

## Osseous Autografts

### III. Comparison of Osseous Coagulum-Bone Blend Implants with Open Curettage.

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IN A PREVIOUS publication we reviewed studies dealing with the effects of autogenous grafts of iliac marrow and cancellous bone or osseous coagulum-bone blend on the restoration of lost periodontium.<sup>1</sup> We noted that similar levels of osseous regeneration apparently took place regardless of graft material used. Since that time additional information has been published concerning the repair response of infrabony defects following grafting procedures.<sup>2-4</sup> Clinically and histologically it has been demonstrated that, in certain cases, osseous regeneration of an infrabony defect takes place without the implantation of any material.<sup>5-8</sup> However, comparison studies of fill efficacy following the use of various therapeutic techniques are still limited.<sup>9</sup>

The purpose of the current investigation was to clinically evaluate and compare "repair responses" of human periodontal defects following open debridement with and without the subsequent implantation of an osseous coagulum-bone blend graft.

#### MATERIALS AND METHODS

A total of 75 sites were treated in 28 male patients, 23 to 64 years of age. Every patient consented to take part in this study. Thirty-seven sites in 23 patients were treated with osseous coagulum-bone blend implants from intraoral sources, while 38 sites in 13 patients were treated by open debridement procedures. In seven of our patients both procedures were performed at different sites with similar morphology, (i.e. one-wall, two-wall or three-wall wide defects of similar configuration). Specifically, 26 such sites were treated in these seven patients. In thirteen of these areas osseous coagulum-bone blend grafts were used, while the remaining thirteen areas were treated by open debridement.

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All individuals selected for this study were patients at the dental clinic of the Veterans Administration Hospital in New York City. In addition to periodontitis these patients suffered from a variety of systemic diseases and, where necessary, medical clearance was obtained. Pre-surgical treatment was similar in all cases, consisting of oral hygiene instruction, adjustment for occlusal interferences, root planing and curettage under local anesthesia. Temporary splinting was employed where mobility exceeded Class II.

Following initial therapy, clinical and radiographic evaluations were used to determine whether surgery was necessary to eliminate the defect. An oral hygiene index was utilized during initial treatment, and only when the index approached zero was surgery considered.

Loss of periodontal attachment apparatus was measured immediately before and during periodontal surgery. In addition, radiographs and clinical photographs were also taken of the operative sites. All measurements were made using a specially-prepared grooved omnivac stent, fabricated on study models as the fixed reference point and recorded to the nearest 0.1 mm with a no. 50 endodontic silver point, a locking pliers, and a Boley gauge. Fabrication of the stent and details of the measurement procedures were previously described.<sup>1</sup> Similar measurements, photographs and radiographs were obtained at the time of reentry.

#### SURGICAL PROCEDURES

In all cases an inverse bevel full thickness, mucoperiosteal flap was reflected. Site preparation consisted of debridement of the osseous defect, root planing to remove root accretions, and irrigation with isotonic saline. For purposes of classification, intraosseous defects were classified according to their predominant configuration and only those having greater than 2.0 mm depth were included in this study. After this, in the cases selected for "open debridement" the flap was coapted and sutured to insure maximum soft tissue coverage.

After site preparation in the "graft" cases the defect was overfilled with osseous coagulum-bone blend obtained from intraoral sources.<sup>1</sup> Closure of the defect was performed in the same manner as in the open debridement cases.

Regardless of procedure, patients were placed on antibiotic coverage for 1 week beginning with the day of surgery.

Reentries were performed 7 to 13 weeks after the initial surgery in all but one case. (Reentry in this case of open debridement was performed 25 weeks after initial surgery).

Measurements, photographs and roentgenograms were obtained at the time of reentry.

Selection of choice of treatment was based on sequential selection and donor site availability, with the first area being treated using a graft and the next area treated by debridement alone.

