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## EVIDENCE REPORT »

A COMPARISON OF BONE GRAFTS WITH AND WITHOUT PLATELET-RICH PLASMA IN PREPARATION FOR DENTAL IMPLANT PLACEMENT

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## **A comparison of bone grafts with and without platelet-rich plasma in preparation for dental implant placement**

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### **Evidence Report for Implant Directions**

#### **Evidence Report Purpose**

Sinus and ridge augmentation is often utilized prior to placement of endosseous implants in the edentulous upper jaw. Bone grafts are used in such procedures to enhance sites deficient in bone quality or quantity, and attention has focused on accelerating bone regeneration and improving wound healing. Recent efforts to improve wound healing have concentrated on autogenous sources of bioactive mediators, such as platelet-rich plasma (PRP), which offer the potential to enhance the biological activity of bone replacement grafts.

#### **Objective**

To critically summarize the recently published literature examining bone characteristics (quality, resorption/gain) and other outcomes in

studies of bone grafts placed with and without platelet-rich plasma in preparation for intraoral dental implant placement.

### **Summary**

One study reported no significant differences in implant survival rates between implants placed in bone grafts with PRP compared to bone grafts alone (rag). One study found a significantly greater bone density in bone augmented with autologous bone plus PRP compared to the bone without PRP group, while another study did not find any differences in bone density when comparing the two groups. There were no significant differences in trabecular bone volumes in one study or in vertical dimension of bone in another study. Two studies found an increased, though nonsignificant, increase in percentage of vital bone in histologic specimens of bone augmented with PRP compared to the non-PRP treated sites. Studies were of moderate quality so conclusions based on reported differences should be considered with caution. Additional methodologically rigorous comparative studies with comparable characteristics between groups are needed to better evaluate the effect of PRP associated with bone grafts upon treatment outcomes.

### **Sampling**

A MEDLINE search was performed to identify recent studies published between January 2005 and July 2009 examining treatment outcomes of bone grafts placed with versus without platelet-rich plasma in preparation for dental implant placement. Three articles met our criteria, evaluating the treatment comparison of interest, and are included in this report, Table 1.

**Table 1. Medline Search Summary**

Terms	Hits	Reviewed
Search <b>dental implants OR dental implantation, endosseous [MeSH]</b>	19,009	
Search <b>(dental implants OR dental implantation, endosseous [MeSH]) AND alveolar ridge augmentation AND comparative study, Limits ENGLISH, Human, Literature containing Abstracts</b>	117	3
Bibliographies from existing literature	0	0
<b>Total Reviewed</b>		<b>3</b>

**Common Outcome Measures**

- Implant survival
- Bone density
- Bone quantity
- Bone quality

**Interventions**

In preparation for intraoral dental implantation, sinus augmentation and bone grafts placed with and without platelet-rich plasma were performed and were described as follows:

**Consolo (2007)**

- Sixteen patients with bilateral symmetrical maxillary sinus pneumatization with corresponding alveolar atrophy underwent bilateral sinus floor augmentation, randomized to autologous (iliac crest) bone on one side and PRP plus autologous bone contralaterally. Implants were inserted 4, 5, 6, and 7 months after surgery in patients randomized into four implant placement groups. Subjects were followed for 7 months following augmentation.

**Kassolis (2005)**

- Ten subjects underwent bilateral sinus

augmentation and were randomized to receive freeze-dried bone allograft (FDBA) plus PRP one side or FDBA plus resorbable membrane on the other. Core biopsy specimens were obtained and implants were placed 4.5 to 6 months after augmentation surgery.

**Raghoobar (2005)**

- Five patients with severe atrophy of the edentulous posterior maxilla underwent bilateral sinus augmentation with autologous iliac crest bone. Patients received the bone graft with PRP on one side, and bone grafting without PRP was performed on the other side in a randomized fashion. After 3 months of healing, endosseous dental implants were placed and bone biopsies were obtained.

Table 2. Comparative studies evaluating bone grafts placed with vs. without PRP in preparation for intraoral dental implant placement.

