ASDJ
AINSHAMS DENTAL JOURNAL

AIN SHAMS DENTAL JOURNAL
Official Publication of Ain Shams Dental School
Des. 2019 - Vol. XXII

Lateral sinus augmentation using L-PRF and xenograft: Radiographic and Histomorphometry analysis.

Corresponding author:

AL-Hassan Ahmed A. Diab, Co-authors: (Prof. Dr.Khaled A.Abd AlGhaffar, Dr.Waleed Mohammed Abbas, Ass.Prof. Dalia Mohey El-Din Ghalwash)***

Abstract: Sever maxillary atrophy occur after extraction of teeth in poster maxilla due to dimensional changes occurs after extraction, in addition sinus membrane pneumatization cause alveolar bone resorption, different classification for remaining alveolar bone in posterior maxilla were done. In this study we follow the ABC sinus classification. Sinus augmentation done with several techniques. Sinus membrane elevation done with two different approaches, either crestal approach or lateral widow approach. Using biofiller material for sinus membrane elevation have been tried by many researchers, using bone graft, platelet concentrates preparation, collagen membranes, tenting screws, or with implant tenting.

Aim of study: using L-PRF as sole graft material in sinus augmentation.

Subject and methods: In this study we perform sinus augmentation with lateral window approach using L-PRF as sole biofiller material in one group, xenograft as sole biofiller material in second group and mixed xenograft with L-PRF in the third group. Histomorphometric analysis was done from core biopsy after three months of augmentation and implant placement was done. After three months prosthetic parts were placed.

Results: this study shows that the augmentation of the sinus using L-PRF mixed with bone graft is showing the best results followed by L-PRF only and the least was xenograft.

** Assistant lecturer of periodontology British University B.D.S, MSc. Ain Shams University.*

*** Minister of higher education and scientific research in Egypt, Periodontology department Ain shams university, periodontology department British university in Egypt*

Conclusion: we can consider that using L-PRF as sole biofiller material can be used in sinus augmentation.

Introduction

Hard tissue defects resulting from trauma, infection, or tooth loss often lead to an unfavorable anatomy of maxillary and mandibular alveolar processes. Dental implant placement in the edentulous posterior maxilla can present difficulties because of a horizontal or vertical alveolar ridge deficiency, unfavorable bone quality, or increased pneumatization of the maxillary sinus. (**Karacayli et al., 2015)**

Implant placement in the posterior maxilla is a challenging procedure when vertical deficiencies occurred. Maxillary sinus elevation technique is a main surgical procedure which permits to augment the sufficient bone volume in posterior maxilla in order to place implants (**Paridah et al.,2016).**

To increase the amount of bone in the posterior maxilla, the sinus lift procedure, or subantral augmentation, originally presented in 1977 and subsequently published in 1980 (**Boyne et al., 1980**).

There is currently no single protocol to follow when planning this type of surgical operation: some variables such as the crestal height, the separation between the walls and the sinus pneumatization, the state of the membrane or the type of residual bone in the crest, affect the surgical indication and the techniques that must be adopted **(Chipaila et al., 2014).**

Lateral sinus lift is one of the most widely used augmentation procedures. It enables to make an implant in the dorsal parts of the maxilla, where the bone often has poor quality and is reduced by the extended maxillary sinus. When considering that the minimum safe length of the implant is 10 mm, the bone at the site of the first premolar is very low in one-fourth (25%) of patients. The bone is insufficient in more than half of patients at the level of the second premolar, and in 80 to 90% of patients at the level of molars **(Šimůnek et al., 2007).**

Sinus lift technique provides satisfactory and predictable clinical results. However, it requires a long healing time, delaying rehabilitation treatment which brings discomfort to the patients. L-PRF is a second-generation platelet concentrate that stimulates and accelerates tissue repair **(Boyne et al., 1980).**