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## RESULTS

*Response to Osseous Coagulum-Bone Blend* (Tables I and II)

Osseous coagulum-bone blend implants were performed in 37 infrabony lesions. Table I lists the range of osseous fill of all defects treated with osseous coagulum-bone blend implants. Fill in the one-wall lesions ranged from a loss of 0.3 mm to a gain of 5.3 mm. Fill in the two-wall lesions ranged from 0.9 mm to 6.2 mm. Fill in the three-wall wide lesions ranged from 2.0 mm to 6.4 mm.

Table II summarizes the repair trends of all defects treated with osseous coagulum-bone blend implants. Among the 37 lesions treated were 15 one-wall, 14 two-wall, and 8 three-wall wide defects. The average fill of all one-wall defects (initial average depth 3.86 mm, S.D. 1.60) was 2.42 mm, S.D. 1.40. The average fill of all two-wall defects (initial average depth 4.15 mm, S.D. 1.44) was 3.21 mm, S.D. 1.34. The average fill in all three-wall lesions (initial average depth 5.03 mm, S.D. 2.33) was 3.64 mm, S.D. 1.51.

The total average increase in bone height with osseous coagulum-bone blend graft material was 2.98 mm, S.D. 1.44 whereas the initial intraosseous depth averaged 4.22 mm, S.D. 1.73.

*Response to Open Debridement Procedures* (Tables III and IV)

Open debridement was the treatment in 38 infrabony lesions. Table III lists the range of osseous fill of all defects treated with open debridement procedures. Fill in the one-wall lesions ranged from a loss of 1.5 mm to a gain of 2.0 mm. Fill in the two-wall lesions ranged from a loss of 0.8 mm to a gain of 2.6 mm. Fill in the three-wall lesions ranged from 1.1 mm to 1.7 mm.

Table IV summarizes the repair trends of all defects treated with open debridement procedures. Among the 38 lesions treated, were 18 one-wall, 15 two-wall, 5 three-wall wide defects. The average fill in all one-wall lesions (initial average depth 3.10 mm, S.D. 0.76) was 0.16 mm, S.D. 0.84. The average fill in all two-wall

lesions (initial average depth 3.00 mm, S.D. 0.92) was 1.03 mm, S.D. 1.00. The average fill in all three-wall wide lesions (initial average depth 2.86 mm, S.D. 0.60) was 1.38 mm, S.D. 0.23.

The total average increase in bone height with open debridement surgical procedures was 0.66 mm, S.D. 0.80 whereas the initial intraosseous depth averaged 3.03 mm, S.D. 0.80.

*Comparison of Fill Following the Use of Osseous Coagulum-Bone Blend versus Open Debridement According to Type of Defect* (Table V)

A comparison of the above reported repair trends demonstrated the following:

Greater fill was obtained by the use of a graft than by debridement alone in one-wall lesions and the difference was statistically significant ( $t = 3.03$ ,  $P < 0.01$ ).

The difference in osseous fill in two-wall lesions obtained by the two methods was statistically significant in favor of the graft filled lesions ( $t = 4.77$ ,  $P < 0.01$ ).

The differences in osseous fill in three-wall wide lesions also proved statistically significant in favor of the graft filled lesions ( $t = 4.15$ ,  $P < 0.01$ ).

Combining all defects, greater osseous fill was obtained by the use of osseous coagulum-bone blend implants than open debridement procedures ( $t = 6.15$ ,  $P < 0.01$ ).

*Comparison of Fill in Similar Defects Following Use of Osseous Coagulum-Bone Blend versus Open Debridement in the Same Host* (Table VI)

Thirteen sites were selected in seven patients and received osseous coagulum-bone blend grafts. Among the 13 lesions were six one-wall and seven two-wall defects. Thirteen similarly classified sites (six one-wall and seven two-wall) were selected in these patients and treated by open debridement procedures. The total average fill in the defects treated by osseous coagulum-bone blend grafts (initial average depth 3.32 mm, S.D. 0.99) was 2.18 mm, S.D. 0.93. The total average fill in the defects treated by open debridement (initial average depth 2.55 mm, S.D. 1.53) was 0.75 mm, S.D. 0.91.

