CESPU
INSTITUTO UNIVERSITÁRIO
DE CIÊNCIAS DA SAÚDE

The comparison between conventional grafting materials and the graftless technique in the sinus lift with simultaneous implant placement

Iris Sarah Fernanda Malika Benani-Othmani

Dissertação conducente ao Grau de Mestre em Medicina Dentária (Ciclo Integrado)

—

Gandra, maio de 2023

CESPU
INSTITUTO UNIVERSITÁRIO
DE CIÊNCIAS DA SAÚDE

Iris Sarah Fernanda Malika Benani-Othmani

Dissertação conducente ao Grau de Mestre em Medicina Dentária (Ciclo Integrado)

The comparison between conventional grafting materials and the graftless technique in the sinus lift with simultaneous implant placement

Trabalho realizado sob a Orientação da
"Professora auxiliar do Mestrado Integrado em Medicina Dentária do IUCS-CESPU Cátia Reis"

CESPU
INSTITUTO UNIVERSITÁRIO
DE CIÊNCIAS DA SAÚDE

DECLARAÇÃO DE INTEGRIDADE

Eu, acima identificado, declaro ter atuado com absoluta integridade na elaboração deste trabalho, confirmo que em todo o trabalho conducente à sua elaboração não recorri a qualquer forma de falsificação de resultados ou à prática de plágio (ato pelo qual um indivíduo, mesmo por omissão, assume a autoria do trabalho intelectual pertencente a outrem, na sua totalidade ou em partes dele). Mais declaro que todas as frases que retirei de trabalhos anteriores pertencentes a outros autores foram referenciadas ou redigidas com novas palavras, tendo neste caso colocado a citação da fonte bibliográfica.

Agradecimentos

C'est avec une joie immense et le cœur ému que je dédie cette thèse à mes chers parents pour leur affection inépuisable et leurs précieux conseils. Je les remercies énormément de m'avoir soutenue, et ce depuis la Guadeloupe, dans mon projet d'études au Portugal et d'avoir été présents à chaque étape de ma vie. Sans eux, mon rêve de devenir dentiste n'aurait jamais pu se réaliser.

À ma sœur, Diane, pour son soutien et son attention, elle est une vraie source d'inspiration et a toujours été à mes côtés dans les moments difficiles.

À mon tonton Momo de Bordeaux, qui m'a toujours encouragé et soutenue.

Je remercie également mon binôme Jonas qui a partagé avec moi ces cinq années d'études, et tous mes amis, Emma, Romy, Clara, Benjamin, Laure et tous ceux qui ont fait partis de cette aventure au Portugal, nos moments magiques passé ensemble seront gravés à jamais dans mon esprit.

À mes amis de Guadeloupe, Julie, François, Léa, Océanne, Faress, Anaïs et tous les autres, je vous remercie du fond du cœur pour nos si belles amitiés.

Agradeço o corpo docente da CESPU, pelo seu acompanhamento durante estes 5 anos de estudo.

Gostaria particularmente de agradecer a minha orientadora de tese, Professora Doutora Cátia Arabela Albuquerque Costa Reis, pela disponibilidade, amabilidade e extraordinário apoio nesta dissertação.

CESPU
INSTITUTO UNIVERSITÁRIO
DE CIÊNCIAS DA SAÚDE

A comparação entre o Bio-Oss® e a técnica graftless na elevação do seio maxillar e colocação de implante em simultâneo

CESPU
COOPERATIVA DE ENSINO SUPERIOR POLITÉCNICO E UNIVERSITÁRIO

Benani I[1], Reis C[2]
[1]Estudante do 5°ano do Maestrado Integrado em Medicina Dentária do IUCS-CESPU
[2]Professora do Maestrado Integrado em Medicina Dentária do IUCS-CESPU

Introdução

A cirurgia de elevação do seio maxilar e colocação de implante em simultâneo está em constante evolução. O uso de enxertos ósseo na elevação do seio maxilar já está há muito estudada. Contudo há agora uma nova corrente cientifica onde existem bons resultados com a técnica graftless.

Objetivos

Determinar a técnica de eleição entre a técnica sem enxerto ósseo graftless e a técnica com enxerto de osso bovino usando o mais conhecido comercialmente no mercado, o Bio-Oss® para a elevação do seio maxilar e colocação do implante em simultâneo.

Materiais e Métodos

Determinar a técnica de eleição entre a técnica sem enxerto ósseo graftless e a técnica com enxerto de osso bovino usando o mais conhecido comercialmente no mercado, o Bio-Oss® para a elevação do seio maxilar e colocação do implante em simultâneo.

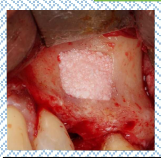
Resultados

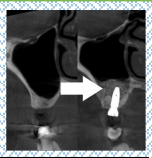
Dos 32 artigos selecionados pelo título e o abstract, excluímos 27 artigos que abordavam a técnica da elevação do seio maxilar em duas etapas, que não estudavam a comparação entre os dois biomateriais e os artigos antigos de mais de dez anos.

Discussão

Bio-Oss®

- Melhor em casos de grandes perdas de ósso para a estabilidade do implante
- Maiores riscos de infeção
- Disponibilidade illimitada
- Résorbção lenta que pode impactar o ósso neoformado
- Biocompatível



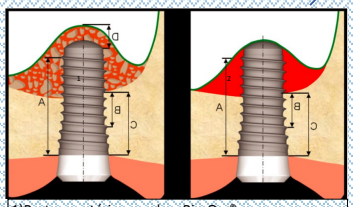


O Bio-Oss® usado como enxerto ósseo para a elevação do seio maxilar e colocação de implante em simultâneo.

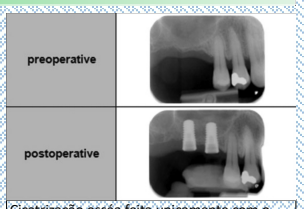
VS

Graftless

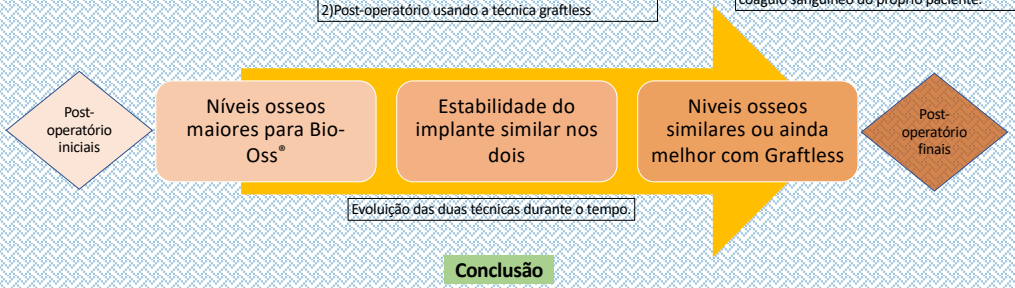
- Menos morbilidade
- Menor risco de infeção
- Mais barrato
- Melhor aceite pelo paciente
- Ostéoinductivel, osteoconductivel



1)Post-operatório usando o Bio-Oss®
2)Post-operatório usando a técnica graftless



Cicatrização ossea feita unicamente com o coagulo sanguíneo do próprio paciente.



