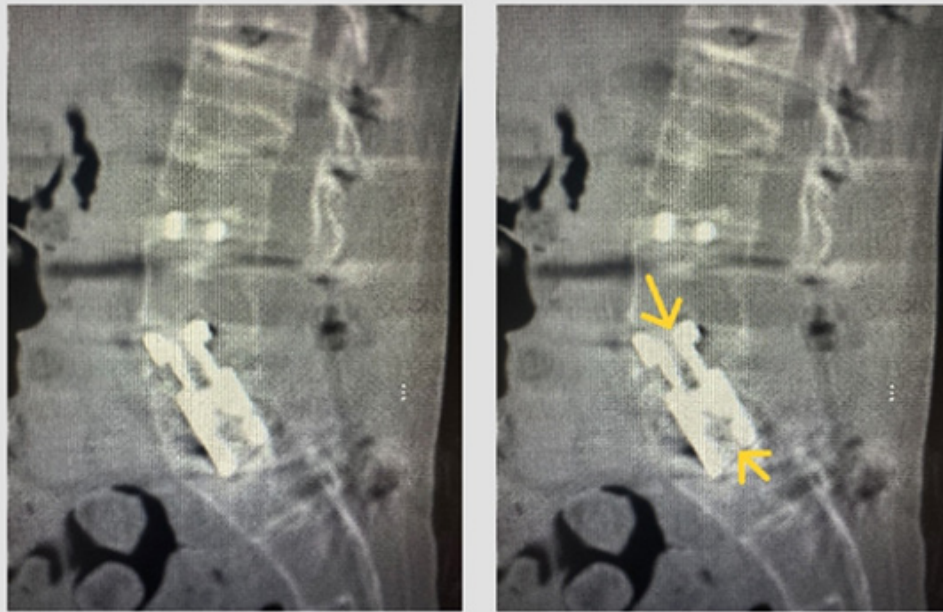


Figure 3a and Figure 3b: 8-month CT Imaging of Corpectomy cage with synthetic bone graft from L2-S1 and arrows indicating bony fusion through the cage 4b.

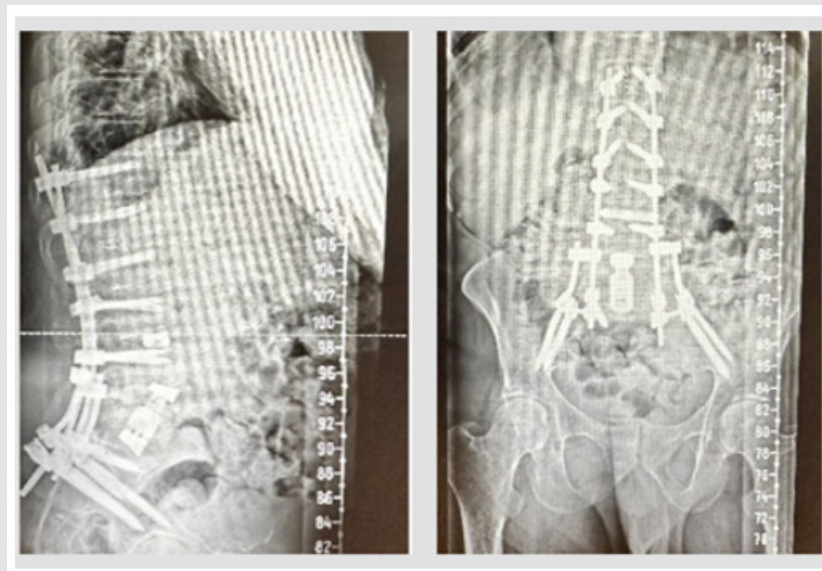


Figure 4a and 4b: Postoperative standing lateral and anteroposterior x-rays.

Case 1 Summary

Patient: 36-year-old male, BMI 18, history of intravenous drug abuse.

Presentation: Severe spinal deformity, inability to stand upright, bilateral lower extremity weakness, and unrelenting pain. CT revealed extensive destruction of L3–L5 vertebral bodies with rigid kyphosis (~60°).

Procedure: Posterior approach L2–S1 reconstruction, including three-level lumbar corpectomy and fixation from T10 to pelvis. Intraoperative cultures were positive for MRSA. A titanium corpectomy cage was filled entirely with Osteoflo® Hydrofiber, reconstituted with saline.

Outcome: Postoperative imaging confirmed deformity correction. At 8 months, CT demonstrated solid fusion through the corpectomy cage despite severe infection.