TABLE I. The Actual Fill Responses (mm) Recorded at the Time of Reentry of the 15 One-Wall, 14 Two-Wall and 8 Three-Wall Wide Lesions Treated with Osseous Coagulum-Bone Blend

1 Wall Lesions		2 Wall Lesions		3 Wall Wide Lesions
-0.3	2.5	0.9	3.4	2.0
1.2	2.5	1.4	3.7	2.3
1.5	3.3	2.0	3.8	2.4
1.6	3.4	2.3	4.0	3.0
1.6	3.6	2.8	4.0	4.0
1.7	4.4	2.8	4.3	4.1
2.0	5.3	3.3	6.2	4.9
2.0				6.4

TABLE II. Osseous Fill (mm) in Intraosseous Defects Treated with Osseous Coagulum-Bone Blend

Type of Lesion	No. of Defects	Initial Average Depth		Average Fill of Defect		% Fill
		Mean	S.D.	Mean	S.D.	
1 Wall	15	3.86mm.	1.60	2.42mm.	1.40	62.7%
2 Wall	14	4.15mm.	1.44	3.21mm.	1.34	77.3%
3 Wall	8	5.03mm.	2.33	3.64mm.	1.51	72.4%
TOTAL	37	4.22mm.	1.73	2.98mm.	1.44	70.6%

TABLE III. The Actual Fill Responses (mm) Recorded at the Time of Reentry of the 18 One-Wall, 15 Two-Wall and 5 Three-Wall Wide Lesions Treated with Open Debridement Procedures

1 Wall Lesions		2 Wall Lesions		3 Wall Wide Lesions	
-1.5	0.2	-0.8	1.2		1.1
-0.8	0.3	0.2	1.3		1.3
-0.6	0.3	0.2	1.9		1.3
-0.5	0.5	0.2	1.9		1.5
-0.5	0.6	0.3	2.1		1.7
-0.4	0.8	0.4	2.5		
0.0	0.9	0.4	2.6		
0.0	1.5	1.0			
0.1	2.0				

TABLE IV. Osseous Fill (mm) in Intraosseous Defects Treated with Open Debridement Procedures

Type of Lesion	No. of Defects	Initial Average Depth		Average Fill of Defect		% Fill
		Mean	S.D.	Mean	S.D.	
1 Wall	18	3.10	0.76	0.16	0.84	5.6%
2 Wall	15	3.00	0.92	1.03	1.00	34.3%
3 Wall	5	2.86	0.60	1.38	0.23	48.3%
TOTAL	38	3.03	0.80	0.66	0.80	21.8%

TABLE V. Comparison of Osseous Fill (mm) Following Osseous Coagulum-Bone Blend and Open Debridement Procedures

Type of Defect	Fill (mm) Bone Blend		Fill (mm) Open Debridement	
	Mean	S.D.	Mean	S.D.
1 Wall	2.42	1.40	0.16	0.84
2 Wall	3.21	1.34	1.03	1.00
3 Wall	3.64	1.51	1.38	0.23
TOTAL	2.98	1.44	0.66	0.80

The difference in osseous fill for defects treated by the two different procedures was statistically significant in favor of graft filled lesions ( $t = 3.95 P < 0.01$ ). This response takes on additional significance because the initial average depth of the defects treated by the two different procedures was not statistically different ( $t = 1.53$ ).

*Comparison of Crestal Resorption with Osseous Coagulum-Bone Blend and Open Debridement Procedures.* (Table VII)

In the 37 cases treated by osseous coagulum-bone blend grafts the average crestal resorption was 0.50 mm, S.D. 1.21. In the 38 cases treated by open debridement procedures the average crestal resorption was 0.82 mm, S.D. 0.67.

The difference in crestal resorption in defects treated by either osseous coagulum-bone blend implants or open debridement procedures was not statistically significant ( $t = 1.34$ ).

*Comparison of Average Depth of Defect at Time of Reentry with Osseous Coagulum-Bone Blend and Open Debridement Procedures* (Table VIII).

In the 37 sites treated by osseous coagulum-bone blend grafts the average depth of the intraosseous defect at the time of reentry was 0.76 mm, S.D. 1.26. In the 38 sites treated by open debridement procedures the average depth of the intraosseous defect at the time of reentry was 1.51 mm, S.D. 1.04.

