PUROS®

DBM Particulate and the DBM component of Puros Ci have osteoinductive (OI) potential post Cancelle SP® DBM Sterilization Process

ZimVie

Puros DBM Particulate and the DBM component of Puros Ci have osteoinductive (OI) potential post Cancelle SP DBM Sterilization Process

Puros DBM Particulate allograft consists of 100% demineralized cortical bone processed via the proprietary Cancelle SP Process. Puros Ci, on the other hand, is an ideal blend of mineralized and demineralized allograft bone. It consists of 31.5% mineralized cortical chips, 13.5% mineralized cancellous chips, and 55% demineralized bone matrix (DBM) by weight. The demineralized component of Puros Ci is also processed via the Cancelle SP Process.

This paper describes the in-vitro and in-vivo tests conducted to measure the BMP-2 levels in the DBM component of Puros Ci and Puros DBM Particulate.

The demineralized bone matrix (DBM) processed by RTI Surgical is sterilized through the Cancelle SP Process. The Cancelle SP Process is a proprietary process designed to preserve protein activity allowing the DBM to maintain OI potential. Through a combination of oxidative treatments and acid or alcohol washes, debris is removed, and pathogens are inactivated and/or removed. Cleansing rinses remove residual chemicals, thereby maintaining biocompatibility. Low temperature and low dose gamma irradiation preserves the utility of the graft over the shelf life.

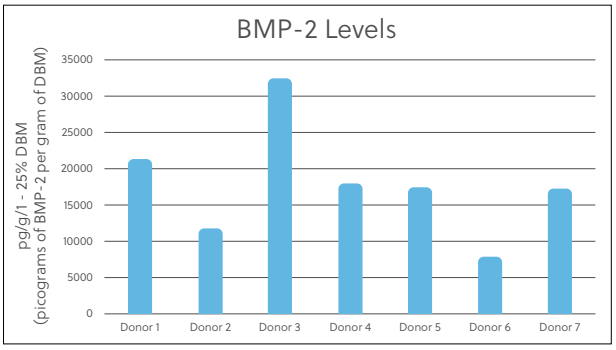

Fig. 1 *BMP-2 measured via ELISA, samples were measured in triplicate.*

In-vitro evaluation of BMP-2 levels in Cancelle SP processed DBM:

BMP-2 is known to have osteogenic properties and participate in osteoblast differentiation. It is required for the initiation of bone healing (Urist 1965, Tsuji 2006; performance data from an in vivo or in vitro model is not representative of human clinical results). Seven (7) donor lots of DBM were evaluated for BMP-2 activity post Cancelle SP processing. DBM proteins were extracted utilizing a Tris/collagenase buffer to dissociate the tissue and break down the native collagen as described in Blum et al. (2004). Each extract solution was assayed on a commercially available solid phase Enzyme Linked Immunosorbent Assay (ELISA) designed to measure human BMP-2 in bone tissue extracts. Results are presented in picograms of BMP-2 per gram of demineralized bone matrix as visually shown in Figure 1.

Table 1 – Osteoinductivity potential of implant

Score	Estimated Percent of Implant Cross Sectional Area
0	Less than 1% evidence of new bone formation
1	1% - 25% of field shows evidence of new bone formation
2	26% - 50% of field shows evidence of new bone formation
3	51% - 75% of field shows evidence of new bone formation
4	76% - 100% of field shows evidence of new bone formation

Table 2 – Inflammation criteria of the implant

Score	Criteria
1	No MNGCs, minimal fibrous connective tissue concentrated at the periphery. Residual allograft is intact or remodeling
2	Occasional MNGCs, moderate fibrosis at the periphery and between particles. Residual allograft is intact or remodeling
3	Frequent MNGCs and dense cellular infiltration, dense fibrous connective tissue throughout. Residual allograft is being resorbed and/or is absent
MNGCs= Multinucleated Giant Cells	

In-vitro evaluation of BMP-2 levels in Cancelle SP processed DBM:

In a different evaluation which was conducted in-vivo, the DBM was implanted into an athymic nude rat model. Each sample was implanted in triplicate in three separate rats with six samples per rat.

The implants were extracted after 28 days and the samples were sent for histological preparation. The histological slides were scored for osteoinductivity and inflammatory responses in accordance with the scoring system of Edwards et al. (1998; performance data from an in vivo or in vitro model is not representative of human clinical results) and shown in Table 1 and 2.

Table 3 – Mean ± standard deviation of OI and inflammation scores

Lot	Tissue	OI±SD	Inflammation ±SD
Donor 1	DMB only	2.0±0.00	1.3±0.58
Donor 2	DMB only	2.3±0.58	1.3±0.58
Donor 3	DMB only	3.3±0.58	1.3±0.58

CONCLUSION

The in-vivo and in-vitro data presented above clearly indicate that DBM in Puros DBM Particulate and Puros Ci maintains its osteoinductive properties post Cancelle SP Processing and has the potential to form vital bone.

REFERENCES

1. Urist MR. Bone: formation by autoinduction. Science 1965; 150 (698): 89
2. Blum B, Mosely J, Miller L, Richelsoph K, Haggard W. Measurement of bone morphogenetic proteins and other growth factors in demineralized bone matrix. Orthopedics 2004 (27): 161
3. Edwards JT, Diegmann MH, Scarborough NL. Osteoinduction of human demineralized bone: characterization in a rat model. Clin Orthop Relat Res 1998 (357): 219
4. Tsuji Kunikazu. BMP2 activity, although dispensable for bone formation, is required for the initiation of fracture healing. Nature Genetics 2006 (1424-1429): 38

For more information, visit ZimVie.com

ZimVie
4555 Riverside Drive
Palm Beach Gardens, FL 33410
1-800-342-5454
Phone: +1-561-776-6700
Fax: +1-561-776-1272

ZimVie
Restoring Daily Life.®