Evoluição das duas técnicas durante o tempo.

Conclusão

O Procedimento graftless é gratificante para o clínico e especialmente para os pacientes, uma vez que reduz a duração total do tratamento, para a cirurgia da elevação do seio maxilar com a colocação de implante em simultâneo.

Bibliografia

1. Nedir, R., Nurdin, N., Khoury, P. & Bischof, M. Short Implants Placed with or without Grafting in Atrophic Sinuses: The 3-Year Results of a Prospective Randomized Controlled Study. *Clin Implant Dent Relat Res* **18**, 10–18 (2016).
2. Cara-Fuentes, M., Machuca-Ariza, J., Ruiz-Martos, A., Ramos-Robles, M. C. & Martínez-Lara, I. Long-term outcome of dental implants after maxillary augmentation with and without bone grafting. *Med Oral Patol Oral Cir Bucal* **21**, e229–e235 (2016).
3. Fouad, W., Osman, A., Atef, M. & Hakam, M. Guided maxillary sinus floor elevation using deproteinized bovine bone versus graftless Schneiderian membrane elevation with simultaneous implant placement: Randomized clinical trial. *Clin Implant Dent Relat Res* **20**, 424–433 (2018).
4. Qian, S. jiao *et al.* Long-term outcomes of osteotome sinus floor elevation with or without bone grafting: The 10-year results of a randomized controlled trial. *J Clin Periodontol* **47**, 1016–1025 (2020).
5. Nedir, R., Nurdin, N., Abi Najm, S., el Hage, M. & Bischof, M. Short implants placed with or without grafting into atrophic sinuses: the 5-year results of a prospective randomized controlled study. *Clin Oral Implants Res* **28**, 877–886 (2017).

CESPU
INSTITUTO UNIVERSITÁRIO
DE CIÊNCIAS DA SAÚDE

The graftless technique in the maxillary sinus lift elevation with simultaneous implant placement

Iris BENANI-OTHMANI[1], Cátia REIS[2]

1 Department of Dental Sciences, University Institute of Health Sciences – CESPU (IUCS-CESPU), 4585-116 Gandra, PRD, Portugal
2 Professora auxiliar do Mestrado Integrado em Medicina Dentária do IUCS-CESPU, UNIPRO – Oral Pathology and Rehabilitation Research Unit, University Institute of Health Sciences (IUCS, CESPU), 4585-116 Gandra, Portugal.

Introduction

The sinus lift surgery and simultaneous implant placement are in constant evolution.[1] The use of bone grafts in the sinus lift has long been studied. However, there is a new scientific trend where there are good results with the graftless technique.[2,3] Atrophy of the posterior maxillary sector can be successfully rehabilitated using the technique of sinus elevation with simultaneous implant placement without using bone graft materials.[4] This technique can offer patients less invasive surgery compared to traditional surgery. The graftless technique has several advantages over conventional sinus lifts, with bone grafting including less morbidity, a lower risk of infection, being less expensive, and better accepted by the patient.[5]

Objectives

Evaluate the advantages and disadvantages of using the blood clot of the patient as the only material in the maxillary sinus lift with simultaneous implant placement.

Methods

Search in the database of PubMed with the following keywords: "sinus lift elevation AND implant placement AND bone substitute".

Inclusion criteria:
- patients partially or totally edentulous in the posterior maxillary region in need of augmentation of the maxillary sinus floor in order to be rehabilitated using fixed prostheses supported by implant;
- patients with pathology-free sinus;
- patients without periodontal disease.

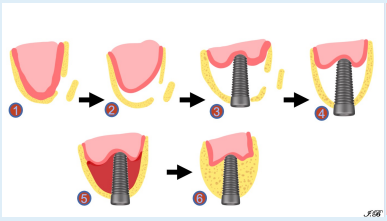
Exclusion criteria:
- patients with poor and inadequate oral hygiene;
- patients with systemic disease;
- heavy smokers (25 cigarettes a day).

Results

Of the 20 articles selected by title and abstract, we excluded 8 that dealt with the 2-stage technique in the sinus lift elevation, that did not study the technique without bone grafts, that were not ddealing with our inclusion and exclusion criteria, and articles older than ten years.

Discussion

How does it work?

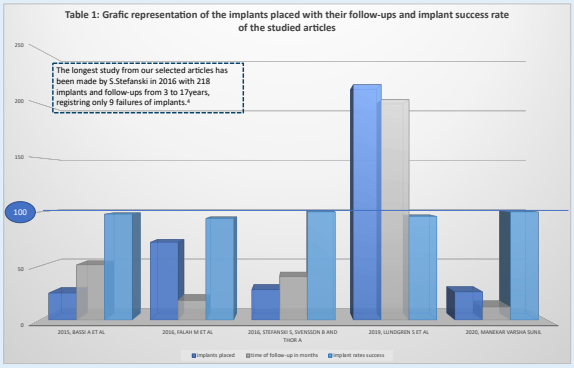


Schematic drawings of the cross-sectional aspect in the buco-lingual direction.

1. Before surgery
2. A dissected bone flap after osteotomy + elevation of the Schneiderian membrane
3. Positioned implant working as a tent pole
4. A replaced bone flap
5. Coagulum formation
6. Formation of new bone

Important numbers

Table 1: Grafic representation of the implants placed with their follow-ups and implant success rate of the studied articles



Benefits of the graftless surgery

- Less morbidity (no harvest zone)[1,3]
- Lower risk of infection[2,4]
- Less expensive[4,5]
- Better accepted by patients[1,2,3,4,5]

Conclusion

The graftless technique is rewarding for the clinician and especially for the patients, as it reduces the total treatment duration for maxillary sinus lift surgery with simultaneous implant placement.

Bibliography

ABSTRACT

Introduction: The sinus lift surgery with simultaneous implant placement (SLWSIP) is in constant evolution. The use of bone grafts in the SLWSIP surgery has long been studied. However, there is now a new scientific technique known as the graftless technique whith good outcomes.