In the 15 one-wall defects treated by graft procedures the average reentry depth of defect was 0.93 mm, S.D. 1.78. In the 18 one-wall defects treated by open debridement procedures the average reentry depth of defect was 2.02 mm, S.D. 1.16.

In the 14 two-wall defects treated by graft procedures the average reentry depth of defect was 0.66 mm, S.D. 0.74. In the 15 two-wall defects treated by open debridement procedures the average reentry depth was 1.03 mm, S.D. 0.66.

TABLE VI. Comparison of Osseous Fill (mm) Following Osseous Coagulum-Bone Blend and Open Debridement Treatment in the Same Host with Similar Types of Defects

<u>Bone Blend</u>					
Type of Defect	No. of Sites	Average Initial Depth (mm)		Average Fill (mm)	
		Mean	S.D.	Mean	S.D.
6 - 1 Wall } 7 - 2 Wall }	13	3.32	0.99	2.18	0.93

<u>Open Debridement</u>					
Type of Defect	No. of Sites	Average Initial Depth (mm)		Average Fill (mm)	
		Mean	S.D.	Mean	S.D.
6 - 1 Wall } 7 - 2 Wall }	13	2.55	1.53	0.75	0.91

TABLE VII. Comparison of Crestal Resorption (mm) Following Use of Osseous Coagulum-Bone Blend Versus Open Debridement Procedures

<u>Bone Blend</u>			
No. of cases	Average Crestal Resorption (mm)		
	Mean	S.D.	
37	0.50	1.21	

<u>Open Debridement</u>			
No. of cases	Average Crestal Resorption (mm)		
	Mean	S.D.	
38	0.82	0.67	

In the eight three-wall defects treated by graft procedures the average reentry depth of defect was 0.59 mm, S.D. 0.80. In the five three-wall defects treated by open debridement the average reentry depth was 1.10 mm, S.D. 0.66.

The average residual depth of intraosseous defects remaining at the time of reentry was less in graft treated than open debridement treated sites. The difference was statistically significant ( $t = 2.82, P < 0.05$ ).

DISCUSSION

This study was designed to focus on the question: Is a graft necessary for osseous regeneration following surgical debridement in an intraosseous defect?<sup>9, 10</sup> A recently published extensive literature review concluded that regeneration is possible without osseous grafts<sup>11</sup> but did not answer the question: "Does a graft potentiate regeneration in defects of various morphology?" Specific

studies, however, indicate histological<sup>2, 12-14</sup> and clinical<sup>14-17</sup> success using autogenous bone grafts. In fact, Haggerty, et al.<sup>18</sup> and Bishop<sup>19</sup> concur that "many investigators have found it (autogenous cancellous bone and marrow) is the best grafting material available today."<sup>19</sup>

Our results suggest that with the exception of narrow three-wall defects, greater fill was obtained in all defects when an autogenous osseous coagulum-bone blend graft was used. These repair trends were similar within the same patient and between patients. (Figs. 1A-C, 2A-C, 3A-E, 4A-F) Yet, as in our previous publications, again we must point out that human periodontal defects are not identical. For example, average initial depth of intraosseous defects treated with osseous coagulum-bone blend was 4.22 mm (S.D. 1.73), whereas debridement treated defects had an average initial depth of 3.03 mm (S.D. 0.80). This variant, although limited, if we consider the

TABLE VIII. Comparison of Crestal Resorption (mm) at Reentry Following the Use of Osseous Coagulum-Bone Blend or Open Debridement

Type of Defect	Bone Blend			Open Debridement		
	No. of Sites	Depth at Reentry		No. of Sites	Depth at Reentry	
		Mean	S.D.		Mean	S.D.
1 Wall	15	0.93mm	1.78	18	2.02mm	1.16
2 Wall	14	0.66mm	0.74	15	1.03mm	0.66
3 Wall Wide	8	0.59mm	0.80	5	1.10mm	0.66
TOTAL	37	0.76mm	1.26	38	1.51mm	1.04

