
Navneet S. Arora, DDS, MPH,* Thaminda Ramanayake, MS,† Yan-Fang Ren, DDS, MD, PhD,‡ and Georgios E. Romanos, DDS, DrMedDent, PhD§

Platelet-rich plasma (PRP) is well accepted and widely used as a treatment mode during surgical procedures and for chronic nonhealing wounds. It is also studied in the context of angiogenesis pertaining to tumor genesis. PRP is an autologous concentration of human platelets in concentrated plasma, with a high concentration of growth factors, which are biological mediators imposing a local and systemic effect. These growth factors are shown to eventually enhance wound healing, not just qualitatively but also on the rate as well. They are well known to regulate cell migration, attachment, proliferation, differentiation, and promote extracellular matrix accumulation via binding to specific cell surface receptors. This complex of growth factors undergoes sequential events at a molecular level to stimulate early wound healing. According to Roberts and Sporn and Marx et al., the theory given for the use of PRP during periodontal surgical procedures is that growth factors in high concentrations can stimulate early wound healing. Growth factors, which are biological mediators, initiate angiogenesis, and inducing cell differentiation that result in better and faster wound healing. Growth factors obtained by adding PRP to grafts...

Background: Although platelet-rich plasma (PRP) has been extensively studied for over a decade, there are no definitive reports, which prove the benefit of using PRP in sinus augmentation procedures. In addition, no systematic literature review has been done to report the benefit of treatment outcome in patients who received PRP in conjunction with bone/bone substitutes in maxillary sinus augmentation procedures. Therefore, it can be rightly stated that evidence for an adjunctive benefit of using PRP with bone grafts in sinus augmentation procedures is equivocal and inconclusive.

Aim: The objective of this systematic literature review was to examine this literature in determining whether PRP with bone and bone substitutes leads to more rapid and effective bone regeneration clinically, radiographically, and histologically with sinus augmentation procedures and was there any clinical data parallel to animal experiments providing clinical evidence in sinus augmentation procedures?

Methods: A systematic review of randomized clinical trials of at least 6 months duration was conducted comparing PRP and bone/bone substitutes (test group) to bone/bone substitutes (control group) alone. Electronic databases such as MEDLINE and CENTRAL (Cochrane central register of controlled clinical trials) were searched for relevant articles. The reference list of all included articles was searched along with unpublished clinical trials whose abstracts were available.

Results: Although, there is a lack of human studies, which show benefit of using PRP in conjunction with bone grafting materials, it can be stated that use of PRP does lead to early regeneration and reduction in healing time of soft and hard tissues. However, no significant statistical or clinical benefit was reported from studies that would satisfy the inclusion criteria. This study answers the question very clearly that at this point of time, there is no human study that strongly supports the benefit of using PRP in sinus augmentation procedures.

Conclusion: There is a paucity of clinically controlled trials regarding benefits of PRP in sinus augmentation procedures. Theoretically, it seems to have significant beneficial effects on the soft and hard tissue healing; however, the disparity in study design, surgical techniques, and different outcome assessment variables used, makes it difficult to assess the practical benefit of its clinical use. Although no obvious positive effects of PRP on healing of bone graft material in maxillary sinus augmentation procedures were noted, the handling of the particulate bone grafts was improved. (Implant Dent 2010;19:145–157)

Key Words: bone regeneration, maxillary sinus augmentation, maxillary ridge augmentation, sinus floor augmentation, platelet-rich plasma, platelet concentrate, PRP
show radiographic maturation rate 1.62 to 2.16 times that of grafts without PRP. The histomorphometric analysis showed a greater amount of trabecular density (75% ± 11%) in comparison with native posterior alveolar bone (38.9% ± 6%) and bone grafts without PRP (55.1% ± 8%), respectively.

When analyzed, PRP concentrate was consistently enriched with growth factors, such as platelet-derived growth factor, transforming growth factor-β, vascular endothelial growth factor, insulin like growth factor, platelet-derived angiogenic factor, and epithelial growth factor. When growth factors in PRP were measured using enzyme-linked immunosorbent assay, a 7-fold increase in transforming growth factor-β, 30-fold increase in platelet-derived growth factor, and 10-fold increase in epithelial growth factor was seen as compared with whole blood. The dominant mechanism that governs the release of growth factor from the complex of PRP and bone substrate is simple diffusion triggered by the concentration gradient at the graft site. The secretion of these factors begins within 10 minutes of initiation of coagulation cascade, and by the end of first hour, 95% of the factors are secreted. Therefore, PRP must be developed in an anticoagulant state and should be used on the graft, flap, or wound within 10 minutes of initiation. However, contradictory results about the favorable effects of PRP make its use not just limited but questionable as well. Therefore, the evidence for an adjunctive benefit of using PRP with bone grafts in sinus augmentation procedure has been equivocal and inconclusive.