Case 2 Summary

Patient: 64-year-old male, diabetic, with prior L4–S1 fusion.

Presentation: Rapid progression of back pain, kyphotic gait, anterior thigh pain, and bilateral quadriceps weakness. Preoperative CT showed L3–L4 disc destruction and endplate irregularities not seen 6 months earlier. Intraoperative cultures grew *Pseudomonas aeruginosa*.

Procedure: L3 corpectomy with long-segment fixation from

T10–pelvis. A titanium expandable cage was filled exclusively with Osteoflo® Hydrofiber.

Outcome: At 6 months, CT confirmed robust fusion across the cage with restored sagittal alignment.

Case Descriptions

The patient is a 64-year-old male with a history of diabetes mellitus and previous L4–S1 spinal fusion surgery. He presents with intractable back with inability to stand and ambulate independently. The patient has severe bilateral anterior thigh pain and anterior leg pain radiating to the feet. He is ambulating with a kyphotic gait and exhibits weakness with quadriceps extension bilaterally measuring 4/5 on manual muscle testing. The L3–4 disc space degeneration was not seen on radiographs from 6 months prior (Figure 5). Preoperative CT (Figures 6a & 6b) immediately preceding surgery exhibits bony destruction at L3–4 with endplate irregularities and listhesis, which is a dramatic change compared to his radiographs. The patient was indicated for an L3 corpectomy with T10–pelvis fusion for decompression and stabilization. L3 corpectomy with long-segment fixation from T10–pelvis was performed and a titanium expandable cage at L3 was placed and was filled exclusively with (Osteoflo® Hydrofiber). Intraoperative cultures to rule out infection as a cause of his bony destruction were obtained. The intraoperative cultures eventually grew *Pseudomonas aeruginosa*. Postoperative x-rays (Figures 7a & 7b) showed appropriate spinal alignment and CT at 6 months after surgery had fusion through the corpectomy cage (Figures 8a & 8b).



Figure 5: Preop x-ray of lumbar Spine without evidence of disc space destruction.

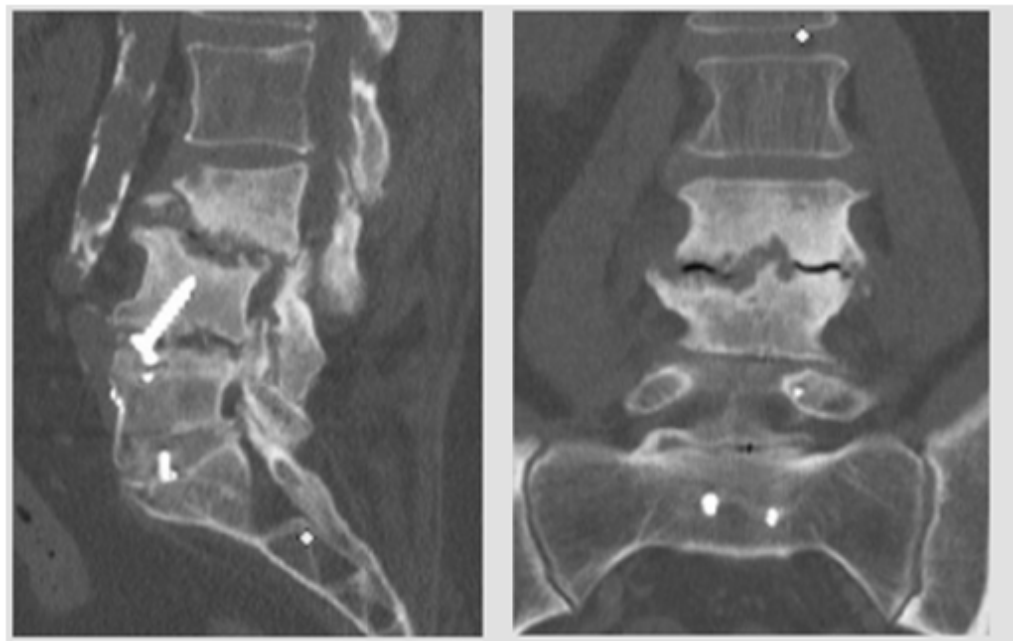


Figure 6a and 6b: Preop sagittal and coronal CT with advanced destruction of disc space.



Figure 7a and 7b: Postoperative AP and lateral Scoliosis x-rays.