L-PRF as grafting material develops new bone of better quality (histologically), but in a smaller amount (radiologically) than the bone obtained from the association of L-PRF and an allograft. The use of LPRF as unique filling material in sinus procedures could be a valuable treatment option **(Bölükba et al., 2013).**

Graftless sinus augmentation technique seems to be very predictable thanks to the osteoconductive principles on which it is based, and in association with the proper management of peri-implant soft tissue, so as to increase the amount of keratinized tissue, which could represent the new gold standard for this type of rehabilitation in the future **(Chipaila et al., 2014).**

The objective of this preliminary study was to compare the effect of L-PRF as unique grafting material in maxillary sinus lifting with delayed implant placement as second surgery to its association with a Xenograft material.

Aim of the Study

The purpose of the study was to describe the role of the Leucocytes and Platelet Rich Plasma as a biofiller material in lateral sinus augmentation and induction of the Schneiderian membrane osteogenic potential.

Subjects and Methods

Total patients were selected randomly from the outpatient clinic of Oral Medicine, Periodontology, and Oral Diagnosis department, Faculty of Dentistry, Ain Shams

University, and British University in Egypt.

SAMPLE SIZE ESTIMATION

For evaluation of lateral sinus augmentation using L-PRF and xenograft: Radiographic and Histomorphometric analysis, based on a pervious study and to determine the mean difference between the 3 experimental groups, A total sample size of 21 (7 for each group) will be sufficient to detect this effect size of f=0.89, a power of 80%, and a significance level of 5%.* **(Zhang et al. 2012).**

Eighteen patients (6 females and 12 males) aged 24-49 years old were blind randomized selected and divided into 3 groups as follow:

Group1:

Lateral sinus augmentation was performed for six patients using L-PRF as only biofiller material.

Group 2:

Lateral sinus augmentation was performed for six patients using xenograft particulates as only biofiller material.

Group 3:

Lateral sinus augmentation was performed for six patients using xenograft mixed with L-PRF as biofiller material.

Inclusions criteria:

1. Healthy adult patients.
2. Both sex, males and females.
3. Age from 24 – 49 years old.
4. All patients were free from any systemic diseases as evidenced by Burkett's oral medicine health history questionnaire.
5. Extraction done at posterior maxilla involved with the maxillary sinus.
6. Remaining alveolar bone ≤ 5mm vertically and ≥ 4mm horizontally and from 1.5 mm to 3.5 mm vertically.
7. Gingival biotype 1-2mm thickness.
8. Patient has no previous surgery in Maxillary antrum.

Exclusion criteria:

1. Smokers.
2. Pregnant and breast-feeding females.
3. Mentally retarded Patients.
4. Presence of hematologic disease.
5. Previous radiation, chemotherapy, or immunosuppressive treatments.
6. Diabetes mellitus, metabolic bone disease, ongoing treatment with bisphosphonates drugs, or pregnancy.
7. Patient with history of chronic sinus pathosis
8. Anticoagulant drugs, Endocarditis risk factors, renal and hepatic failure.

Pre-surgical Procedure:

All patients received an exhaustive explanation of the surgical procedure, the possible risks, and the alternative prosthetic solutions. Written informed consent was assigned by each participant. Cone Beam Computed Tomography (CBCT) radiographic X-Ray was done for all patients to assess the morphology of the remaining alveolar ridge and sinus lining level. Presurgical medication of the patients consisted of a chlorhexidine digluconate 0.2% mouth rinse for 2 minutes. Local anesthesia consisted of articaine 4% and epinephrine 1:100,000.*

Surgical phase: First surgery (sinus augmentation):

Following application of local anesthesia, a full thickness Para crestal incision was performed within the keratinized mucosa of the edentulous ridge using 15c blade**. The incision extended intra-sulcular to 1 or 2 mesially adjacent teeth. One vertical releasing incisions was made buccally at the mesial end of the crestal incision. The buccal full-thickness flap was elevated to gain a wide access using *BUSER's* mucoperiosteal elevator. A continuous releasing periosteal incision at the base of the buccal flap was done, to obtain at the end of the surgery, a completely tension free suturing.