Maxillary sinus is the largest of all paranasal sinuses, which is shaped like a pyramid ~2.5 cm wide, 3.75 cm high, and 3 cm deep. The antral floor is usually 5 to 8 mm apical from the alveolar crest, however, after tooth or teeth loss, there is an increase in the sinus volume because of resorption of the bony walls. Inadequate alveolar bone height is a common limitation in the placement of dental implants in posterior maxillae. grafting the floor of the maxillary sinus over time has become a predictable surgical treatment modality for correcting this inadequacy in vertical bone height. Tatum introduced the technique that increased maxillary bone height by placing graft material in the maxillary sinus under the Schneiderian membrane by making a lateral window on the buccal wall. Others have modified this technique, however the rationale, which is to prove that sinus augmentation procedures as a reliable method to reconstitute the antral floor of patients who had lost a significant amount of alveolar bone, remains the same. However, there has been a long lasting debate about the healing time as to when implants could be placed in grafted bone or if they were placed simultaneously how long should the restorative dentist wait before the implants can be loaded. The answer to this question is in the histological changes in maxillary sinus augmentation procedures.

There have been several case reports that have questioned the use of PRP with bone grafting materials in sinus augmentation procedures. From et al published a case report of 3 bilateral sinus augmentation procedures. In this study, anorganic bovine bone and PRP was placed in test sites, whereas only anorganic bone was placed in the control sites. No significant benefits of PRP use were noted with respect to histological outcome measures. Similarly, another study done on 5 patients failed to show evidence of any benefit with implant placement by using PRP in sinus augmentation procedure. The histological evidence from these studies was not able to evaluate and demonstrate the therapeutic benefits and clinical significance in usage of PRP with bone grafts in sinus augmentation procedure.

Experimental studies performed in different animal models with PRP combined with autogenous bone, failed to demonstrate any enhanced bone formation or regeneration, analyzed both histologically and histomorphometrically. In addition, Klionoi et al failed to show any beneficial effect when using PRP in conjunction with autogenous bone, to the fact that it enhanced bone regeneration in maxillary sinus or had any positive effect on bone implant contacts percentages when implants were placed in grafted sinuses. Similarly, other researchers have used bone substitutes like hydroxyapatite, β-tricalcium phosphate (β-TCP), anorganic bovine bone, and bovine hydroxyapatite, still to indicate no significant promise for bone regeneration when using PRP in conjunction with bone substitutes. On the basis of these experiments, the authors concluded that the regenerative capacity of PRP is of low potency and addition of PRP to bone/bone substitute used in sinus or ridge augmentation procedures have no or questionable adjuvant clinical value. On the other hand, Fennis et al has evidence supporting the positive effect of PRP when added to autogenous bone grafts in goats. Similarly, Gerard et al showed newer and early bone formation in the healing process when PRP was used with autogenous bone in mandibular defects of dogs. These authors are confident that there is significant promotion of tissue regeneration and wound healing enhanced by using PRP in conjunction with bone/bone substitute materials.

What everyone agrees on is that PRP acts as a biologically adhesive material that significantly improves the manipulation of bone or bone substitute grafting material especially for sinus augmentation by making its packing easy in sinus cavity. What still needs to be determined is whether PRP improves the rate and quality of new bone formation and if it does, how much it shortens the healing time after sinus augmentation procedures. The rationale behind using PRP whether in intrabony defects, furcation defects, extraction sites, ridge augmentation procedures, or sinus augmentation procedures is the same that PRP contains important growth factors that are responsible for increasing cell maturation, differentiation, angiogenesis and collagen production. But can we prove their effects based on this literature on PRP to show clinical and statistical significance? Can it be proven that PRP is quantitatively and qualitatively effective in sinus augmentation procedures?
From 1950 to 2008, procedures? Therefore, the objective of this systematic review was to examine this literature to determine:

a. If PRP with bone and/or bone substitutes leads to more rapid and effective bone regeneration clinically, radiographically, and histologically with sinus augmentation procedures.

b. Is there any clinical data parallel to animal experiments providing clinical evidence in sinus augmentation procedures?

**Inclusion Criteria**

Types of studies: published/unpublished studies and randomized controlled trials or clinical controlled trials.

Types of participants: patients with edentulous posterior maxilla who require sinus augmentation procedures because of lack of residual bone height between floor of maxillary sinus and alveolar bone crest.

Types of interventions: PRP with bone or bone substitutes as an intervention (test) versus bone or bone substitutes alone (control) or with any other modulator or growth factor in maxillary sinus augmentation procedures.