Objectives: The aim of the study is to assess the interest and efficiency of the biomaterials used in the sinus lift with simultaneous implant placement. We want to set by side to side the graftless technique with bones substitutes one in order to compare their efficacity and to identify which one could be the preferable technique to increase the retention of the implant.

Material and Methods: A bibliographic search was conducted in the PUBMED database, between the years 2013 and 2023, in English, on human beings, using the following key words: (sinus lift) AND (implant placement) AND (bone substitute).

Results: The different search identified 590 studies, of which 38 were considered relevant to this study.

Discussion: Atrophy of the posterior maxilla can be successfully rehabilitated using the the SLWSIP with the graftless technique, this technique could offer patients a less invasive surgery compared to traditional surgery, implying a number of advantages such as: less risk of infection, less risk of morbidity, it is cheaper and thus better accepted by the patient.

Conclusion: The results of this articles are very promising but its use is still recent in dental surgeries, further studies are needed to improve this surgery technique.

Keywords: "sinus lift elevation", "simultaneous implant placement", "bone substitute", "maxillary sinus floor augmentation", "graft biomaterials", "bone grafting".

RESUMO

Introdução: A cirurgia de elevação do seio maxilar e colocação de implante em simultâneo está em constante evolução. O uso de enxertos ósseo na elevação do seio maxilar já está há muito estudada. Contudo há agora uma nova corrente cientifica onde existem bons resultados com a técnica graftless.

Objetivos: Determinar a técnica de eleição entre a técnica graftless sem enxerto ósseo e as técnicas com enxertos ósseos como osso autólogo, Bio-Oss®, ou com biomateriais como Platelet-Rich-Fibrin (PRF), Beta-Tricalcium Phosphate (B-TCP), alloplastic dental putty para a elevação do seio maxilar e colocação de implante em simultâneo.

Materiais e Métodos: Pesquisa na base de PUBMED, entre 2013 e 2023, em Inglês, com estudos feitos sobre humanos, com as seguintes palavras-chaves: (sinus lift) AND (implant placement) AND (bone substitute)

Resultados: Nas pesquisas foram identificados 590 estudos, dos quais 38 foram considerados relevantes para este estudo.

Discussão: A atrofia do sector posterior da maxila pode ser reabilitada com sucesso usando a técnica de elevação do seio maxilar e colocação de implante em simultâneo sem usar enxertos, essa técnica poderia oferecer aos pacientes uma cirurgia menos invasiva comparada à cirurgia tradicional, implicando uma série de vantagens como: menos risco de infeção, menos risco de morbilidade, mais barato e melhor aceite pelo paciente.

Conclusão: Os resultados destes artigos são muito promissores, mas a utilização da técnica graftless tem uma utilização recente nas cirurgias dentarias, e são necessários estudos futuros para melhorar esta técnica cirúrgica.

Palavras-chaves: “sinus lift elevation”, “simultaneous implant placement”, “bone substitute”, “maxillary sinus floor augmentation”, “graft biomaterials”, “bone grafting”.

General Index

GENERAL INDEX XIII

1. INTRODUCTION 1

2. OBJECTIVES AND HYPOTHESES 4

2.1 OBJECTIVES 4

2.2 HYPOTHESES 4

3. MATERIAL AND METHODS 5

3.1 INCLUSION CRITERIA 6

3.2 EXCLUSION CRITERIA 6

3.3 PICO QUANTITATIVE STUDY 7

4. RESULTS 10

5. DISCUSSION 27

5.1 GRAFT MATERIALS 27

5.2 SURGERY TECHNIQUE 33

5.3 COMPARISIONS OF THE BIOMATERIALS 36

6. LIMITS 53

7. CONCLUSION 54

8. BIBLIOGRAPHY REFERENCES 56

9. ANNEXES 60

Index of the figures

Figure 1. Fluxogram PRISM 2020 flow diagram for new systematic reviews which included searches of databases and registers only. 9
Figure 2: Sinus lift with simultaneous implant placement using autogenous bone as the graft material. Pictures from DR Luigi BERTAUD 27
Figure 3: illustration of the PRF membrane production from the blood patient. Pictures from Inara BELHAOUES 29
Figure 4: BioOss® used in the sinus lift with simultaneous implant placement. Pictures from DR Luigi BERTAUD 30
Figure 5: Schematic illustartion of the sinus lift with simultaneous implant placement using the graftless technique 34
Figure 6: Clinical photographs showing the sequence of sinus lift with the B-TCP graft and the simultaneous placement of the implants. Vertical Bone Gain after Sinus Lift Procedures with Beta-Tricalcium Phosphate and Simultaneous Implant Placement .... **Erreur ! Signet non défini.**
Figure 7: : radiographic evolution of sinus floor level over 3 years, Short Implants Placed with or without Grafting in Atrophic Sinuses: The 3-Year Results of a Prospective Randomized Controlled Study, Nedir et Al, 2015. 49
Figure 8: Radiographic measurments of crestal bone loss, endo-sinus bone gain, and proximal bone anchorage. Short Implants Placed with or without Grafting in Atrophic Sinuses: The 3-Year Results of a Prospective Randomized Controlled Study, Nedir et Al 2015. .. **Erreur ! Signet non défini.**

Index of the tables

Table 1: overview of the results of the selected articles for this study. 11

List of abbreviations

β-TCP: Beta-Tricalcium Phosphate

DBBMS: Deproteinized Bovine Bone Mineral Substitute

ESBG: Endosinus Bone Gain

ISQ: Implant Stability Quotient

LFSE: lateral approach to maxillary sinus lift elevation

MSSM: Maxillary sinus Schneiderian membrane

PRF: Platelet-Rich Fibrin

SLWSIP: Sinus Lift With Simultaneous Implant Placement

1. Introduction

In the past 40 years, sinus elevation surgery has come a long way. With possibilities of new horizons thanks to better understanding and material knowledge, today more emphasis is laid on techniques which are conservative, cost effect, and proficient with higher success rate. [1]

The loss of one or more maxillary posterior teeth is associated with dimensional alterations of the alveolar bone, not only there is bone resorption but also increased pneumatization of the maxillary sinus which in turn may lead to residual crest dimensions not compatible with implant placement.[1,2]

Resorption of bone in edentulous regions often requires augmentation before an implant can be inserted. Augmentation of the floor of the maxillary sinus is a well-established procedure used to increase the height of the bone in the atrophic posterior maxilla to allow placement of dental implants. [3]