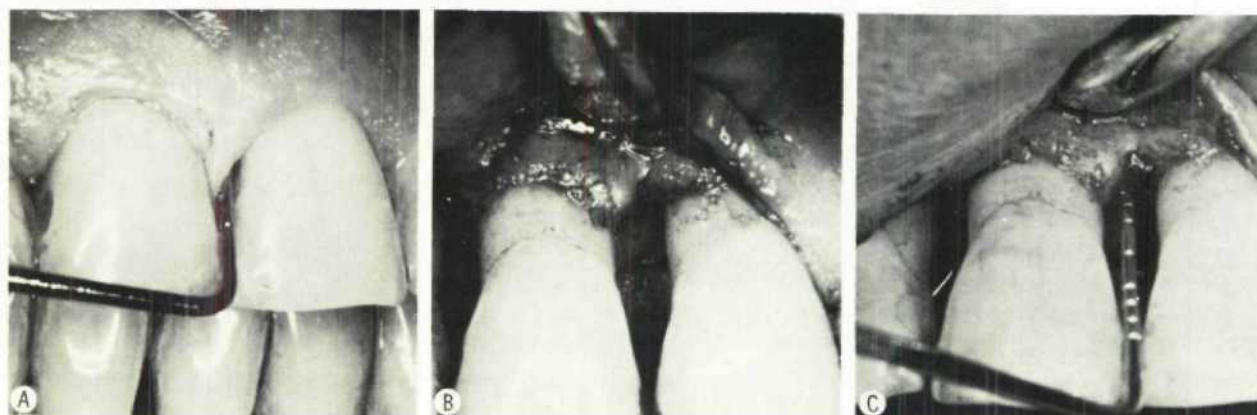


FIGURE 1. A, Preoperative probing of an 8.1 mm pocket on the mesial of the maxillary left central incisor. B, Exposure of the osseous defect measuring 3.6 mm during the open debridement procedure. C, Appearance of the probed defect shown in 1B at reentry, 10 weeks after initial surgery. Note the residual defect of 1.3 mm. Crestal resorption of 2.3 mm has taken place but there has been 0 mm of osseous fill.

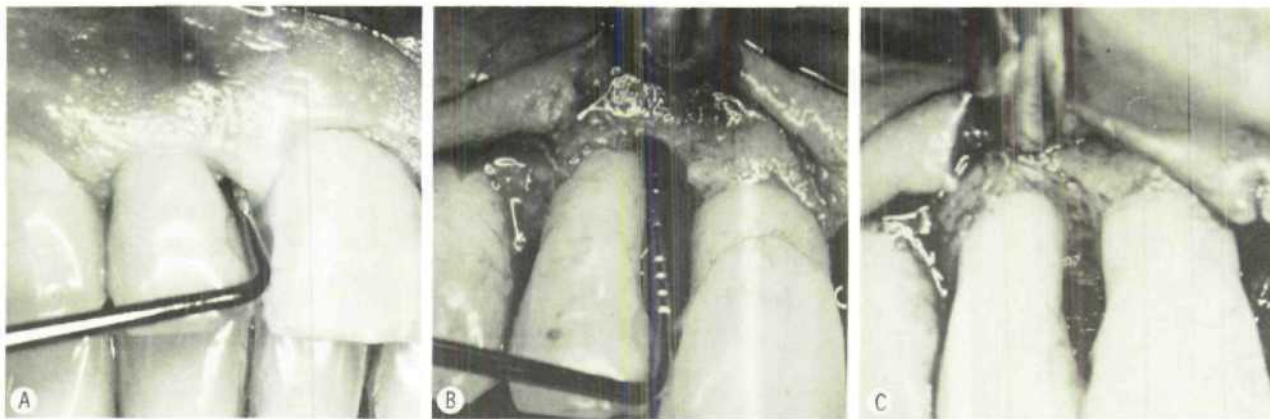


FIGURE 2. A, Preoperative probing of an 8.1 mm pocket on the mesial of the maxillary right lateral incisor in the same patient as shown in Figure 1A. B, Exposure and probing of the osseous defect prior to placement of an osseous coagulum-bone blend graft. The defect measured 3.9 mm in depth. C, Appearance of the defect shown in 2B at reentry, 10 weeks after initial surgery. Note the apparent fill and remodeling of the lesion. Although there was 1.4 mm of crestal resorption, 2.5 mm of osseous fill has taken place. Both sites were initially treated at the same time and reentered at the same time.