Types of outcome measures: (1) primary: histological evaluation of bone formed after the procedure and radiographic evaluation of bone formation, (2) secondary: early implant placement, (3) patient-centered outcomes: quality of life issues, (4) adverse outcomes: intraoral adverse effects and implant failures in grafted bone.

**Search Strategy**

MEDLINE and CENTRAL, Cochrane central register of controlled clinical trials were searched to find published studies that related use of PRP in maxillary sinus augmentation procedures. Articles searched were from 1950 to 2008.

Ovid Medline Search

1. Explode maxilla/
2. Explode maxillary sinus/
3. Explode alveolar ridge augmentation/
4. 1 or 2 or 3
5. Explode blood platelets/
6. Explode blood preservation/or exp blood platelets/or exp platelet transfusion/or exp platelet count/
7. 5 or 6
8. 4 and 7
9. Limit 8 to humans
10. Limit 9 to randomized controlled trial

The Cochrane Central Register of Controlled Trials (CENTRAL)

1. Maxilla.mp. [mp = title, original title, abstract, mesh headings, heading words, keyword]
2. Maxillary sinus.mp. [mp = title, original title, abstract, mesh headings, heading words, keyword]
3. Alveolar ridge augmentation.mp. [mp = title, original title, abstract, mesh headings, heading words, keyword]
4. 1 or 2 or 3
5. PRP.mp. [mp = title, original title, abstract, mesh headings, heading words, keyword]
6. Platelet concentrate.mp. [mp = title, original title, abstract, mesh headings, heading words, keyword]
7. PRP.mp. [mp = title, original title, abstract, mesh headings, heading words, keyword]
8. PRP.mp. [mp = title, original title, abstract, mesh headings, heading words, keyword]
9. 5 or 6 or 7 or 8
10. 4 and 9

Grey Literature Searched

Hand searching of abstracts of conference proceedings of the following was done for American Academy of Periodontology and International Association of Dental Research.

**Reference List**

The reference list of all included articles was searched and the articles described as a clinical trial were selected. A separate search was performed to identify review articles and the references of the review were examined to look for additional clinical trials that were not included in the above database or published from 1980.

**Data Extraction**

A data extraction form was used to retrieve information regarding study

Identifying Unpublished Trials

NLG Gateway was searched to locate relevant meeting abstracts. For those studies with only an abstract were followed with attempts to contact the author for more detailed information. We also searched for unpublished trials through an Internet search engine GOOGLE. In addition, worldwide clinical trial registration sites (www.clinicaltrials.gov, www.controlled-trials.com, and www.actr.org.au) were searched for studies, and the principal investigator of relevant studies were contacted to request trial information if available.

This systematic review was performed to demonstrate in an objective way to enhance the understanding of a clinician about PRP and its application in sinus augmentation procedures.

**Exclusion Criteria**

Studies that did not involve randomization, a control group, included PRP alone as an intervention or were not clear in the outcome variables were excluded in this study and in the review. However, during the search, it became evident that there is no single variable, which has ever been consistently used to measure the success of PRP in treatment of sinus augmentation procedures. All the randomized clinical trials have evaluated the success of sinus elevation procedures by using different individual outcome variables. Therefore, a qualitative rather than a quantitative systematic review was performed for sinus augmentation procedures.

According to criteria of evidence-based dentistry, randomized clinical trials have the strongest level of evidence. However, as the search for research articles was systemically performed, very few studies were included to state conclusions. There were 6 studies that satisfied all inclusion criteria, thus subsequently it was decided to conduct a systematic qualitative review for sinus augmentation procedures.
Studies were included in the systematic review as these studies fulfilled the inclusion criteria of type of study, participants, interventions, and outcome variables.