Therefore, in order to obtain the minimum height required for dental implant placement, techniques such as the sinus lift associated with grafts are performed routinely.[4]

Sinus augmentation procedures using a variety of graft materials have been shown to be a highly predictable way to increase bone height in the posterior maxilla. [5]

Autogenous bone graft have long been considered as the "*gold standard*" to promote new bone formation due to their presumptive maintenance of cellular viability in maxillary sinus floor elevation surgery. [6,7]

However, intraoral or extraoral donor sites provide limited autogenous bone.[7]

Additionally, it has various drawbacks like limited availability, increased morbidity of patients, and the unpredictable resorption of the graft that can result in a lack of bone quality and volume.[8]

So scientists have tried to find an alternative bone substitute to reduce surgical complexity and morbidity.[7]

For these reasons, alternative materials have been sought that provide the same clinical results as autografts, have unlimited availability, avoid the complications of grafting, and are more cost effective.[8]

The alveolar recess of the maxillary sinus, due to sufficient blood supply and other anatomical properties, possesses a high osteoconductive potential. Thus, a sinus lift without grafted bone material or with an autologous graft is a very natural and attractive approach[9]

The choice of a biomaterial must fulfill several qualities: it should be biocompatible in the grafted site and should not induce an inflammatory reaction of the sinus mucosa, which could be deleterious to the whole surgical procedure. It must be integrated within the grafted areas by combining its resorption and its substitution by new bone. Resorption should be progressive to allow bone remodeling with apposition of lamellar bone.[6]

The biomaterial must be easy to use for the clinical practician and must afford the best technique and therapeutic post-operative conditions for the patients.

In this context, in our study, we will compare different biomaterials, used in conjunction or alone such as: autologous bone harvested in the patient, PRF (platelet rich fibrin) made from the patient's blood, xenograft material such as Bio-Oss®, we assume in this study that we will use the commercial name of this bovine bone biomaterial as all the articles studied deal with this commercial brand, β-TCP (beta-tricalcium phosphate), alloplastic putty and the graftless technique. The aim of this study is to find the ideal biomaterial for the sinus lift and the simultaneous dental implant placement comparing grafting techniques with the graftless technique.

2. Objectives and hypotheses

2.1 Objectives

- The aim of this systematic review is to assess the interest and efficiency of the bio materials used in the sinus lift surgery with simultaneous implant placement (SLWSIP).
- We want to set by side to side the graftless technique with the bones substitutes one, in order to compare their efficacity and to identify which one could be the preferable technique to increase the retention of the implant.

2.2 Hypotheses

- The hypothesis of this study was that the graftless technique was the best technique in the SLWSIP and could afford a good implant prosthetic rehabilitation.

- The null hypothesis tested was that the graftless technique in the SLWSIP surgery could not permit a good retention of the implant, thus could not afford a good prosthetic rehabilitation.

3. Material and Methods

This work is characterized as an integrative systematic review study, based on a literature search in PubMed database.

The aim was to collect as much as information as possible on the subject, using the following strategy, in isolation and combined by the operator AND so that the largest possible of articles is obtained.

Manual search: performed with the aim of further investigation, index journals were manually consulted to identify studies that could meet the search criteria.

The search criteria were there terminology in the medical index "dental journals" with the strategy of using maximum six key words.

- Search 1: (sinus lift elevation) AND (implant placement) AND (bone substitute)→ 20 results
- Search 2: (sinus lift) AND (implant placement) AND (sinus floor augmentation)→ 176 results
- Search 3: (sinus lift) AND (implant placement) AND (graft materials) → 122 results
- Search 4: (sinus lift) AND (implant placement) AND (biomaterials) → 58 results
- Search 5: ((maxillary sinus floor augmentation[MeSH Terms]) AND (dental implant[MeSH Terms])) AND (simultaneous dental implant placement)→ 18 results
- Search 6: ((maxillary sinus floor augmentation[MeSH Terms]) AND (dental implant[MeSH Terms])) AND (platelet rich plasma[MeSH Terms])→ 7 results
- Search 7: (((maxillary sinus floor augmentation[MeSH Terms]) AND (dental implant[MeSH Terms])) AND (bone grafting[MeSH Terms])) AND (BioOss®)→ 14 results
- Search 8: ((maxillary sinus floor augmentation[MeSH Terms]) AND (dental implant[MeSH Terms])) AND (bone grafting[MeSH Terms])→ 84 results

- Search 9: (((maxillary sinus floor augmentation[MeSH Terms]) AND (dental implant[MeSH Terms])) AND (bone grafting[MeSH Terms])) AND (beta tricalcium phosphate)→ 4 results
- Search 10: ((xenograft) AND (dental implant)→ 87 results

The selection of the articles followed the inclusion/exclusion criteria.

3.1 Inclusion criteria

The inclusion criteria involved are:

- studies in English,
- studies published in the last ten years, between 2013 and 2023,
- studies that evaluate the clinical process of grafting materials in the sinus lift and simultaneous implant placement,
- patients partially or totally edentulous in the posterior maxillary region in need for augmentation of the maxillary sinus floor in order to be rehabilited using fixed protheses supported by implant
- patients older than 18 years
- patients with good general health
- patient with pathology-free sinus
- patients without periodontal disease

3.2 Exclusion criteria

The exclusion criteria involved are:

- studies that did not meet the defined inclusion criteria,
- studies that are not written in English,
- studies published with more than ten years,
- studies that did not included the simultaneous implant placement,
- studies that did not concerned the sinus lift elevation,

- studies tested on non-human oral cavity
- patients with any contraindications to implant surgery
- patients with presence of active infection or inflammation in the area intended for sinus floor augmentation and implant placement
- patients with chronic nasal obstruction, sinusitis or other sinus pathologies
- patients with any signs of periodontitis
- patients with systemic disease
- patients with poor and inadequate oral hygiene
- pregnant or breastfeeding women
- patients with severe bruxism or clenching habits
- patients with alcohol or drug abuse
- heavy smokers (those who smoke equal to 25 or more cigarettes a day)

3.3 PICO Quantitative study

- Patient, Population or Problem

  What are the characteristics of the patients problem?
  - Inadequate alveolar bone density in the posterior maxilla to do an implant placement as a functioning implant-supported fixed partial prothesis.

  What is the condition or disease you are interested in?
  - Edentulous or partially edentulous patients in the posterior maxillary.

- Intervention or exposure

  What do you want to do with this patient?
  - Prosthetic rehabilitation with an implant placement simultaneously with the sinus lift surgery.

- Comparison

  What is the alternative to this intervention?

  - The comparison is between the bio-materials or without any graft material to find the one that leads to the best results.