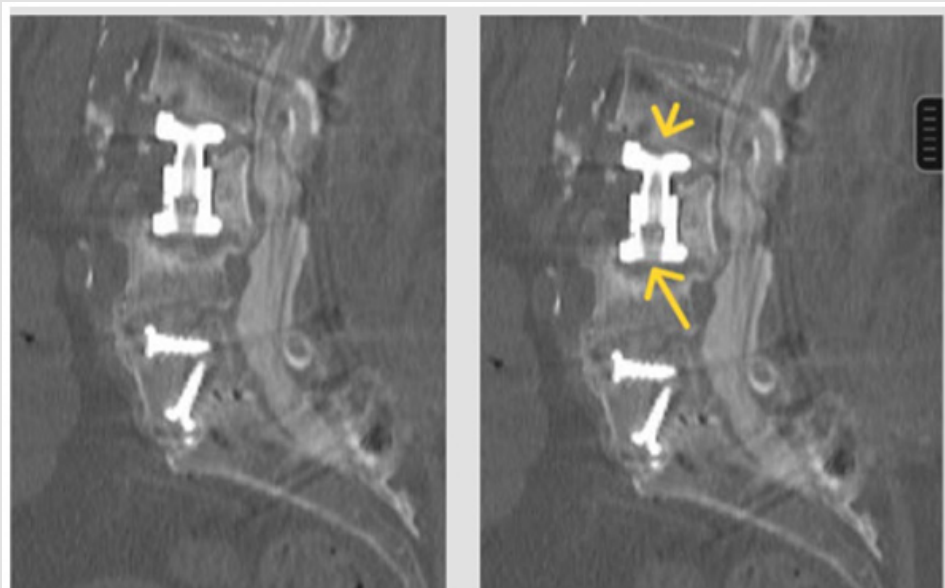


Figure 8a and Figure 8b: Postoperative CT Sagittal Imaging with bony growth through the corpectomy cage (yellow arrows).

Discussion

Osteomyelitis is a challenging clinical scenario, and surgical treatment is associated with significant risks to the patient. Obtaining fusion can be very challenging because of the local biological environment, patient comorbidities, and long construct fusions that may be required. Synthetic grafts such as the product utilized in these two examples reflect a step towards the goal of achieving solid fusion without bone harvesting. Using synthetic bone grafts also reduces operative time, morbidity, and blood loss compared to iliac crest or vascularized strut grafts. The early bony ingrowth is promising and should be further evaluated in larger studies of osteomyelitis patients. Achieving solid fusion in the context of osteomyelitis is one of the greatest challenges in spinal surgery [1,2,7]. The combination of poor bone quality, systemic comorbidities, and high bacterial load creates an environment where traditional grafts often fail [3]. In both cases presented here, Osteoflo® Hydrofiber achieved early and complete fusion despite the presence of virulent organisms (MRSA, *Pseudomonas*) and significant patient risk factors. These outcomes underscore several advantages:

- Avoidance of donor morbidity: No iliac crest harvest or vascularized struts required.
- Reduced operative complexity: Eliminated need for additional grafting procedures.
- Promising biological response: Early radiographic fusion suggests a strong osteogenic effect [4-6].

Compared to published failure rates of 20 to 40% in infected spinal fusions using traditional grafts [1,2,7], the early results with Hydrofiber are striking. While limited to two cases, the magnitude of improvement warrants larger multicenter studies.

Mechanistic Insights

The success of Osteoflo® Hydrofiber in these hostile biological settings may be attributed to its hydrophilic and osteostimulatory properties [4-6]:

1. Hydrophilicity rapidly absorbs blood and marrow, creating a microenvironment rich in progenitor cells and growth factors.
2. Porosity and ionic surface chemistry promote vascular infiltration and osteoblast differentiation, accelerating both osteoconduction (scaffold effect) and osteostimulation (cell activation).
3. In infected bone, where autograft and allograft often fail, the graft's fluid-wicking capacity may enhance local antibiotic penetration, improving infection control while bone healing progresses [7].