**Table 1. Included Studies**

<table>
<thead>
<tr>
<th>No.</th>
<th>Study</th>
<th>Year</th>
<th>No. of Patients</th>
<th>Preoperative Bone Height</th>
<th>Initial Treatment (TI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Consolo et al&lt;sup&gt;29&lt;/sup&gt;</td>
<td>2007</td>
<td>16</td>
<td>1–3 mm</td>
<td>1-Autogenous bone + PRP 2-Autogenous bone</td>
</tr>
<tr>
<td>2</td>
<td>Thor et al&lt;sup&gt;30,31&lt;/sup&gt;</td>
<td>2005</td>
<td>19</td>
<td>2–5 mm</td>
<td>1-Autogenous bone + PRP 2-Autogenous bone</td>
</tr>
<tr>
<td>3</td>
<td>Kassolis and Reynolds&lt;sup&gt;32&lt;/sup&gt;</td>
<td>2005</td>
<td>10</td>
<td>5–8 mm</td>
<td>1-FDBA + PRP 2-FDBA + biogide + tetracycline</td>
</tr>
<tr>
<td>4</td>
<td>Raghoebar et al&lt;sup&gt;33&lt;/sup&gt;</td>
<td>2005</td>
<td>5</td>
<td>&gt;5 mm</td>
<td>1-Autogenous bone + PRP 2-Autogenous bone</td>
</tr>
<tr>
<td>5</td>
<td>Wiltfang et al&lt;sup&gt;34&lt;/sup&gt;</td>
<td>2003</td>
<td>39</td>
<td>2–7 mm</td>
<td>1-β TCP + PRP 2-β TCP</td>
</tr>
<tr>
<td>Final Treatment (TF)</td>
<td>TI-TF</td>
<td>TF-T (Outcome)</td>
<td>Results</td>
<td>Comments</td>
<td></td>
</tr>
<tr>
<td>---------------------</td>
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<td>----------------</td>
<td>---------</td>
<td>----------</td>
<td></td>
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<tr>
<td>4, 5, 6, and 7 mo</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-TiO blast astra implants</td>
<td>6 mo</td>
<td>1 y</td>
<td></td>
<td>Higher implant survival rate and stable margin bone condition that can be active after 1 y of loading in maxillae with autogenous bone being used whether PRP is used or not</td>
<td></td>
</tr>
<tr>
<td>2-TiO blast astra implants</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-3i Implants</td>
<td>4.5–6 mo</td>
<td>Not given</td>
<td></td>
<td>Greater bone formation if PRP is added to FDBA and is statistically significant</td>
<td></td>
</tr>
<tr>
<td>2-3i Implants</td>
<td></td>
<td>Ratio vital</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-Nobelbiocare 13–15 mm</td>
<td>3 mo</td>
<td>6 mo</td>
<td>1-NS difference in bone density with or without PRP</td>
<td>No additional benefit.</td>
<td></td>
</tr>
<tr>
<td>2-Nobelbiocare 13–15 mm</td>
<td></td>
<td>2-NS difference in the overall area occupied by the bone</td>
<td></td>
<td>However might promote beneficial effect of PRP on early bone healing making early implant placement after grafting possible</td>
<td></td>
</tr>
<tr>
<td>1-3i Implants</td>
<td>6 mo</td>
<td>Not done</td>
<td>1–1-Osseous regeneration 38%</td>
<td>Rate of bone regeneration was slightly increase</td>
<td></td>
</tr>
<tr>
<td>2-3i Implants</td>
<td></td>
<td></td>
<td></td>
<td>New bone formation 8%–10% increased when PRP applied PRP will result in accelerated bone formation if osteoblasts and osteocytes are present</td>
<td></td>
</tr>
</tbody>
</table>
design, inclusion and exclusion criteria, patient characteristics, and outcomes. All studies that were included in the review were evaluated based on a set inclusion criteria and a power analysis was done to determine the strength of individual studies.

**Methods of the Review**

**Study Selection**

The authors (N.S.A. and Y.F.R.) who performed the study selection were not to be blinded to the publishing journal, the authors, or the institution. The first stage of screening search results involved assessing titles and abstracts to determine whether each article was meeting predetermined criteria. If the title and abstract were not enough to make a decision, then the full text of the article was obtained to which the inclusion criteria were applied. Disagreement between N.S.A. and Y.F.R. was resolved through discussion, and if no agreement was reached, then an opinion was taken from G.E.R.

A flow chart detailing the number of studies excluded at each step is provided. All studies, which are excluded at the final step, are also listed and reasons for their exclusion clearly stated.

**Data Collection**

Data collection was done on specifically designed data extraction forms and without blinding to the publishing journal, the authors, or the institution. N.S.A. and Y.F.R. extracted data independently and then compared. Any disagreement was resolved by discussion, and if no agreement was reached, then an opinion was taken from G.E.R. Original investigators were contacted if any additional data were required.

**Results**

Analysis of all included studies revealed the lack of a single common outcome variable (Tables 1 and 2). Therefore, it was not possible to perform a valid meta-analysis by combining data from these studies. Every individual study evaluated its success of therapy by different measurement techniques and outcome variables. The different outcome variable used for comparison between experimental and control groups although have been used in past by other investigators but till date there is no standardized protocol that has been described to evaluate the actual success of maxillary sinus augmentation procedures. Histological data usually describes the quality and quantity of new vital bone formed in sinus cavity and also determines the percentage of bone to implant contact interface. However, histological evaluation and histomorphometry would be the best way of assessing the role of PRP in the regenerative potential of maxillary sinus augmentation procedures.