Author (year)	Study Design	Population	Diagnostic Characteristics	Implant Placement		Follow-up (%)	LoE*
				Bone Grafts with PRP	Bone Grafts without PRP		
Consolo (2007)	RCT	N=16 female: 69% age: 47 ± 5.9 (37-57) yrs	Maxillary sinus augmentation required prior to implant placement	N=16	N=16	7 months: NR†	Moderate
Kassolis (2005)	RCT	N=10 female: NR age: NR	Maxillary sinus augmentation required prior to implant placement	N=10	N=10	4.5-6 months: NR†	Moderate
Raghoobar (2005)	RCT	N=5 female: 60% age: 58.4 ± 1.9 (57-62) yrs	Edentulous, severely resorbed maxilla requiring bone augmentation prior to implant placement	N=5; Ni=3	N=5; Ni=3	20.2 ± 4.3 months: NR†	Moderate

N=number of subjects; Ni=number of implants

\*Level of Evidence (LoE) is based on study design and methods (Very high, High, Moderate, and Poor)

†NR (not reported) = for follow-up rate either not reported or precise follow-up rate could not be determined since the initial number of eligible patients or number lost to follow-up were not provided.

Table 3. Evaluation of articles comparing studies evaluating bone grafts placed with vs. without PRP.

Study design and methods	Consolo (2007)	Kassolis (2005)	Raghoobar (2005)
1. What type of study design?	RCT	RCT	RCT
2. Statement of concealed allocation?*	YES	YES	YES
3. Intention to treat?*	YES	YES	YES
4. Independent or blind assessment?	NO	NO	NO
5. Complete follow-up of >85%?	NO	NO	NO
6. Adequate sample size?	NO	NO	NO
7. Controlling for possible confounding?	YES	YES	YES
<b>LEVEL OF EVIDENCE</b>	<b>Moderate</b>	<b>Moderate</b>	<b>Moderate</b>

\* Applies to randomized controlled trials only

### **Implant survival**

- Implant survival was 100% for implants placed in bone augmented without PRP and was 93.3% for implants placed in bone augmented with PRP after a mean follow-up time of 20.2 months. [Raghoobar]

### **Bone density**

- The basal bone densitometric values of sinuses were significantly greater in the autologous bone plus PRP compared to the bone only group at 7 months after sinus floor augmentation (mean values in Hounsfield units [HU]:  $500 \pm 40.8$  HU vs.  $392.5 \pm 61.9$  HU, respectively;  $p < .05$ ). Longitudinal analysis showed significantly greater bone densitometry among months 4 through 7 for the bone plus PRP group (+71% at 4 months, +81% at 5 months, +48% at 6 months, +29% at 7 months;  $p < .05$ ), Figure 1. [Consolo]

- The average bone density on microradiographs, measured with arbitrary gray values, at the first premolar and first molar regions were  $91 \pm 23.1$  and  $71.8 \pm 23.8$  at the PRP side and  $84.6 \pm 19.6$  and  $90.7 \pm 13.5$  at the non-PRP side, respectively ( $p > .05$ ). [Raghoobar]

### **Bone quantity (resorption/gain)**

- There were no significant differences in mean trabecular bone volumes between the autologous bone plus PRP site compared to the bone alone site at 7 months ( $p > .05$ ). [Consolo]

- The vertical dimension from the crest of the ridge to floor of the sinus was comparable after grafting with FDBA plus membrane and FDBA plus PRP 4.5-6 months after augmentation ( $13.2 \pm 1.3$ mm vs.  $13.9 \pm 2.1$ mm, respec-

tively,  $p > .05$ ). [Kassolis]

### **Bone quality (histology)**

- Histologic specimens at 4.5-6 months following the augmentation procedure revealed a significantly greater percentage of vital tissue (bone and connective tissue) in subantral spaces grafted with FDBA and PRP than with FDBA alone ( $78.8\% \pm 8.3\%$  vs.  $63.0\%$  vs.  $15.7\%$ , respectively;  $p = .01$ ). [Kassolis]

- Further, a greater, though not statistically significant, percentage of vital bone was found in the subantral spaces grafted with FDBA and PRP than with FDBA plus membrane ( $33.3 \pm 11.3\%$  vs.  $26.5 \pm 6.8\%$ , respectively;  $p > .05$ ), Figure 2. [Kassolis]

- In histologic specimens taken at 3 months after the augmentation procedure, the average area occupied by bone in the augmented regions were  $41.1 \pm 8.3\%$  at the non-PRP treated side and  $38.4 \pm 11.3\%$  at the PRP side ( $p > .05$ ), Figure 2. [Raghoobar]

### **Methodological considerations**

- All studies reviewed were randomized controlled trials with a rating of moderate (low quality randomized controlled trials) level of evidence. No very high quality randomized controlled trials or high quality cohort studies were identified in the literature.