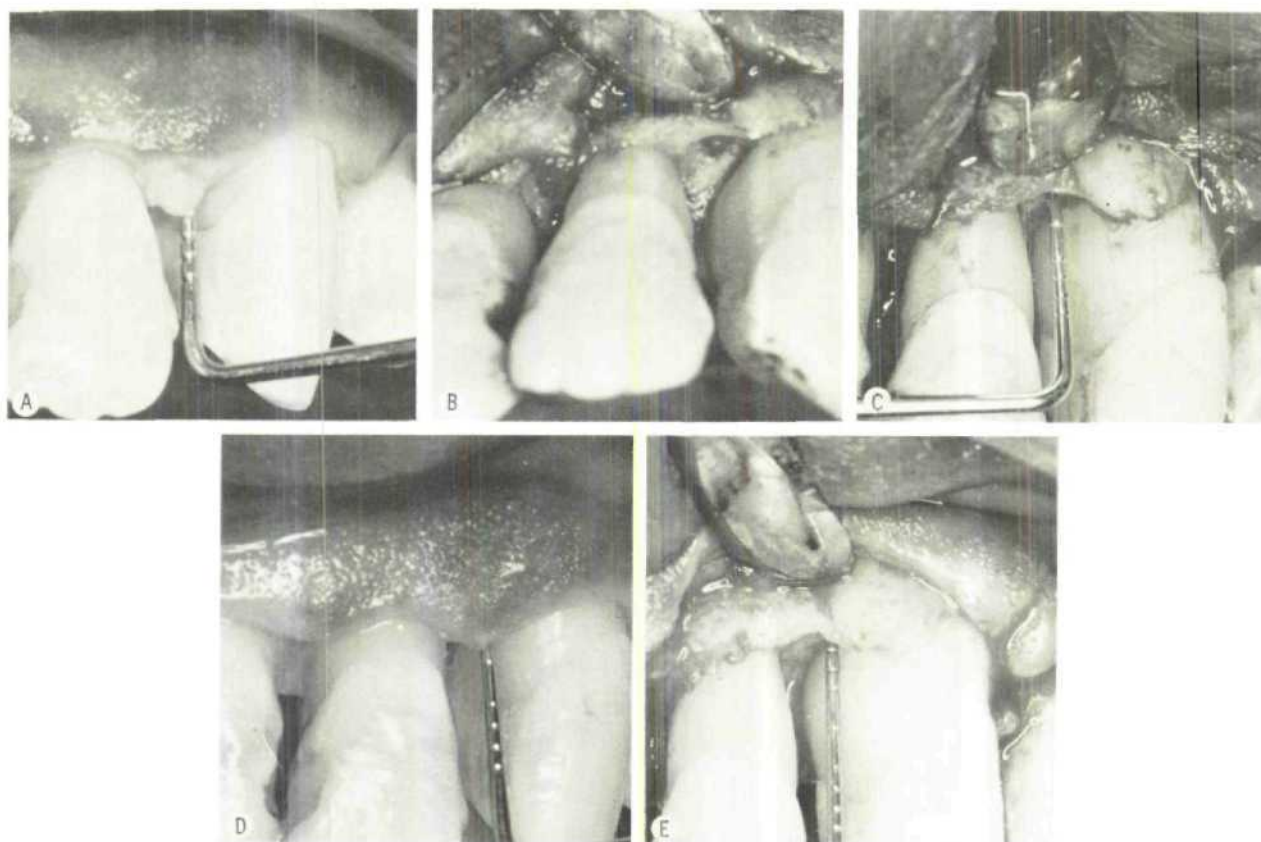


FIGURE 3. A, Preoperative soft tissue probing of a 7.0 mm pocket on the mesial of the maxillary left canine. B, Exposure of the two-wall osseous defect during the open debridement procedure. C, Probing the osseous defect which measured 3.2 mm in depth. D, Re-probing of pocket just prior to reentry shows a pocket depth of 4.2 mm. E, Probing the 1.2 mm residual defect at the time of reentry, 10 weeks after initial surgery. Although 0.3 mm of osseous fill has taken place, the 1.77 mm of crestal resorption accounts for the major decrease in the depth of the defect.