Consolo et al compared the rate of maturation and Hounsfield units of autogenous bone graft (iliac crest) with PRP in test sites and autogenous bone alone in control sites. There was a significant difference between Hounsfield units for the first 7 months test sites being higher than control sites; however, the difference was not significant after 6 to 7 months because of the progressive extinguishment of PRP effect. It was concluded that regeneration potential was time dependent and PRP showed certain regenerative potential when used with autogenous bone than using autogenous bone alone. This early bone maturation favors early implant placement and loading and reducing the time between sinus elevation procedures and implant placement/loading.

In a study by Thor et al, 19 patients with 2 to 5 mm preoperative bone height underwent sinus elevation procedures. Patients were treated by placing autogenous bone with PRP in test sites and only autogenous bone in control sites. After 6 months, Astra Tech AB, MÖlndal, Sweden) implants were placed and assessment was done based on number of implant failures. There was 100% survival rate with higher implant stability when PRP was used than 97.4% survival rate with lower initial stability was found in the group without PRP. The author concluded that PRP did not accelerate the osseointegration rate of the implants used in the study. Al-though the test group had higher stability at the early stages, over time, the control group had an increase in stability. This study used implant stability assessed by resonance frequency analysis, which measured in implant stability quotient units. There was no statistically significant difference between the implant stability quotient of implants placed in test and control sites over a period of 1 year in function. Therefore, this study failed to show any added advantage of using PRP in conjunction with autogenous bone in sinus elevation procedures.

Apart from autogenous bone, freeze-dried bone allograft has also been used with or without PRP in a study by Kassolis and Reynolds. In this study, 3i implants (3i/Implant Innovations, Palm Beach Gardens, FL) were placed 4.5 to 6 months after the sinus elevation procedures. Results showed statistically significant increase in vital bone regeneration and resorption of residual graft after 4.5 to 6 months. However, evaluating the data clinically, the adjunctive use of PRP resulted in no demonstrable effect on clinical gain in ridge height, suggesting that the observed increase in volume was primarily attributable to the physical nature and confinement of graft material in the subantral space. Significant increase in vital bone regeneration and decrease in residual graft particles in test sites shows that PRP enhances the osteoconductive nature of freeze-dried bone allograft leading to regeneration, bone formation, and early wound healing.

Raghaebar et al used autogenous bone obtained from iliac crest for bilateral sinus lift in 5 patients. After 3 months, 13 mm or 15 mm implants from Nobel Biocare (Nobel Biocare AB, Göteborg, Sweden) were placed. Bone biopsy was taken after 3 months. Results showed no statistically significant difference in histological bone density and quality of the regenerated bone was observed however early healing was observed. Therefore, early implant placement may be performed. Even in this study, early bone healing favored early implant placement. One of the factors given in this study for autogenous bone not show-

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ing significant difference over time was because of the osteogenic potential of autogenous bone, which masks the regenerative potential of PRP.

In another study, Wiltfang et al. showed statistical significantly higher regeneration in test sites compared with control sites (38% vs 29%, respectively) after 6 months. In the test site, β-TCP was used with PRP, whereas in the control site only β-TCP was placed in the sinuses. Bone biopsies were taken 6 months after graft placement and even after 6 months, >60% of the graft material had not resorbed. This study showed that there was slow resorption of β-TCP and addition of PRP made no difference in its resorption. The authors concluded that the rate of bone formation was faster due to addition of PRP and bone substitutes like β-TCP. It was also stated that instead of autogenous bone, β-TCP could also be used in conjunction with PRP for sinus augmentation procedures. However, the benefit of this method was limited.

One of the limitations of this analysis is the great heterogeneity between studies in assessment of regenerative potential of PRP, making comparison of the results difficult. An internationally accepted and standardized protocol for assessment of sinus grafted procedures in lacking.

**Conclusion**

There is a paucity of clinically controlled trials regarding benefits of PRP in sinus augmentation procedures. Theoretically, it seems to have significant effects on the soft and hard tissue healing. However, the disparity in the study design, surgical techniques, and different outcome assessment variables used, makes it difficult to assess the practical benefit of using PRP in sinus grafting procedures. The main drawbacks of this literature includes lack of standardization or uniform study design, inadequate number of study subjects, and above all lack of a consistent single outcome variable for sinus elevation studies. There are studies that show beneficial effects but as always with what might be statistically insignificant or borderline in its significance. Although the angiogenic and rapid tissue regenerative potential of PRP has been demonstrated in trauma surgery and in transplantation, the benefits are not as evident in the field of surgical implant dentistry. One possibility is that limited area at the graft site during sinus augmentation procedures may mask the outcome of PRP by restricting cellular infiltration, compared with an area of a larger trauma site. Hence, the need for clinical randomized controlled trials to further evaluate benefits of PRP in sinus augmentation procedures remains definite. In addition, there is a need for a standardized protocol to extract and prepare PRP that yields a specific threshold concentration of platelets needed to be used with secured benefits, as these factors influence the success rate of PRP. These are some factors, which may have a direct effect on clinical decisions for using PRP in treatment compared with the cost of PRP-preparation.