- Outcomes

  What are the relevant outcomes?

  - Achieving a good implant placement in less time, with the ideal materials, minimizing the surgical trauma.

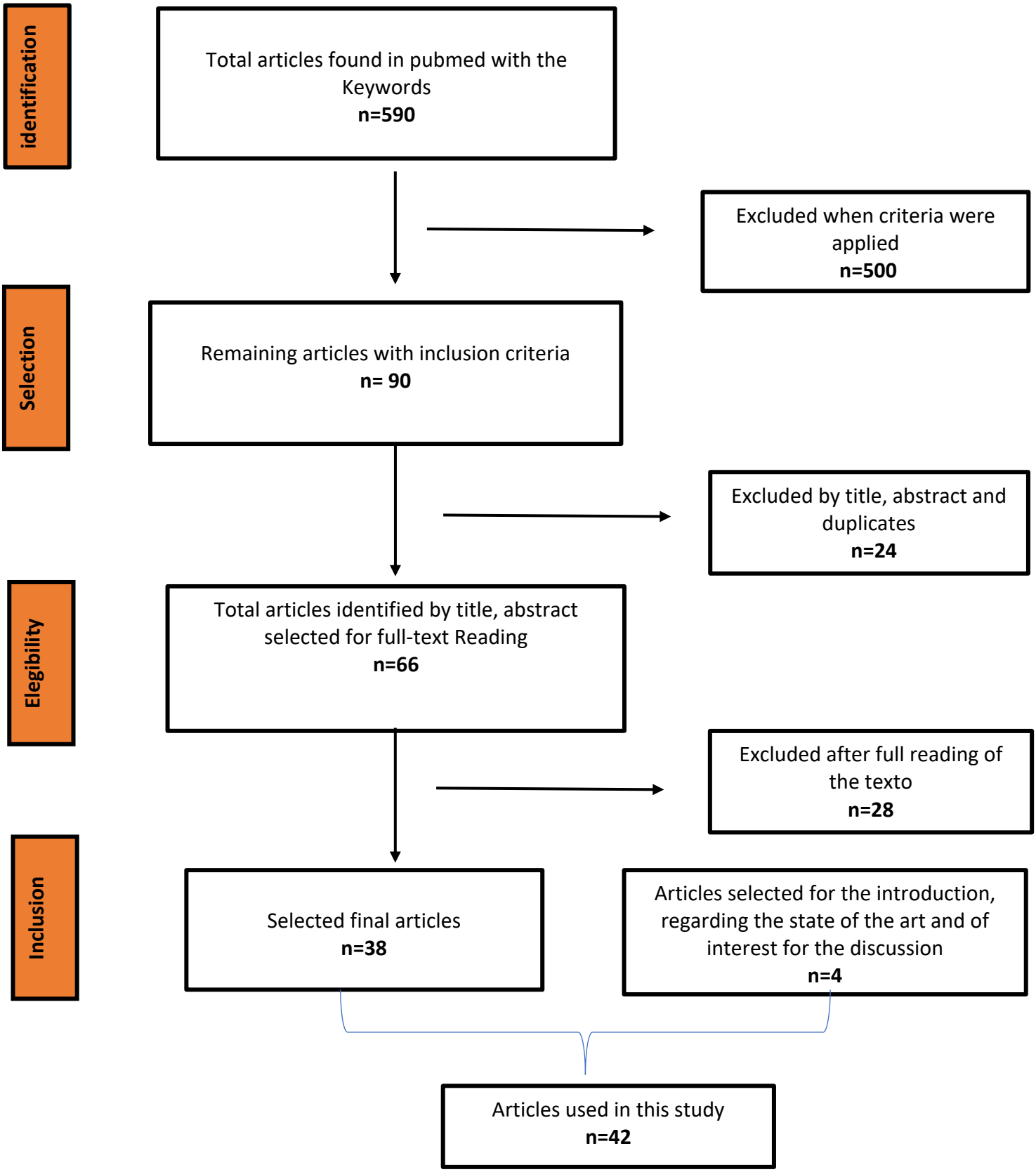


Figure 1. Fluxogram PRISM 2020 flow diagram for new systematic reviews which included searches of databases and registers only.

4. Results

The 38 selected articles obtained according the fluxogram (flowchart) for this study were read and individually evaluated regarding the objectives of this study. These final articles are presented in the following table, with general information such as title, author's names, year of publication, research methods, results and finally, conclusions.

Autologous

Authors and year	Titles	Materials and methods	Results	Conclusions
Mario Santagata, Umberto Tozzi, Gianpaolo Tartaro Vincenzo Santillo, Corrado Giovanni, Ettore Lamart, Angelo Itro, Giuseppe Colella, Salvatore D'Amato 2013 *J. Maxillofac. Oral Surg.*	Maxillary Sinus Augmentation with Autologous and Heterologous Bone Graft: A Clinical and Radiographic Report of Immediate and Delayed Implant Placement	35 patients were treated with maxillary sinus augmentation and 93 implant fixtures were installed. The height of the augmented sinus and the gain of bone volume were measured by Cone Beam CT Scan and intraoral radiographs immediately after augmentation and up to 48 months subsequently. Inclusion criteria were severe atrophy (<7 mm) of the alveolar process in the sinus area bi- or unilaterally. All patients received oral hygiene instructions before entering the study. After information about the procedure they were required to sign a consent form. Exclusion criteria: poor general health, severe renal/or liver disease, acute myocardial infarction within the past 12 months, uncontrolled coagulation disorders, uncontrolled metabolic diseases, radiotherapy to the head in the past 24 months, treatment with intravenous bisphosphonates or with oral bisphosphonates for 3 years, psychiatric problems, heavy smoking ([10 cigarettes/day), alcohol or drug abuse, maxillary sinus pathologies, oral infections, and uncontrolled periodontal disease.	The cumulative survival rate was 98.92 % in all 93 implants. Normal healing process without any complication was observed in all patients. The original sinus height was a mean of 4.52 mm (range 2.0–6.4 mm) and the augmented sinus height was a mean of 14.1 mm (range 12.0–16.5 mm) after the surgery. The bone volume gain had a mean of 9.613 mm (range 7–13 mm).	The sinus lift procedure with autologous bone graft harvested from the maxillary tuberosity combined with deproteinized bovine bone allows for a predictable outcome regarding the amount of bone formation in sinus floor augmentation and the immediate placement of implants, when possible, is recommended.
S.M. Meloni, S.A. Jovanovic, F.M. Lolli, C. Cassisa, G. De Riu, M. Pisano, A. Lumbau, P.F. Lugliè, A. Tullio 2015 *British Journal of Oral and Maxillofacial Surgery*	Grafting after sinus lift with anorganic bovine bone alone compared with 50:50 anorganic bovine bone and autologous bone: results of a pilot randomised trial at one year	20 sinuses with 1–4 mm of residual crestal height below the maxillary sinuses were randomized into two groups according to a parallel group design (n = 10 in each). Sinuses were grafted using a lateral approach. In one group the grafts were 50:50 anorganic bovine bone (Bio-oss®) and autologous bone and in the other anorganic bovine bone alone. After 7 months, 32 implants had been inserted. Inclusion criteria: the need to insert an implant in an atrophic posterior maxilla with a residual alveolar bone height of 1–4 mm, the patient was 18 years of age or older; the patient provided written informed consent, and there were no signs of a sinus cyst or active sinusitis. Exclusion criteria: any general contraindication to implant surgery; signs of periodontitis; bruxism; any signs of immunosuppression; a previous history of irradiation to the head and neck area; uncontrolled diabetes; smoking more than 10 cigarettes/day; poor oral hygiene; current or past treatment with bisphosphonates; substance abuse; psychiatric disorder; inability to complete a follow-up of 1 year; or lactation.	After 12 months, the mean (SD) marginal bone loss (mm) was 1.06 (0.61) in the 50:50 group and 1.19 (0.53) in the anorganic bovine group. The mean (SD) values for pocket probing depth (mm) and bleeding on probing (score) were 2.49 (0.38) and 1.59 (0.82) in the 50:50 group and 2.31 (0.64) and 1.36 (0.87) in the anorganic bovine group (neither difference was significant).	The results seem to confirm the first hypothesis that the clinical outcome of implants inserted in sinuses grafted with anorganic bovine bone alone compared with those grafted with 50:50 anorganic bovine bone and autologous bone, are comparable. Further controlled trials with more patients and longer follow-up are needed to provide better evidence, with the purpose of avoiding the use of autologous bone for grafting maxillary sinuses.