standard deviations, may have influenced the repair sequence. However, in at least 26 sites (Table VI) pretreatment depth of intraosseous defect recordings were similar. Yet the repair responses following grafting versus debridement were significantly different ( $t = 3.95$   $P < 0.01$ ). Thus, our results are in the nature of case

report evidence. This clinical limitation may also account for the unusually high standard deviations noted in our results. They reflect both loss of crest as well as fill which is routinely observed as a clinical response to the same therapeutic procedure. It is this range of variability in human responses<sup>20</sup> that frequently produces exceedingly

high standard deviations in statistical evaluations based on human case reports.

The present report is the last in a series of clinical and histologic observations of repair trends following the use of grafts in human periodontal lesions.<sup>1, 2</sup> Since identical measurement techniques were used in all three studies, we now wish to compare repair responses following the use of open debridement, hip marrow grafts and osseous coagulum-bone blend grafts. Statistical comparisons of

our results (Table IX), show that both graft materials demonstrated significantly greater osseous regeneration than debridement alone. Furthermore, as pointed out in other studies, osseous coagulum-bone blend grafts showed similar results to those observed following the use of hip marrow,<sup>14</sup> with the exception of very deep lesions where hip marrow grafts acted more efficiently.<sup>1</sup>

Finally, it is important to note that although "fill" procedures show many advantages, continuous long term