**Disclosure**

The authors do not have any financial interest directly or indirectly in the products listed in the study.

**REFERENCES**


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**Table 2. Excluded Studies**

<table>
<thead>
<tr>
<th>Number</th>
<th>Study</th>
<th>Year</th>
<th>Reason for Exclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Schaff et al.</td>
<td>2008</td>
<td>Ridge augmentation not sinus augmentation</td>
</tr>
<tr>
<td>2</td>
<td>Mannai</td>
<td>2006</td>
<td>No control group</td>
</tr>
<tr>
<td>3</td>
<td>Steigmann and Garg</td>
<td>2004</td>
<td>No bone/bone substitute placed with PRP</td>
</tr>
<tr>
<td>4</td>
<td>Rodriguez et al.</td>
<td>2003</td>
<td>No control group</td>
</tr>
</tbody>
</table>

Studies were excluded in the systematic review as these studies failed to fulfill the inclusion criteria of type of study, participants, interventions and outcome variables.


SCHLÜSSELWÖRTER: Knochengewebsregeneration; Sinusanreicherung im Oberkiefer; Aufbau des Kamms im Oberkiefer; Anreicherung des Sinusbodens; Thrombozytreiches Plasma; Thrombozytenkonzentrat; TRP

ABSTRACTO: Antecedentes: A pesar de que el plasma rico en plaquetas (PRP) ha sido estudiado extensamente durante más de una década, no hay informes definitorios, que demuestren el beneficio de usar el PRP en los procedimientos para aumentar el seno. Además, no se ha hecho una evaluación sistemática de la literatura para informar el beneficio del resultado del tratamiento en pacientes que reciben PRP junto con hueso o sustitutos de hueso en los procedimientos de aumento del seno del maxilar. Por lo tanto, se puede afirmar correctamente que la evidencia de un beneficio adicional al usar PRP en injertos de hueso en procedimientos de aumento del seno es ambigua y no concluyente. Objetivo: El objetivo de este análisis sistemático del material publicado fue examinar los artículos existentes para determinar si el plasma rico en plaquetas (PRP) con hueso o sustitutos de hueso lleva a una regeneración del hueso más rápida y eficaz, clínica, radiográfica e histológicamente con los procedimientos de aumento del seno. M étodos: Se realizó una evaluación sistemática de las pruebas clínicas aleatorias de por lo menos 6 meses de duración para comparar el PRP y el hueso/sustitutos de hueso (grupo de prueba) con el hueso/sustitutos de hueso (grupo de control) solo. Se buscó en bases de datos electrónicos como MEDLINE y CENTRAL (Cochrane Central Register of Controlled Clinical Trials) para encontrar los artículos pertinentes. La lista de referencia de todos los artículos incluidos fue analizada junto con las pruebas clínicas no publicadas cuyos abstractos estaban disponibles. Resultados: A pesar de la falta de estudios en humanos, que muestren el beneficio al usar PRP junto con los materiales para el injerto de hueso, se puede afirmar que el uso de PRP lleva a una regeneración más temprana y reducción en el período de curación de los tejidos blandos y duros. Sin embargo, no se encontró ningún beneficio clínico ni estadístico que pudiera satisfacer el criterio de inclusión. Este estudio responde la pregunta muy claramente que en este momento no hay estudios humanos que justifiquen el beneficio en el uso de PRP en los procedimientos de aumento del seno. Conclusión: Existe escasez de pruebas controladas clínicamente sobre los beneficios del PRP en los procedimientos de aumento del seno. Teóricamente, parece producir efectos significativamente positivos en la curación del tejido blanco y duro; sin embargo, la disparidad en el diseño de los estudios, las técnicas quirúrgicas y diferentes variables usadas en la evaluación del resultado hacen que sea difícil evaluar el beneficio práctico de su uso clínico. A pesar de que no existe un efecto positivo obvio del PRP en la curación del material del injerto de hueso en los procedimientos de aumento del seno, mejoró el manejo del injerto de hueso de partículas.

