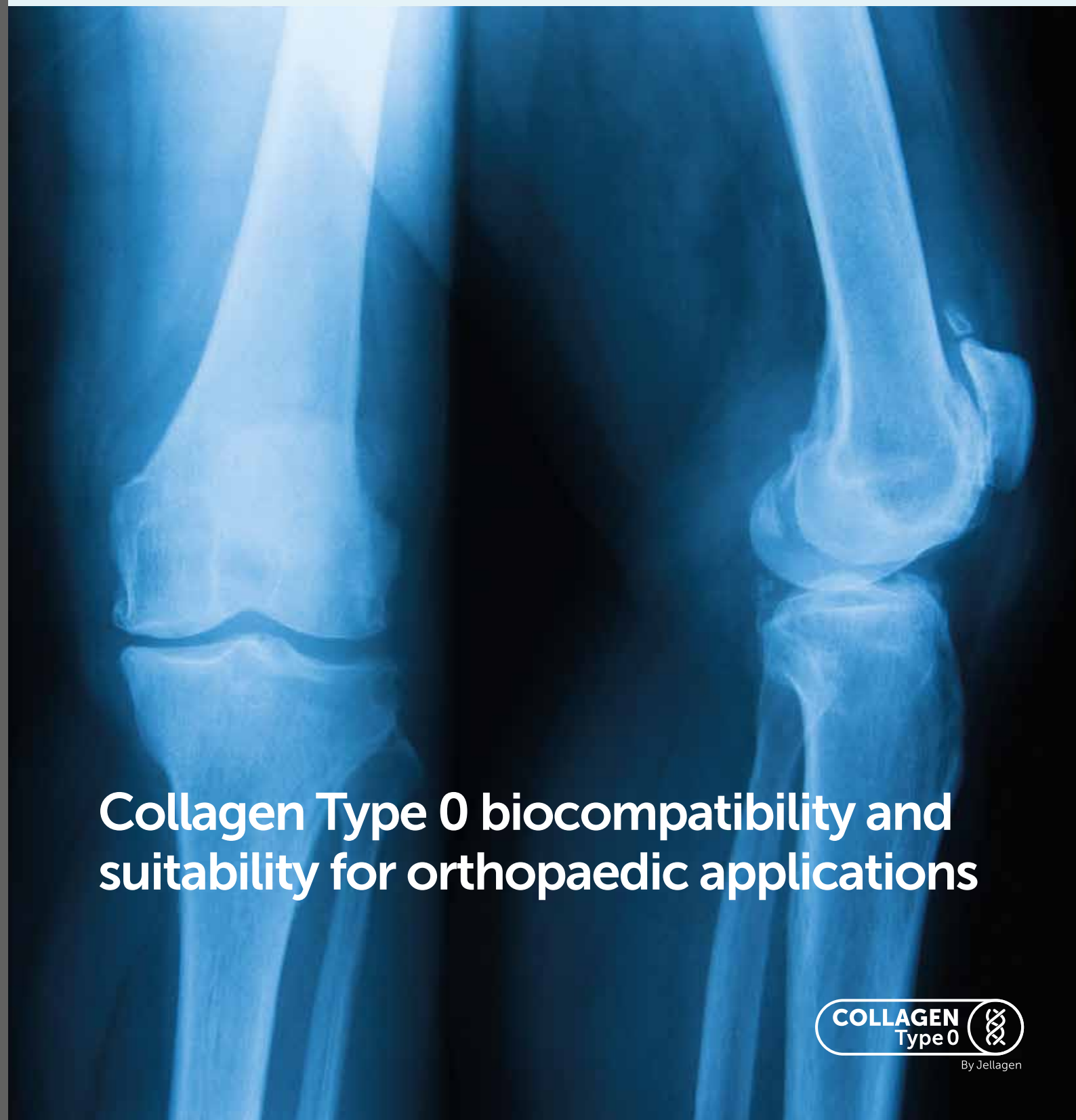
Jellagen

NEXT GENERATION COLLAGEN

CASE STUDY



# Collagen Type 0 biocompatibility and suitability for orthopaedic applications

COLLAGEN Type 0

By Jellagen

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# Collagen Type 0 biocompatibility and suitability for orthopaedic applications

## THE PROBLEM:

Collagen is a naturally occurring protein in the human body and is widely used in orthopaedics for its unique properties. From tissue engineering to wound healing, collagen has been shown to be an effective material for promoting cell growth and regeneration of bones, tendons, and ligaments. Its biocompatibility and biodegradability make it a promising biomaterial.

