

# Demineralized Bone Matrix in Extraction Sockets: A Clinical and Histologic Case Series

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## 1 Background

Demineralized bone matrix (DBM) products in gel or putty form have been used alone or in composite grafts to immediately augment extraction sockets, but questions about material efficacy and predictability remain unanswered. A variety of qualitative features such as particle size, matrix integrity and the composition of the carrier are known to influence their osteoinductive potential<sup>1-3</sup>. This case series was undertaken to evaluate the efficacy and predictability of a novel 100% human-derived DBM putty in fresh extraction sockets.

## 2 Methods

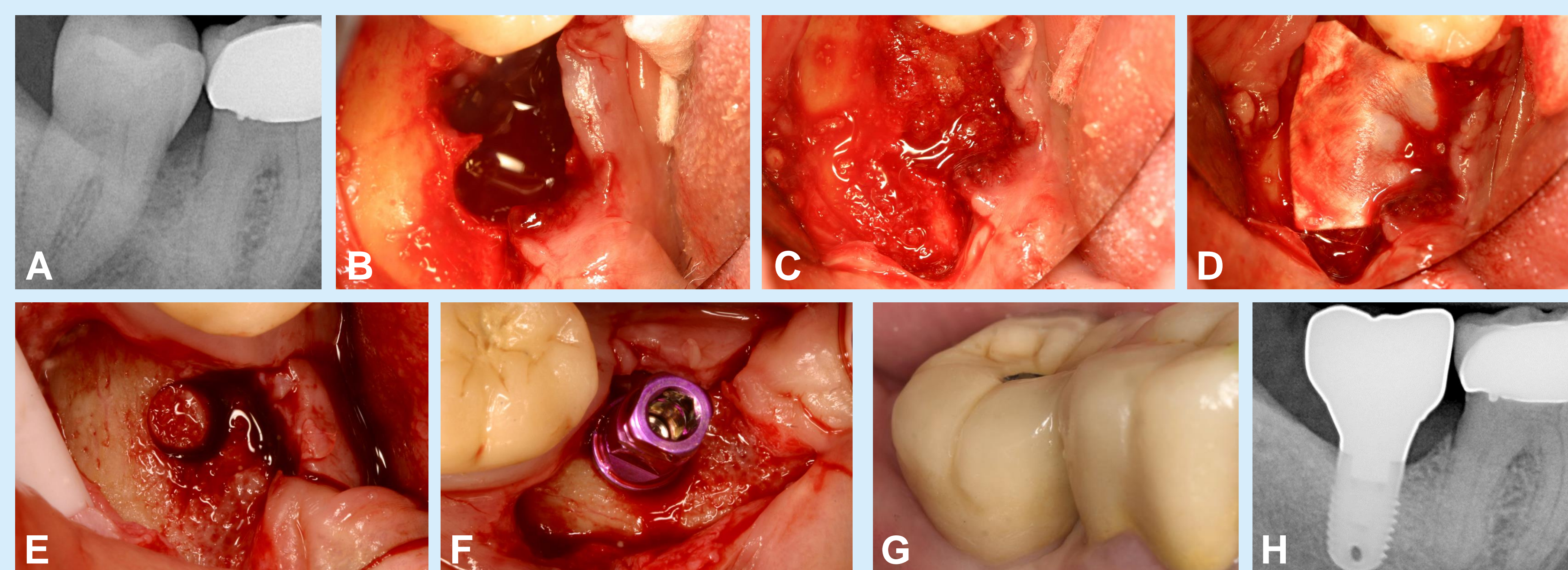
DBM putty with and without mineralized cortical and cancellous bone chips (Puros DBM Putty, Zimmer Dental Inc., Carlsbad, CA) was used to augment the sockets. The 100% biologic carrier was manufactured from the long bones of the same tissue donor that provided the DBM and bone chips in every lot; the only excipient material was sterile water. As shown in Figure 1, a single failing tooth was atraumatically extracted from each of 12 subjects and sockets were debrided. Intact sockets were grafted with DBM putty (Group 1, n=6), and sites with buccal defects were grafted with DBM putty with bone chips (Group 2, n=6). Grafted sites were covered with a bovine pericardium membrane (CopiOs Pericardium Membrane, Zimmer Dental Inc.), and tension-free primary closure was obtained. After 6 months of healing, a trephine biopsy was taken from the center of each graft for histology and histomorphometry evaluations. The osteotomy was then enlarged and a dental implant (Tapered Screw-Vent implant, Zimmer Dental Inc.) was placed.