PALABRAS CLAVES: Regeneración del hueso; aumento del seno del maxilar; aumento de la cresta del maxilar; aumento del piso del seno; plasma rico en plaquetas; concentrado de plaquetas; PRP
**RESUMO:** Histórico: Embora o plasma rico em plaquetas (PRP) tenha sido extensamente estudado por mais de uma década, não há relatos definitivos que provem o benefício de usar PRP em procedimentos de aumento da cavidade. Além disso, nenhuma revisão sistemática da literatura foi feita para relatar o benefício do resultado do tratamento em pacientes que receberam PRP em conjunto como osso/substitutos de osso em procedimentos de aumento da cavidade maxilar. Portanto, pode ser corretamente declarado que a evidência para benefício adjuntivo de usar PRP com enxertos ósseos em procedimentos de aumento da cavidade é equivocada e inconclusiva. Objetivo: O objetivo desta revisão sistemática da literatura foi examinar a literatura atual ao determinar se o plasma rico em plaquetas (PRP) com osso e substitutos de osso leva à regeneração do osso mais rápida e eficaz clínica, radiográfica e histologicamente com procedimentos de aumento da cavidade, e houve algum dado clínico paralelo a radiográfica e histologicamente com procedimentos de aumento da cavidade maxilar. Regeneração do osso; aumento da caviidade

**PALAVRAS-CHAVE:** PRP, regeneração do osso, aumento da cavidade maxilar, aumento do rebordo maxilar, aumento da superfície da cavidade, plasma rico em plaquetas; concentração de plaquetas; PRP

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**RUSSIAN / РУССКИЙ**

**АВТОРЫ:** Navneet S Arora, доктор хирургической стоматологии, магистр общественного здравоохранения, Thaminda Ramanayake, магистр естественных наук, Yan-Fang Ren, доктор хирургической стоматологии, доктор медицины, доктор философии, Georgios E Romanos, доктор хирургической стоматологии, доктор стоматологии, доктор философии

**РЕЗЮМЕ.** Из истории вопроса. Несмотря на то, что опыт активного изучения богатой тромбоцитами плазмы (PRP) насчитывает более десяти лет, однозначные сообщения, подтверждающие полезный эффект при использовании PRP в процедурах наращивания пазухи, отсутствуют. Кроме того, не было проведено ни одного системного обзора литературы, позволяющего сообщить об эффективности лечения пациентов с использованием PRP в сочетании с костной тканью/заменителями костной ткани в процедурах наращивания костной ткани в области пазухи. Поэтому можно обоснованно утверждать, что наличие дополнительного полезного эффекта применения PRP в сочетании с костными трансплантами в процедурах наращивания костной ткани в области пазухи не очевидно и не доказано. Цель. Целью данного системного обзора литературы являлось исследование современной литературы на предмет установления, способствует ли применение богатой тромбоцитами плазмы (PRP) в сочетании с костной тканью/заменителями костной ткани в процедурах наращивания костной ткани в области пазухи более быстрой и эффективной регенерации кости с клинической, рентгенографической и гистологической точек зрения, а также ведутся ли какие-либо клинические исследования, аналогичные экспериментам на животных, предоставляющие клинические данные по процедурам наращивания костной ткани в области пазухи? **Методы.** Был проведен системный обзор литературы, посвященной рандомизированным клиническим исследованиям длительностью минимум 6 месяцев; сравнивались две группы: с использованием PRP в сочетании с костной тканью/заменителями костной ткани (группа
Sinüs Ogmantasyon prosedürlerinde Trombositten Zengin Plazma: Sistematik bir literatür taraması: Bölüm II


ANAHTAR KELİMELER: Kemik regenerasyonu; maksiller sinüs ogmantasyonu; maksiller srt ogmantasyonu; sinüs ze min ogmantasyonu; trombositten zengin plazma; tromosit konsantresi; TZP

TURKISH / TÜRKÇE

YAZARLAR: Navneet S. Arora, DDS, MPH, Thaminda Ramanayake, MS, Yan-Fang Ren, DDS, MD, PhD, Georgios E. Romanos, DDS, Dr. med. dent., PhD

KLUÇEVİE SLOVA: koste regeneracija, na raşıvanije kostne tkani u oblasti dva verhnećesti pojavi, na rasšivanie verhnečestnog grebja, na rasšivanie dva pojavi, bogatá tromboцитами плазма, trom bočitarja masa, PRP
サイナスリフト処置における多血小板血漿：体系的文献評価：パートII

共同研究者氏名: ナヴネクト・S・アロラ (Navneet S Arora) DDS, MPH, サミンダ・ラマナヤケ (Thaminda Ramanayake) MS, ヤン・ファン・レン (Yan-Fang Ren) DDS, MD, PhD, ジョルジオ・E・ロマノス (Georgios E. Romanos) DDS, Dr. med. dent., PhD

研究概要:
背景: 多血小板血漿 (PRP) に関する広範囲におよぶ研究は過去10年以上にも及ぼし、サイナスリフト処置におけるPRP使用の利点を証明する決定的報告書は在りである。それゆえ、上顎骨サイナスリフト処置で骨欠あるいは代用骨とPRPを併用した患者の治療結果における利点を報告する体系的文献評価は今までにないことである。そこでサイナスリフト処置において骨移植にPRPを使用した場合の付加的貢献の証拠に関して、あいまいで結論に達していないと断言することもできる。