- All three studies had sample sizes that were likely inadequate to show a difference between the study groups for some of the outcomes measured.

- Since multiple implants in the same subject are not statistically independent, either one implant should be chosen per patient or statisti-

cal analysis should account for multiple implants per patient.

- None of the studies reported a follow-up rate. A follow-up rate of  $\geq 85\%$  is necessary to ensure valid study results. Further, the length of follow-up for all studies was likely not adequate to assess long-term study outcomes.

## References

### Studies

#### Study 1

Consolo U, Zaffe D, Bertoldi C, Ceccherelli G (2007)

Platelet-rich plasma activity on maxillary sinus floor augmentation by autologous bone  
Clin Oral Impl Res 18:252-62.

#### Study 2

Kassolis JD, Reynolds MA (2005)

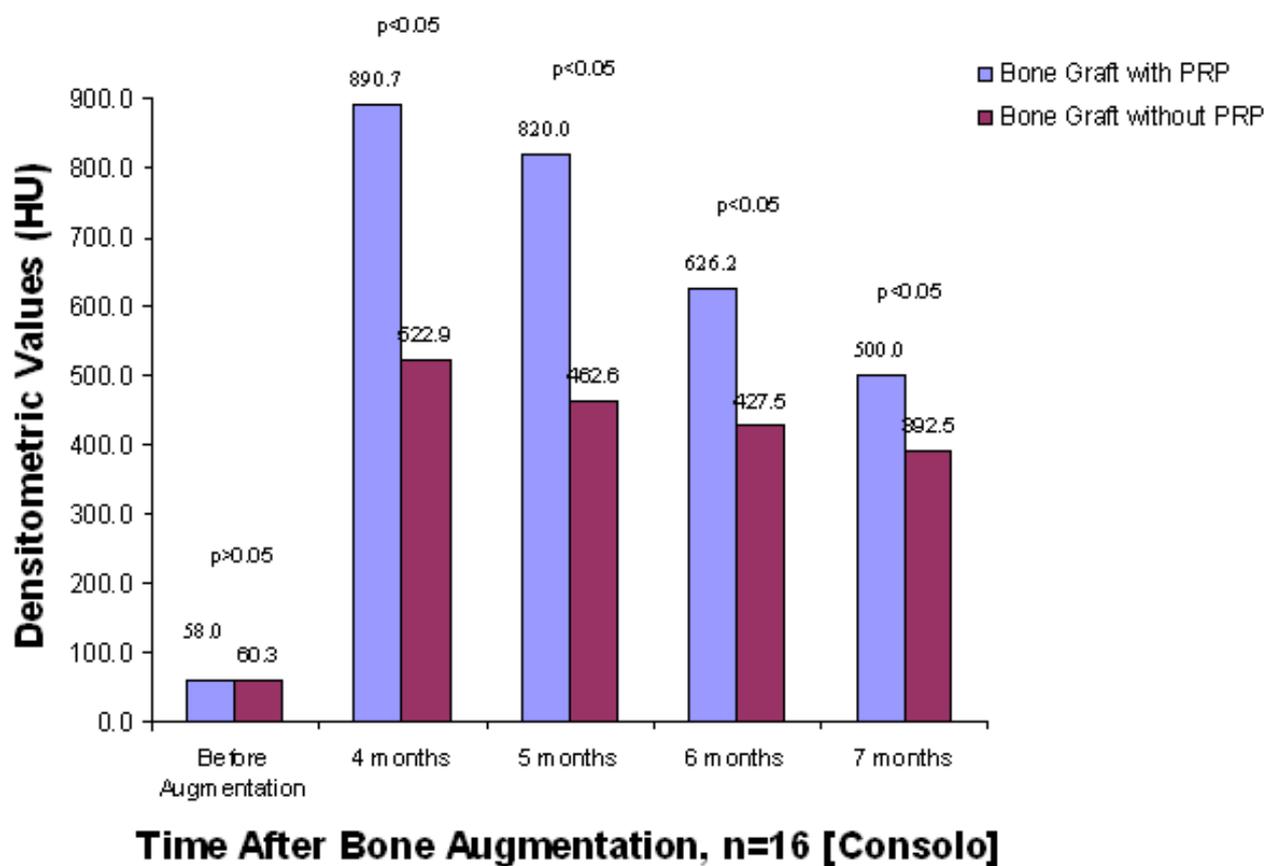
Evaluation of the adjunctive benefits of platelet-rich plasma in subantral sinus augmentation  
The Journal of Craniofacial Surgery 16(2):280-7.