A lateral window approach was done to get access to the sinus membrane (Schneiderian membrane) using sinus lift surgical kit*, after membrane elevation a bio-filler material was add to each group as mention in group divisions.

All cases went for tension free primary flap closure using a 5\0 polypropylene monofilament***

Post-surgical:

All patients had a post-operative regimen treatment (Amoxicillin/ clavulanic acid) @ starting 1 hour before surgery (2 tablets) and then 2 times a day for 1 week. Non-steroidal anti-inflammatory drug Diclofenac sodium; 50 mg@@ a tablet 1 hour before surgery and then tablet 3 times a day for 5 days, rinse twice daily for 14 days with an antiseptic and anti-inflammatory mouth wash@@@ Sutures removed 14 days after surgery.

CBCT was done 3 months later to re asses the augmentation surgery and measure new bone volume.

Second surgery (Core biopsy harvest and implant placement):

After 3 months all patients went for the second surgery in order to place dental implants. Trephine bur with 3 mm diameter was used to harvest core biopsy for histomorphometry analysis to examine new bone formation. Implant site preparation for osteotomy and implant placement was done for patients of group II and group III while group I lateral window approach and sinus elevation were performed for all patients due to insufficient bone height formation. Tapered form implant* design was placed with regular diameters and lengths.

Post-surgical protocol:

All patients had a post-operative regimen treatment (Amoxicillin/ clavulanic acid;) starting 1 hour before surgery (2 tablets) and then 2 times a day for 1 week. Non-steroidal anti-inflammatory drug Diclofenac sodium; 50 mg a tablet 1 hour before surgery and then tablet 3 times a day for 5 days, rinse twice daily for 14 days with an antiseptic and anti-inflammatory mouth wash. Sutures removed 14 days after surgery.

Leukocyte and Platelet Rich Fibrin (L-PRF) preparation:

The PRF preparation 10 ml of whole venous blood was collected in vacutainer tubes without anticoagulant. The vacutainer tubes were then placed in the centrifugal machine*. in less than one minute from blood collection at (2700 (rpm) for 12 minutes), after which it settles into the following layers: red lower fraction containing red blood cells, upper straw-colored cellular plasma and the middle faint line containing leucocytes called buffy coat. The upper straw colored layer is then removed and middle fraction is collected, 2 mm below lower dividing line, which is the PRF. Fibrinogen which is initially concentrated in the upper part of the tube, combines with the circulating thrombin due to centrifugation, to form fibrin Platelets are trapped massively in the fibrin meshes. A fibrin clot is then obtained in the middle of the tube, just between the red corpuscles at

the bottom and acellular plasma at the top part**. *(Pinto Et al 2013).***

Radiographic Analysis:

A Cone Beam Computed Scan (CBCT) was done six months after augmentation and 3 months after implant placement and before loading of final restoration to evaluate bone quality around the implant and compared with the pre-operative.

Each case under investigation was examined radiographically using CBCT Scanora 3DX* by using the smallest field of view(8×8cm) and high definition mode with exposure parameters of ; 60-90 Kvp , 4-10 m.A ,exposure time 4-10s,effective exposure time 2.4-6 s, and 0.5mm focal spot. The exposure parameters were considered fixed for all patients.

Histomorphometry Analysis

- From each Masson's Trichrome stained section, 3 fields were captured at original magnification 20X for measuring the area fraction of mature, immature and total bone in each field.
- All images were captured using digital camera (Canon, Japan) which was mounted on a light microscope (BX60, Olympus, Japan). Images were then transferred to the computer system for analysis. This was performed in the Precision Measurement Unit, Oral Pathology Department, Faculty of Dentistry, Ain Shams University. The histomorphometry analysis was performed using Image J, 1.41a, (NIH, USA) image analysis software.
- The mature bone stained red while the immature bone stained blue.
- The analysis was performed as shown in the table:

Conclusions

1. Using platelet concentrates as source of growth factor accelerates and improves soft and hard tissue healing around immediate dental placement.