This dual benefit, supporting fusion and potentially assisting infection control, makes hydrophilic synthetic bone grafts uniquely suited for osteomyelitis reconstruction. Extensive preclinical and clinical research demonstrates that calcium phosphate grafts with hydrophilic properties and submicron-to-nanoscale surface topographies stimulate osteogenesis by enhancing protein adsorption, mesenchymal stromal cell adhesion, and osteoblast differentiation [8-11]. Silicate-containing, nano-structured CaP grafts further accelerate bone formation through synergistic effects of ionic chemistry and surface nanotopography [12,13]. The HydroFiber graft leverages these same biologic principles through its highly hydrophilic fiber-based architecture and large interconnected surface area, which are designed to promote capillary wicking, early cell ingress, and vascularization throughout the corpectomy cage. The rapid, robust fusion observed in both of our osteomyelitis cases is consistent with this well-described osteo-stimulatory mechanism. These two cases demonstrate that a hydrophilic synthetic bone graft, when engineered with appropriate mechanical and structural properties, can serve effectively as a stand-alone filler in titanium corpectomy cages, achieving rapid and robust fusion even in the challenging setting of severe lumbar osteomyelitis. By reducing surgical morbidity, eliminating donor site complications, and supporting fusion in biologically hostile environments, Osteoflo® Hydrofiber shows the potential to revolutionize and redefine anterior column reconstruction in spinal infection. Future research should focus on prospective trials comparing synthetic hydrophilic grafts with traditional grafting strategies in infected and high-risk spinal populations.

Conflicts of Interest

The author reports receiving royalties from Surgentec and Spine-Wave. The author also holds stock options in TrackX. No other financial or non-financial conflicts of interest are declared.

References

1. Rutges JP, Kempen DH, van Dijk M (2016) Outcome of surgical treatment of spondylodiscitis: A multicenter retrospective cohort study. *Spine J* 16(4): 504-510.
2. Berbari EF, Kanj SS, Kowalski TJ, Rabih O, Darouiche, Andreas F, Widmer, et al. (2015) 2015 Infectious Diseases Society of America clinical practice guidelines for the diagnosis and treatment of native vertebral osteomyelitis in adults. *Clin Infect Dis* 61(6): e26-e46.
3. Panchbhavi VK (2010) Synthetic bone grafting in foot and ankle surgery. *Foot Ankle Clin* 15(4): 559-576.
4. Conway JC, Oliver RA, Wang T, Daniel J, Wills, Joe Herbert, et al. (2021) The efficacy of a nanosynthetic bone graft substitute as a bone graft extender in rabbit posterolateral arthrodesis. *Spine J* 21(11): 1925-1937.
5. A Lazary, PP Varga, L Kiss, Z Szoverfi, S Czop, et al. (2024) First-In-Human Study with a Novel Synthetic Bone Graft, OssDsign Catalyst™, in Transforaminal Lumbar Interbody Fusion with Instrumented Posterolateral Fusion. *Biomed J Sci Tech Res* 54(4): 46078- 46085.

6. Bernhard JC, Presen DM, Li M, Monforte X, Ferguson J, et al. (2022) Effects of endochondral and intramembranous ossification pathways on bone tissue formation and vascularization in human tissue-engineered grafts. *Cells* 11(19): 3070.
7. Tschöke SK, Rauschmann MA (2018) Infections in spinal surgery: surgical management and outcome. *Eur Spine J* 27(2): 265-272.
8. Denry I, Kuhn LT (2016) Design and characterization of calcium phosphate dental bioceramics. *Dent Mater* 32(1): 43-53.
9. Chai YC, Carlier A, Bolander J, S J Roberts, L Geris, et al. (2012) Current views on calcium phosphate osteogenicity and the role of surface structure. *Acta Biomater* 8(11): 3876-3887.
10. Müller P, Bulnheim U, Diener A, et al. (2008) Calcium phosphate surfaces promote osteogenic differentiation of MSCs in the absence of osteogenic supplements. *Tissue Eng* 14(11): 2059-2067.
11. van Dijk LA (2023) Osteoinductive calcium phosphate with submicron surface topography: preclinical and clinical evaluation in maxillary sinus augmentation. *Clin Oral Invest* 27(5): 2463-2478.
12. Conway JC, Oliver RA, Wang T, Wills DJ, Herbert J, et al. (2021) The efficacy of a nanosynthetic silicate CaP bone graft substitute as a graft extender in rabbit posterolateral arthrodesis. *Spine J* 21(11): 1925-1937.
13. Gibson IR, Lopes VR, Oliver R, Wang T, Wills D, et al. (2025) Early new bone formation in ovine intramuscular defects: comparison between silicate-containing calcium phosphate grafts. *J Orthop Surg Res* 20(1): 369.

ISSN: 2574-1241

DOI: 10.26717/BJSTR.2025.63.009911

Justin A Iorio. Biomed J Sci & Tech Res



This work is licensed under Creative Commons Attribution 4.0 License

Submission Link: <https://biomedres.us/submit-manuscript.php>



Assets of Publishing with us

- Global archiving of articles
- Immediate, unrestricted online access
- Rigorous Peer Review Process
- Authors Retain Copyrights
- Unique DOI for all articles

<https://biomedres.us/>