#### Study 3

Raghoobar GM, Schortinghuis J, Leim RSB, Ruben JL, van der Wal JE, Vissink A (2005)

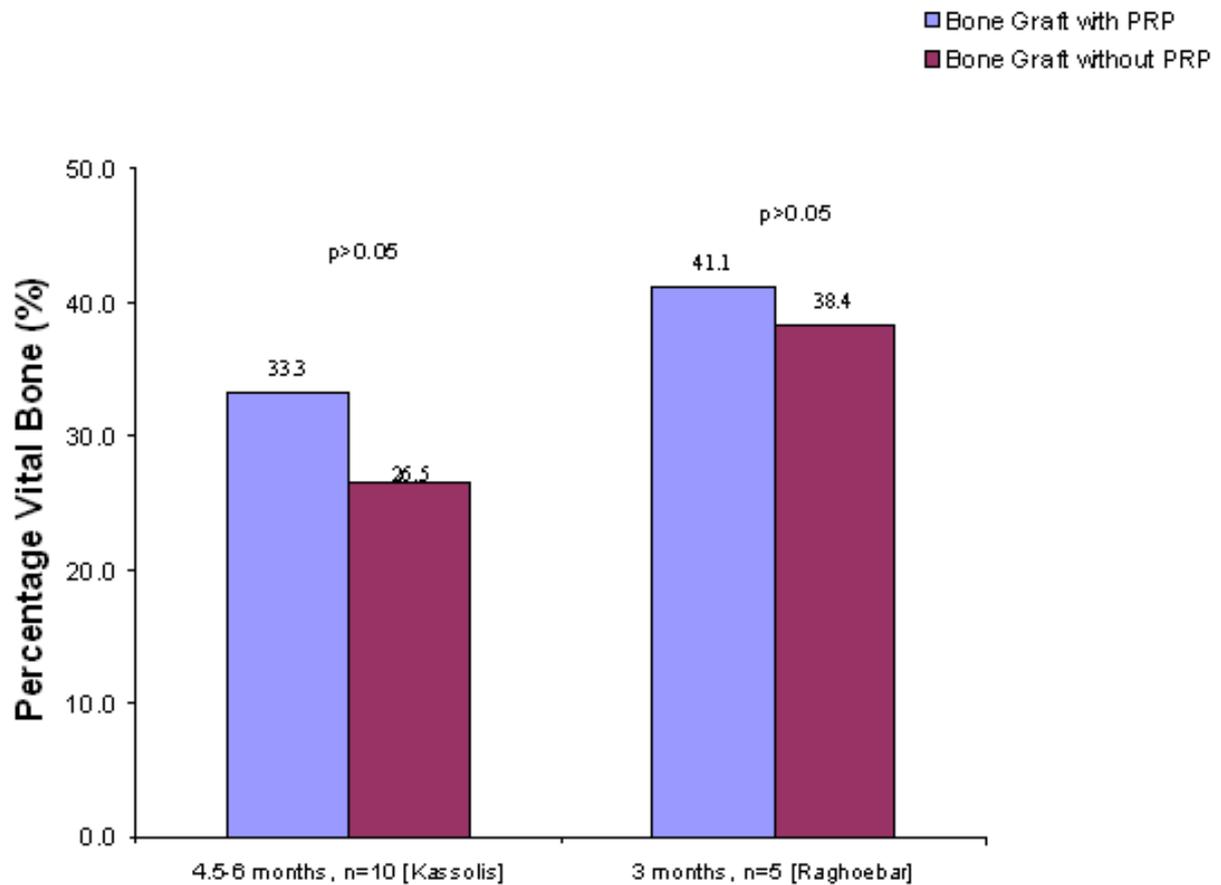
Does platelet-rich plasma promote remodeling of autologous bone grafts used for augmentation of the maxillary sinus floor?  
Clin Oral Impl Res 16:349-56.

Figure 1. Changes in basal bone densitometric values for bone grafts placed with PRP compared to bone grafts placed without PRP in preparation for intraoral dental implant placement.



Statistical significance noted on graphs if provided by author

Figure 2. Percentage vital bone in histologic specimens for bone grafts placed with PRP compared to bone grafts placed without PRP in preparation for intraoral dental implant placement.



Statistical significance noted on graphs if provided by author