## 3 Results

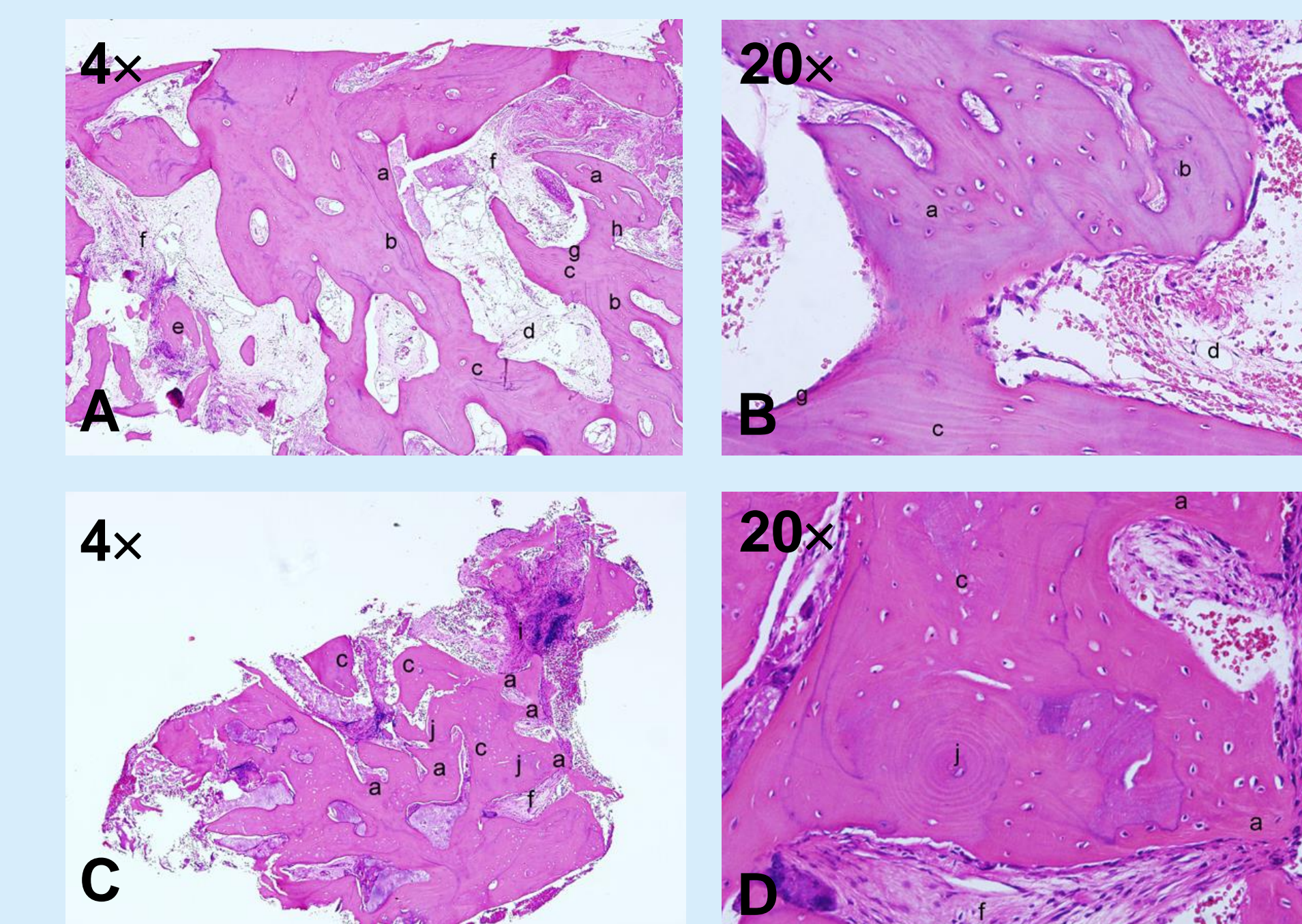
Clinical and histologic results are summarized in Table 1 and Figure 2. Two subjects were withdrawn from the study (1 lost to follow-up and 1 had infection that prevented primary closure), and histologic data could not be obtained from 2 other subjects (1 ridge was too narrow for biopsy and 1 poor quality bone core could not be analyzed). One subject provided 2 biopsy samples (1 per tooth root location) from a large grafted molar site. Both Group 1 (n=5) and Group 2 (n=4) sites achieved adequate bone fill for implant placement in 6 months. New bone mineralized from the socket rim and moved inward at approximately 1mm per month. The centers of the large graft sites were still remodeling, as evidenced by mean new bone fill of 40.28%, with 7.92% residual graft material, 46.81% marrow and 4.99% fibrous tissue, for DBM putty (n=5) and 44.60%, with 8.04% residual graft material, 39.38% marrow and 7.98% fibrous tissue, for DBM putty with bone chips (n=4). DBM putty with bone chips also achieved 4.32% greater mean bone fill than DBM putty without bone chips, but sample sizes were inadequate to determine if this difference was statistically significant.