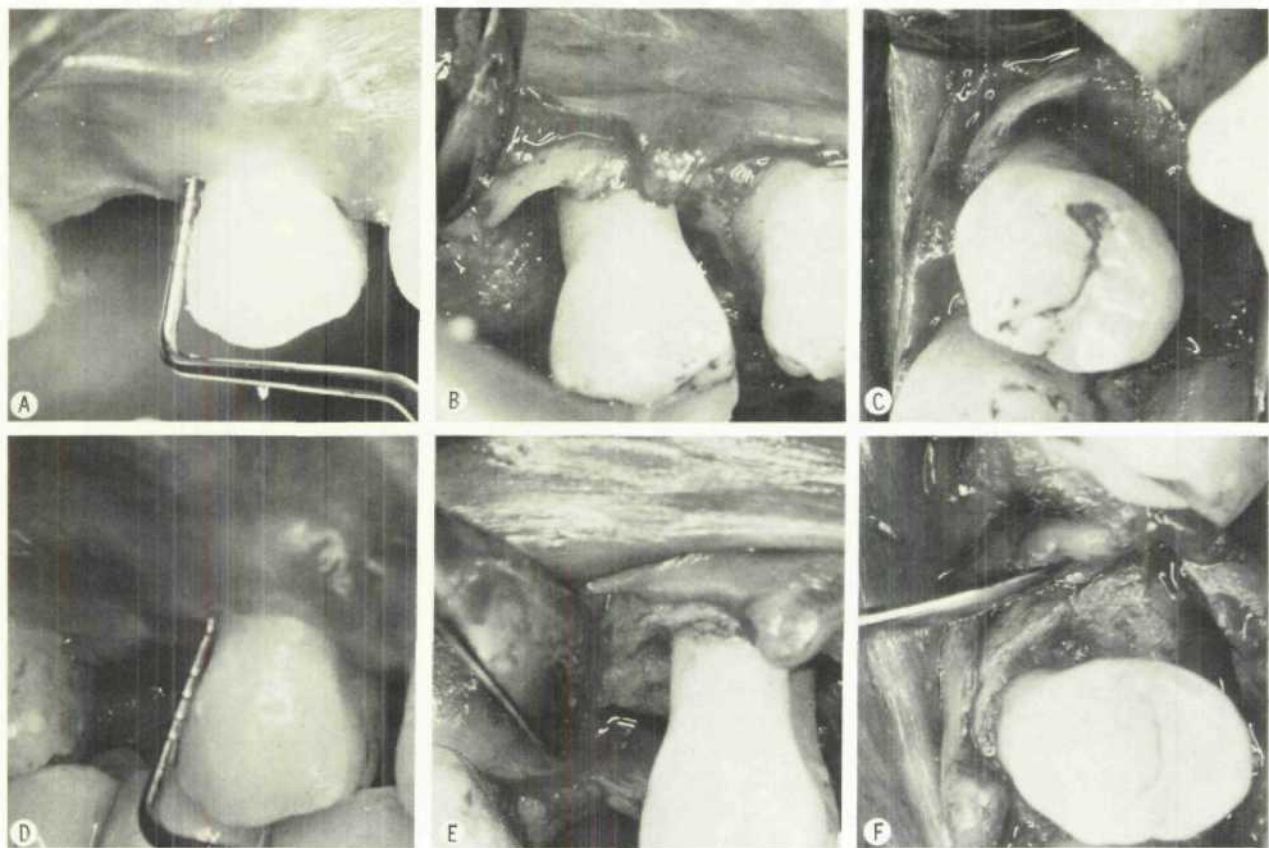


FIGURE 4. A, Preoperative probing of a 6.7 mm pocket on the distal of the maxillary right second premolar. B, Exposure of the combination 1, 2 wall osseous defect prior to implantation of osseous coagulum-bone blend. The defect measures 3.7 mm in depth. C, Occlusal view of the defect. D, Reprobing of the pocket just prior to reentry shows a pocket depth of 3.6 mm. E, Appearance of the defect at the time of reentry, 10 weeks after initial surgery. There has been 2.8 mm of osseous fill including 0.3 mm of crestal apposition. The residual defect measures 1.2 mm in depth. F, Occlusal view of the residual defect at the time of reentry.

TABLE IX. Comparison of Osseous Repair Following Hip Marrow Grafts, Osseous Coagulum Grafts or Open Debridement

	Marrow Treated			Coagulum-Bone Blend Treated			Debridement Treated		
	No. of Sites	Fill (mm)	Fill %	No. of Sites	Fill (mm)	Fill %	No. of Sites	Fill (mm)	Fill %
1 Wall	5	4.30	57.3%	15	2.42	62.7%	18	0.16	5.6%
2 Wall	2	3.40	100%	14	3.21	77.3%	15	1.03	34.3%
3 Wall Wide	-	-	-	8	3.64	72.4%	5	1.38	48.3%
TOTAL	7	4.36	60.7%	37	2.98	70.6%	38	0.66	21.8%

crestal remodeling occurs regardless of graft or debridement procedures utilized.<sup>12</sup> Therefore, ultimate adaptation to function at the treated sites can be evaluated only by long term follow up studies.

#### SUMMARY

A clinical investigation was undertaken to compare regeneration of osseous defects following either osseous coagulum-bone blend grafts or open debridement procedures. Seventy-five sites in 28 patients were treated by the two procedures.

The average fill in the 37 intraosseous defects treated by graft procedures (initial average depth = 4.22 mm, S.D. 1.73) was 2.98 mm, S.D. 1.44.

The average fill in the 38 intraosseous lesions treated by open debridement procedure (initial average depth = 3.03 mm, S.D. 0.80) was 0.66 mm, S.D. 0.80.

Statistical analysis showed a significant difference ( $P < 0.01$ ) in fill patterns between the bone blend and open debridement responses in favor of graft treated sites. Therefore greater levels of osseous regeneration apparently took place in our cases following osseous coagulum-bone blend autogenous graft procedures than following open debridement procedures in all types of defects studied.

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## In Memoriam

**Harold G. Amrein**  
1909-1975

Dr. Amrein, an Associate member since 1957, received his dental training at Pacific University in San Francisco and took numerous short courses in periodontology. At the time of death he held the classification of an Academic member, and was 64 years of age.