Collagen plays a crucial role in bone regeneration by providing a scaffold for new bone tissue to grow on. It acts as a supportive structure for osteoblasts, which are responsible for generating new bone. The presence of collagen fibres in the bone matrix also helps to provide strength and stability to the new tissue. Additionally, collagen has been shown to promote angiogenesis, providing the necessary nutrients and oxygen for bone tissue to regenerate.

Traditional mammalian sources of collagen have been called into question due to their pathological risk of transmitted diseases, creating regulatory concerns. Purification to reduce the risk of transmitted diseases runs a high risk of structurally altering the collagen. Furthermore, it has been reported that this purification induces pro-inflammatory tissue responses.

## THE SOLUTION:

Jellagen's collagen is derived from the jellyfish species *Rhizostoma pulmo*. This unique protein predates its mammalian counterparts and, as such, has been designated as 'Collagen Type 0'. Although mammalian collagens are highly specialized, Collagen Type 0 is chemically simple and universal, allowing greater functionality and structural versatility in various applications.

## THE SCIENCE:

**Study 1.** *In vitro* investigation of jellyfish collagen as a tool in cell culture and (bone) tissue engineering

*In vitro* cytocompatibility assays conducted in accordance with ISO 10993-5/-12, comparatively testing Collagen Type 0 as a coating material for multi-well plates seeded with MC3T3 pre-osteoblasts.

Cell viability of MC3T3 pre-osteoblasts showed a highly significant increase in both the Collagen Type 0 coated plates and scaffolds compared to the control (Fig. 1A). MC3T3 pre-osteoblasts displayed reduced cytotoxicity values but non-significant in the 3D scaffold group compared to medium control and titanium scaffold (Fig. 1B). MC3T3 proliferation rates decreased in both Collagen Type 0 groups (Fig. 1C). Comparing all Collagen Type 0 data with the titanium implant group, there was no significant differences (Fig.1). Titanium implants are well regarded to be particularly biocompatible options.

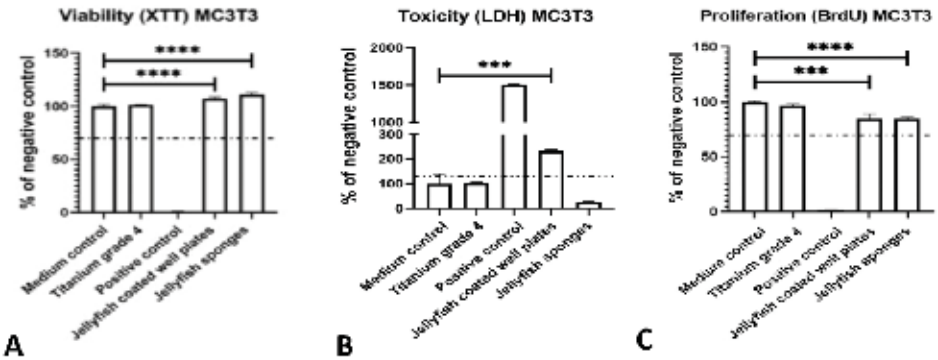


**Fig. 1** A B C

CASE STUDY

## **Study 2.** Suitability of R. *Pulmo* jellyfish-collagen coated well plates for cytocompatibility analyses of biomaterials.

*In vitro* cytocompatibility assays conducted in accordance with ISO 10993-5/-12, comparatively testing Collagen Type 0 to bovine and porcine collagen as a coating material for multi-well plates seeded with MC3T3 pre-osteoblasts.

Cell viability analysis revealed Collagen Type 0 and bovine collagen induced a significantly higher viability compared to the control group. Collagen type 0 viability was significantly higher than porcine group (Fig. 2).