目的: 今回の体系的文献評価で目指すことは、現存文献からサイナスリフト処置での多血小板血漿(PRP)と骨片あるいは代用骨併用の臨床研究の各面で比較的迅速で効果的な骨組織再生につながるかを判断し、さらにサイナスリフト処置で臨床的証拠を提供する動物実験と並行した臨床データの存在を確認することである。

方法: 最低6ヶ月間の任意抽出臨床試験を体系的評価し、PRPと骨片もしくは代用骨併用（テストグループ）と骨片もしくは代用骨のみ（コントロールグループ）を比較した。MEDLINEやCENRAL（コクラン対照臨床実験登録）などのオンラインデータベースから関連記事を検索した。登録全文文献の参照リストと同時に、未発表だが入手可能な臨床実験研究概要も検査した。

結果: PRPと骨移植補材併用の利点を示す人体実験は不足しているものの、PRPを用いることで軟骨組織の早期再生に至る治療期間短縮が実現すると言及できる。ただし、研究では選択基準を満たす実証数あるいは臨床経過は報告されていない。当研究から現時点ではサイナスリフト処置でPRPを用いる利点を強調する人体実験が在在するが解明した。

結論: サイナスリフト処置において、PRPがもたらす利点の関連臨床的対照実験が不足している。理论上では軟骨組織治癒においてもわめて優れた効果が得られると考えられるが、研究企画や手術テクニックの異種性、そしてさまざまな成果の可変的評価などをふまえるとPRP臨床使用の実用的利点を評価することは困難である。また上顎骨サイナスリフト処置でPRPが骨補材治癒においてよりはるかに明確なポジティブ効果は記載されていないが、粒子骨移植法には改良が見られた。

キーワード: 骨組織再生; 上顎骨サイナスリフト; 上顎歯槽開増大術; 上顎洞底挿上術; 多血小板血漿; 血小板製剤; PRP

CHINESE / 中国語
富血小板血漿用於骨增髄術：系統性文献探討：第二部分

作者: Navneet S Arora, DDS, MPH, Thaminda Ramanayake, MS, Yan-Fang Ren, DDS, MD, PhD, Georgios E. Romanos, DDS, Dr. med. dent., PhD

摘要:
背景: 虽然富血小板血漿 (PRP) 已經被廣泛研究超過十年，但仍無確切的報告能證明使用 PRP 對骨增髄術的助益。此外，尚無系統性的文獻探討報告，提出有關在上顎骨增髄術時接受 PRP 結合骨 / 骨替代物的治療結果對病患的助益。因此，理所當然可以聲稱沒有明確與確定的證據可以證明使用 PRP 結合骨移植物於骨增髄術的輔助效益。

目的: 本系統化的文獻探討旨在檢視現有文獻在判定 PRP 結合骨和骨替代物用於骨增髄術時，在臨床上、放射學上以及組織學上是否能導致更快速及有效的骨質再生，以及是否有任何同等動物實驗的臨床數據可提供骨增髄術的臨床證據。
방 법: 6개월 기간 동안 수행된 무작위배정 임상시험을 체계적으로 검토하였다. MEDLINE 및 CENTRAL (Cochrane central register of controlled clinical trials)과 같은 전자 데이터베이스에서 관련 논문을 검색하였다. 포함된 논문들의 참고문헌 목록과 초록을볼 수 있는 미발간 임상시험 역시 검색하였다.

결 과: 본 연구에서는 PRP 사용의 유익성을 나타내는 임체 시험이 부족하였으나, PRP 사용 시 연조직과 경조직의 기능 유지성과 치유시간 감소 효과가 보였다고 보할 수 있다. 그러나, 선정 기준을 충족시킨 연구들에서는 통계적 유의성이 없어 임상적 유익성을 보이지 않았다. 본 연구는 현 시점에서 상악동 기상술 시 PRP 사용의 유익성을 강하게 다발성하는 임체 시험이 없음을 확실히 알게 해준다.

결 론: 상악동 기상술 시 PRP의 유익성에 관한 임상적으로 통계적으로 유의한 임상시험 자료는 불충분하다. 이론적으로 PRP는 연조직 및 경조직의 기능에 유의한 효과를 나타낸다. 그러나, 임체 시험이 수행되어 임상적 임상시험성과 평가가 불분명하다. 

키 워드: 금세포, 상악동 기상술, 상악치조절 기상, 상악동 저 기상술, 핵소판 농축협장, 농축협소판, PRP