Table 1. Patient Demographics, Treatment Data and Histology Findings								
Clinical Data				Histologic Data				
Age (Years)	Gender	Group #	Tooth Location	New Bone (%)	Residual Graft (%)	Fibrous Tissue (%)	Marrow (%)	Total (%)
60	F	1	Mandibular right 2 <sup>nd</sup> molar	52.08	2.11	6.46	39.35	100
67	M	1	Maxillary left 2 <sup>nd</sup> premolar	42.16	8.88	5.55	43.41	100
38	F	1	Mandibular left 2 <sup>nd</sup> molar	—†	—†	—†	—†	—†
70	F	1	Mandibular right 2 <sup>nd</sup> molar	19.49	12.54	6.03	61.94	100
83	M	1	Mandibular right 1 <sup>st</sup> molar	26.07	14.41	4.53	54.99	100
61	F	1	Mandibular right 1 <sup>st</sup> molar	61.62	1.66	2.38	34.34	100
<b>Group 1 (Mean)</b>				<b>40.28</b>	<b>7.92</b>	<b>4.99</b>	<b>46.81</b>	<b>100</b>
68	F	2	Mandibular right central incisor	—*	—*	—*	—*	—*
57	M	2	Mandibular right 2 <sup>nd</sup> molar	44.44‡	13.25‡	6.42‡	35.89‡	100‡
				50.95°	3.99°	15.60°	29.47°	100°
50	M	2	Maxillary right 1 <sup>st</sup> molar	47.03	3.17	1.74	48.06	100
46	M	2	Mandibular left 1 <sup>st</sup> molar	—°	—°	—°	—°	—°
40	F	2	Maxillary left 2 <sup>nd</sup> premolar	— <sup>o</sup>	— <sup>o</sup>	— <sup>o</sup>	— <sup>o</sup>	— <sup>o</sup>
71	M	2	Mandibular right 2 <sup>nd</sup> molar	36.00	11.75	8.15	44.09	100
<b>Group 2 (Mean)</b>				<b>44.60</b>	<b>8.04</b>	<b>7.98</b>	<b>39.38</b>	<b>100</b>

†Subject moved and was lost to follow-up; \*Narrow ridge; no biopsy taken but implant was successfully placed; ‡Mesial root biopsy was taken in a molar site with 2 augmented root areas; °Distal root biopsy was taken in a molar site with 2 augmented root areas; °Subject had a pre-existing infection and primary closure could not be achieved after grafting; no biopsy taken but implant was successfully placed; <sup>o</sup>Poor histology sample could not be accurately analyzed



**Figure 1.** Surgical protocol: A) Failing mandibular right second molar. B) Double-rooted extraction socket after tooth sectioning and sequential root removal. C) DBM putty injected into the socket. D) Bovine pericardium membrane draped over the graft site. E) Biopsy at 6 months. F) Dental implant placement. G) Final restoration, clinical view. H) Final restoration, radiographic view.



**Figure 2.** Representative histology images (hematoxylin & eosin stain) of biopsies collected at reentry from Group 1: DBM putty without bone chips (A and B) and Group 2: DBM putty with bone chips (C and D).

a - new bone, b - residual graft material, c - existing bone matrix, d - mild marrow fibrosis, e - biopsy debris, f - moderate marrow fibrosis, g - osteoblasts, h - osteoclasts, j - residual bone chip

## 4 Significance

The 100% human-derived DBM putty with or without bone chips preserved or restored ridge dimensions with newly mineralized bone that permitted implant placement at 6 months. The preliminary findings of this case series suggest that more research is warranted to adequately document this material.

## 5 Acknowledgement

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## 6 References

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