Table 1: overview of the results of the selected articles for this study.

Marcello Maddalone MD, DDS, Luca Mirabelli DDS Pier Matteo Venino DDS Lorena Karanxha DMD, PhD Gianluca Porcaro DMD, DDS Massimo Del Fabbro MSc, PhD 2018 *Clin Implant Dent Relat Res*	Long-term stability of autologous bone graft of intraoral origin after lateral sinus floor elevation with simultaneous implant placement	33 patients (mean age 56 years, range 46-68 years) who had undergone lateral approach to maxillary sinus floor elevation (LSFE) with intraoral autologous bone graft from mandibular ramus and simultaneous implant insertion were included. A minimum of 5 years of follow-up was required. The total peri-implant bone height was measured at mesial and distal aspects of the implants immediately after surgery (T0) and after a period ranging from 5 to 11.5 years after surgery (mean 7.65 1.80 years) (T1) on digital panoramic and periapical radiographs. « Wilcoxon matched-pairs signed rank test » was used to compare bone graft height at T0 and T1. The influence of patient, surgery, and implant-related factors on the outcomes was investigated. Inclusion criteria: patients older than 18 years, in general good health, patients with posterior edentulous maxilla in need for augmentation of the maxillary sinus floor in order to be rehabilitated using fixed prostheses supported by standard size implants (≥10 mm length); residual bone height in the posterior maxilla region intended for implant placement ranging from 4 to 9 mm as determined by preliminary diagnostic CT evaluation. In case the residual bone volume and density was sufficient to provide optimal implant primary stability, implant placement was performed simultaneously to the sinus lifting procedure. Exclusion criteria: presence of active infection or inflammation (maxillary acute sinusitis) in the area intended for sinus floor augmentation and implant placement; presence of systemic diseases such as uncontrolled diabetes or any disease affecting bone metabolism; patients immunosuppressed or immunocompromised; patients who underwent irradiation to the head and neck regions within 12 months before surgery; severe bruxism or clenching habits; pregnant or nursing women; inadequate oral hygiene (full-mouth plaque score and full mouth bleeding score >25%); and poor motivation to follow the protocol instructions and to regularly return at follow-up controls.	Of the 58 implants placed, no one was lost. All prostheses were in function, and no biological or mechanical complications occurred. The residual ridge height at the involved sites averaged 6.48 1.72 mm. The mean bone height at grafted regions was 12.05 2.47 mm at T0 and 12.13 2.39 mm at T1 (not statistically significant). Marginal bone level change at T1 averaged –1.22 1.60 mm. None of the evaluated factors significantly affected the results.	The use of autologous bone grafts from intraoral donor sites for LSFE and simultaneous implant placement excellent volume stability over time that may contribute to optimal outcomes of the procedure.
Yerko Leighton, DDS, Benjamin Weber, DDS, MSc,Eduardo Rosas, DDS,Nelson Pinto, DDS, and Eduardo Borie, DDS, PhD 2019 *The Journal of Craniofacial Surgery*	Autologous Fibrin Glue With Collagen Carrier During Maxillary Sinus Lift Procedure	12 patients who had lost their teeth in the region associated to maxillary sinus, with a bone remnant 3 to 5mm in height, were selected to perform a maxillary sinus augmentation with autologous fibrin glue and collagen membrane, placing the implant immediately. The patients were followed-up for a 3-year period, being evaluated every 6 months. Inclusion criteria:Adult patients, bone remnant between 3 and 5 mm, to achieve primary stability of implant, absence of active sinus pathology or contraindication of implants. 4. Bone width availability to plan an implant, 4.1 mm in diameter.	At the end of the 3-year follow-up period, 100% implant success was observed, with a mean of bone augmentation of 7.75mm. 3 maxillary sinus membranes were perforated and healed by using AFG and collagen membrane without identify any complication during the follow-up period.	The use of collagen carrier combined with autologous fibrin glue as a filling material during the maxillary sinus lift procedure may be a low-cost and reliable alternative that allows bone formation.