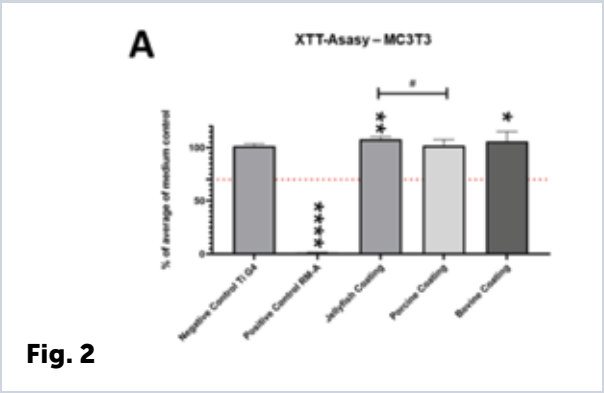


**Fig. 2**

## **Study 3.** *In vivo* analysis of the biocompatibility and immune response of jellyfish collagen scaffolds and its suitability for bone regeneration.

The anti-inflammatory properties of Collagen Type 0 were examined in the healing of cranial (calvarial) wounds in Wister rats. Collagen Type 0 was implanted into rats with calvarial defects, and a control group was also studied in which no collagen was implanted.

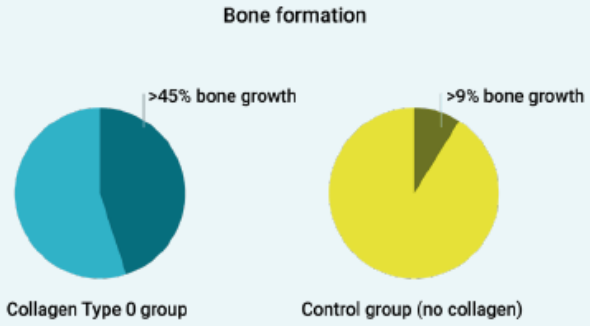


**Fig. 3**

A >45% de novo bone growth was observed in the Collagen Type 0 group with a significantly lower percentage (9%) observed within the no collagen group (Fig. 3).

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## CONCLUSIONS

Collagen Type 0 has excellent cytocompatibility compared to porcine or bovine collagen as a culture medium for MC3T3 pre-osteoblasts. The data indicates Collagen Type 0 can be used in bone regeneration and especially as scaffolds in bone tissue engineering. Overall, Collagen Type 0 provides biocompatibility and adhesive properties for both cell culture and bone tissue engineering applications.

## FUTURE OPPORTUNITIES

- *Tissue engineering:* Collagen Type 0 can be used as a scaffold material helping to repair or replace damaged tissues such as ligaments, tendons, and cartilage.
- *Regenerative medicine:* Collagen Type 0 can be used as cell and therapeutic agent carriers helping to promote cell growth and tissue repair.
- *Wound healing;* Collagen Type 0 has been shown to be effective in promoting wound healing.
- *Joint Reconstruction:* Collagen Type 0 can be used as a replacement for natural tissue in joint reconstruction, helping to improve joint function and reduce pain.
- *Implants and scaffolds:* Collagen Type 0 provides support and stability to the surrounding tissues.

References:

ALKILDANI, S., JUNG, O. and BARBECK, M. (2021). In Vitro Investigation of Jellyfish Collagen as a Tool in Cell Culture and (Bone) Tissue Engineering. Anticancer Research, 41(2). pp.707–717.

Ren, Y., Liu, L., Xiong, X., Krastev, R., Smeets, R., Rimashevskiy, D., Schnettler, R., Alkildani, S., Emmert, S., Jung, O. and Barbeck, M. (2023). Suitability of R. pulmo Jellyfish-Collagen-Coated Well Plates for Cytocompatibility Analyses of Biomaterials. International Journal of Molecular Sciences, [online] 24(3), p.3007.

Flaig, I., Radenković, M., Najman, S., Pröhl, A., Jung, O. and Barbeck, M. (2020). In Vivo Analysis of the Biocompatibility and Immune Response of Jellyfish Collagen Scaffolds and its Suitability for Bone Regeneration. International Journal of Molecular Sciences, [online] 21(4518), p.4518.

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