2. L-PRF as source of growth factor can be used as biofiller material in sinus augmentation.

3. L-PRF as sole graft material in sinus augmentation show better results than using xenograft in new bone formation.

4. L-PRF when mixed with other biologic material as bone substitutes show better results in space keeping after sinus lifting procedure.

5. Using L-PRF as sole graft material opens discussion in power of blood clot advantage in healing and regeneration.

6. CBCT is reliable technique to measure bone volume (thickness, height and density).

References:

- \Sanja Umanjec-Korac, 2 Azin Parsa, 1 Aria Darvishan Nikoozad, 1 Daniel Wismeijer and 1 Bassam HassanAccuracy of cone beam computed tomography in following simulated autogenous graft resorption in maxillary sinus augmentation procedure : an ex vivo study. (2016), 1–5. https://doi.org/10.1259/dmfr.20160092
- Ab C, Meschi N, Temmerman A, Pinto N, Lambrechts P, Teughels W. Regenerative potential of Part B : sinus floor elevation , alveolar ridge preservation and implant therapy . A systematic review. 2017;(2014):225-234. doi:10.1111/jcpe.12658

- Access O. We are IntechOpen , the world ' s leading publisher of Open Access books Built by scientists , for scientists TOP 1 %. Long-Haul Travel Motiv by Int Tour to Penang. 2018;i(tourism):13. Accuracy of cone beam computed tomography in following simulated autogenous graft resorption in maxillary sinus augmentation procedure : an ex vivo study. 2016:1-5. doi:10.1259/dmfr.20160092
- Adibelli Z, Songu M, Adibelli H. Paranasal sinus development in children: A magnetic resonance imaging analysis. Am J Rhinol Allergy. 2011;25:30-35. doi:10.2500/ajra.2011.25.3552
- Aimetti M, Massei G, Morra M, Cardesi E, Romano F. Correlation between gingival phenotype and Schneiderian membrane thickness. Int J Oral Maxillofac Implants 2008; 23: 1128-1132 [PMID: 19216284]
- Ali S, Bakry SA. Platelet-Rich Fibrin in Maxillary Sinus Augmentation : A Systematic Review. 2015;XLI. doi:10.1563/AAID-JOI-D-14-00167
- AMLER MH, JOHNSON PL, SALMAN I. Histological and histochemical investigation of human alveolar socket healing in undisturbed extraction wounds. J Am Dent Assoc. 1960;61:32-44. doi:10.14219/jada.archive.1960.0152
- Anduze-Acher G, Brochery B, Felizardo R, Valentini P, Katsahian S, Bouchard P. Change in sinus membrane dimension following sinus floor elevation: a retrospective cohort study. Clin Oral Implants Res 2013; 24: 1123-1129 [DOI: 10.1111/j.1600-0501.2012.02520.x].
- Anitua E, Pascual C, Antequera D, et al. Plasma rich in growth factors (PRGF-Endoret) reduces neuropathologic hallmarks and improves cognitive functions in an Alzheimer's disease mouse model. Neurobiol Aging. 2014;35(7):1582-1595. doi:10.1016/j.neurobiolaging.2014.01.009
- Aoki N, Kanayama T, Maeda M, et al. Case Report Sinus Augmentation by Platelet-Rich Fibrin Alone : A Report of Two Cases with Histological Examinations. 2016;2016. doi:10.1155/2016/2654645
- Ardekian L, Oved-Peleg E, Mactei EE, Peled M. The clinical significance of sinus membrane perforation during augmentation of the maxillary sinus. J Oral Maxillofac Surg 2006; 64: 277-282 [PMID: 16413901 DOI: 10.1016/j.joms.2005.10.031]
- Article R. Open Sinus Lift Surgery and the Importance of Preoperative Cone-Beam Computed Tomography Scan : A Review. 2015;7(July):127-133.