Platelet Rich Fibrin

Authors and year	Titles	Materials and methods	Results	Conclusions
Naofumi Aoki, Takeo Kanayama, Michinori Maeda, Koichiro Horii, Hironori Miyamoto, Keinoshin Wada, Yasutaka Ojima, Tsukasa Tsuchimochi, and Yasuyuki Shibuya 2016 *Case Reports in Dentistry*	Sinus Augmentation by Platelet-Rich Fibrin Alone: A Report of Two Cases with Histological Examinations	The first case was a 28-year-old female her general health was good and she was a nonsmoker and the second case was a 58-year-old man, he showed no systemic pathology and he was a smoker. Both underwent sinus augmentation using only PRF as the sole graft material with CT control, during implant replacement, a tissue sample was obtained from the site of augmentation with PRF and was evaluated histologically.	As a result, new bone formation was confirmed histologically in both cases. Our findings show that the use of PRF as a graft material during sinus floor augmentation induces natural bone regeneration. First case: lost of the implant due to parafuncional problems.	Based on these findings, at 24 months after surgery, the use of PRF alone should be sufficient to maintain natural new bone around protrusion implants into the sinus. Although PRF as the sole graft material is useful because it can be easily obtained, is cost-effective, and has the potential to promote natural bone regeneration, further studies with more cases will be required.
Takeo Kanayama, DDS, PhD, Koichiro Horii, DDS, PhD, Yasuko Senga, DDS, and Yasuyuki Shibuya, DDS, PhD 2016 *Implant Dentistry*	Crestal Approach to Sinus Floor Elevation for Atrophic Maxilla Using Platelet-Rich Fibrin as the Only Grafting Material: A 1-Year Prospective Study	27 patients (12 men and 15 women), 39 implants using PRF as a graft material. Panoramic radiography and computed tomography were used to measure the endosinus bone gain. Inclusion criteria: good general health or controlled medical conditions and participated with the physician's approval, the patient required implant treatment in the posterior maxilla;Cases with a residual bone height (RBH)between >0,5 >5 mm which was measured by CT. The patient agreed to not wear a removable prosthesis at the implantation site during the healing period; The patient agreed to complete at least 12 months of clinical follow-up.	The mean residual bone measurements before surgery in the SA and HA groups were 2.85 and 2.68 mm, respectively. The mean average bone gains for 1 year in the SA and HA groups were 4.38 and 4.00 mm, respectively. All patients completed the scheduled follow-up visits till the 1-year control period. None of the patients complained about pain, signs of suppuration, or sinus- related pathology. All implants were clinically stable, yielding a survival rate of 100%.	This 1-year prospective study showed that the use of PRF as the sole grafting material during simultaneous sinus lift and implantation is a safe and reliable method. PRF is an inexpensive biomaterial that could lead to endosinus bone gain. However, some recent studies have reported favorable results without using any grafting material. Long-term prospective studies are needed to evaluate the superiority of PRF as a grafting material over graft-free procedures. In addition, more randomized controlled studies are needed to understand how various factors, such as the length of the implant protruding into the sinus, types and amounts of grafting materials, and the implant surface, could affect endosinus bone gain.
Zhenzhen Liu, MS, Chunyan Li, DDS, PhD, Jing Zhou, BS, Xiaolin Sun, DDS, MS, Xue Li, DDS, PhD, Manlin Qi, MS, Yanmin Zhou, DDS, PhD 2018 *Medicine*	Endoscopically controlled flapless transcrestal sinus floor elevation with platelet-rich fibrin followed by simultaneous dental implant placement. A case report and literature review.	Endoscopically controlled flapless transcrestal sinus floor elevation using platelet-rich fibrin as the only grafting material and simultaneous dental implant placement. Patient: 26 years old female, with loss of the maxillary right first molar. She is in healthy conditions, and denied smoking and history of bruxism.	The results of this case indicate that simultaneous dental implant placement and endoscope-guided transcrestal approach to flapless sinus floor elevation using platelet-rich fibrin as the only grafting material is viable in the edentulous posterior maxilla. ISQ (implant stability quotient) value at 8 weeks after surgery: 72,6 12 weeks after: 76,6.	The use of the PRF reduced the healing period; and expanded the indications of the treatment of transcrestal sinus elevation. The period of treatment was reduced.
Hanchi Wang, MS, Jia Wang, DDS, Tianqi Guo, DDS, Xinxin Ding, MS, Wanqi Yu, MS, Jinghui Zhao, DDS, PhD, Yanmin Zhou, DDS, PhD	The endoscopically assisted transcrestal sinus floor elevation with platelet-rich fibrin at an immediate implantation	Patient : 25 years old healthy non-smoking female Patient was immediately subjected to implant after root extraction of the right second molar. The sinus floor elevation was performed under endoscopy. A 12mm-long implant was installed.	The mucosa of the maxillary sinus was raised, reaching a total height of 12mm. At 10 months after surgery, the hard and soft tissues were stable, and a full-ceramic crown was placed. The mucosal integrity and osteogenesis of the	Immediate implant and endoscope-guided sinus floor elevation through a transcrestal approach by using PRF as the only grafting material is viable in periapical infected sites with a residual bone height of less than 1mm. The advantages of this technique

2019 *Medicine*	of periapical lesion site, a case report	Before the surgery 30mL of blood was centrifuged to obtain PRF. During elevation, endoscopy was used to monitor the state of sinus membrane continuously.	maxillary sinus floor were observed through 3D reconstruction. These findings indicated that the implant demonstrated good stability and excellent osteogenic effect around the implant 10months after surgery ISQ(implant stability quotient)= 77,2 (standard ISQ = 70 at 6 months)	are as follows: immediate implantation avoids bone loss, transcrestal approach reduces, bone and soft tissue injury, PRF promotes tissue healing, postoperative adverse reactions of patients are reduced; and the indications of the treatment of transcrestal sinus floor elevation are expanded.
Horia Mihail Barbu, Stefania Andrada Iancu, Violeta Hancu, Daniel Referendaru, Joseph Nissan and Sarit Naishlos. 2021 *Membranes*	PRF-Solution in Large Sinus Membrane Perforation with Simultaneous Implant Placement-Micro CT and Histological Analysis	19 implants were simultaneously placed in the course of 9 maxillary sinus floor augmentation surgeries with PRF placed in the sinus cavity both for membrane sealing and sinus floor grafting. Radiological, histological and micro-CT analyses were performed. Implant survival was assessed every 6 months for 1 to 4 years, with a mean follow up of 1.8 years, after prosthetic loading. Inclusion criteria: Large Schneiderian membrane perforations (>15 mm) that cannot be sealed with any type of membrane by itself CBCT examinations performed preoperatively and postoperatively Bone width (minimum 5.5 mm) and bone height (minimum 3 mm) to ensure primary implant stability Exclusion criteria: Other materials than PRFs placed for sinus floor augmentation, patients who did not give their consent to harvest a bone core for histological analysis, patients who underwent a separated surgery for implant placement, bone width less than 5.5 and bone height more than 7 mm	Successful outcomes in terms of bone grafting and implant integration. Radiological examinations were performed on CBCT at 9 and 12 and 36 months postoperatively and revealed improved degrees of radiopacity. New bone formation was evidenced 12 months postoperatively on all the analyses effectuated. The mean gain in bone height of the sinus floor augmentation was 6.43 mm, with a maximum of 9 mm. The mean amount of vital bone obtained from histologic assessment was 52.30%, while bone volume/tissue volume ratio in micro-CT 3D had a mean of 50.32%.	PRF may be considered as an alternative treatment for a single surgery of sinus augmentation with simultaneous implant placement, even in complicated cases with significant sinus membrane tearing.
Shivendra Choudhary, Yashika Bali, Amrit Kumar, Vaibhav Singh, Ravpreet Singh, Kamal Nayan 2022 *Cureus*	Outcomes Following Hydraulic Pressure Indirect Sinus Lift in Cases of Simultaneous Implant Placement With Platelet-Rich Fibrin	24 patients (males and females) aged 18-74 years were assessed at 1 day, 1 week, 1 month, 3 months, and 6 months after surgery. Inclusion criteria: Subjects with no medical history; those with one or more missing maxillary premolars, first molar, or second molar with the alveolar ridge of 8 mm height on cone-beam computed tomography (CBCT) or orthopantomogram (OPG); those with low sinus; and those willing to consider dental implants as a tooth replacement option were included in the study. Exclusion criteria: were subjects with contraindications to surgery/local anesthesia, those with chronic nasal	The average mean height preoperatively was 5.573 ± 0.66 mm which showed a significant increase postoperatively to 9.603 ± 0.78 mm ($p < 0.001$). Mean sinus membrane lift was 4.8 ± 2.2 mm at six months. The implant stability quotient increased significantly at six months postoperatively from 69.07 ± 3.39 at the immediate postoperative time to 72.92 ± 2.714 at 6 months postoperatively ($p < 0.001$).	The current study suggests that minimally invasive indirect sinus lift with bone augmentation utilizing PRF increased residual alveolar ridge height and implant stability with fewer problems than previous sinus lift procedures in the posterior maxillary are.

		obstruction/sinusitis, immunocompromised subjects, uncontrolled diabetics, and those with a bone height of 4 mm.		
Yerko Leighton, DDS,Eduardo Rosas, DDS, Raphael Freitas de Souza, DDS, PhD, and Eduardo Borie, DDS, PhD 2022 *The Journal of Craniofacial Surgery* *Brief Clinical Studies*	Simultaneous Implant Placement and Sinus Lift Using Leukocyte-Platelet Rich Fibrin: A Retrospective 40-Month Study	21 implants in 20 patients (12 female, mean age 52 years-old) were included in the study. A lateral sinus floor elevation was performed and immediately the implant was placed and the maxillary sinus was filed with L-PRF clots as a single graft. Inclusion : All patients without any systemic indication for minor oral surgery or phlebotomy, as part of standard treatment. Eligible patients (any gender/sex, age > 18 years) should be partially edentulous, and missing teeth in the region associated to maxillary sinus. Ridge bone should have at least 3 mm in height, and 5 mm in width, as verified by clinical exam and preoperative CBCT.	The minimum implant stability quotient (ISQ) value was 56 with a mean of 61.1 (±3.53). During the surgery 2 membranes suffered noncritical perforations, which were covered with L-PRF clots. The mean bone height gain was 62.6%, observing that all the cases achieved at least 12 mm (original ridge plus grafted bone). This study has a 100% of the implants success, including the cases of sinus membrane perforation, observing no biological complications during 40 months of follow-up.	The use of platelet-rich fibrin clot as a single graft biomaterial during the maxillary sinus lift procedure combined with immediate implant placement may be a reliable clinical alternative, even to repair the sinus membrane.

Authors and year	Titles	Materials and methods	Results	Conclusions
Torres Garcia-Denche J, Wu X, Martinez P-P, Eimar H, Ikbal DJ-A, Hernandez G, Lopez-Cabarcos E, Fernandez-Tresguerres I, Tamimi F 2013 *J Clin Periodontol*	Membranes over the lateral window in sinus augmentation procedures: a two-arm and split-mouth randomized clinical trials	A two-arm and split-mouth randomized controlled clinical trial was performed on 104 and 5 patients respectively. In the two-arm study, antrostomy defects were membrane-covered in 66 procedures and uncovered in 69, before placing a total of 265 implants, in all cases the graft material Bio-Oss® when residual bone height was ≥4 mm, implants were placed simultaneously to sinus augmentation and followed up for 1 year. Bone biopsies from each sinus were histologically analysed 6 months later. The ridge height assessed by computed tomography (CT). Inclusion criteria: edentulous patients with insufficient bone height (<7 mm) in the posterior maxilla Exclusion criteria: patients with severe systemic disease, previous history of chronic sinusitis or who were pregnant, patients with diseases affecting bone, such as osteomalacia, Paget's disease, vitamin D deficiency, hyperthyroidism, cancer (excluding non-melanoma skin cancer), or alcoholism as well as those on corticosteroids, antiepileptic drugs, or bisphosphonates were also excluded. Smokers were included, but smoking habit was considered as confounder in the logistic regression analysis.	In the two-arm study, implant survival rates were similar (p = 0.08) in the membrane-covered (96.1%) and uncovered (94.2%) groups. In the split- mouth study, bone augmentation was similar in both groups (p = 0.52). Delayed implant placement (p = 0.04), thick Schneider's membrane (≥2 mm) (p < 0.01), treatment for hypertension (p = 0.04) and non-smoking (p = 0.01) seemed to be associated with lower risk of implant failure. Over the 278 implants placed, 265 implants survived and 13 failed, resulting in a 95.3% implant survival rate.	Implant survival in sinus lifting procedures could be influenced significantly by timing of implant placement, in this study, significant differences in implant failure were found between simultaneous and delayed placed implant, Schneider's membrane thickness, antihypertensive treatment and smoking habits, but not by antrostomy membrane coverage.
Xian ZHOU, Xiu Lian HU, Jian Hui LI, Ye LIN 2017 *The Chinese Journal of Dental Research*	Minimally Invasive Crestal Sinus Lift Technique and Simultaneous Implant Placement	11 patients underwent crestal sinus lift technique The mean residual bone height was 6.4 mm (range: 4.1 mm to 8.6 mm). Bio-Oss collagen was used as the graft material, and 12 implants were simultaneously placed after sinus augmentation. Radiographic and clinical examinations were conducted during follow-up. Inclusion criteria: residual bone height > 4 mm and < 9 mm, before surgery, all oral diseases were thoroughly treated. The systemic and local conditions were comparable with implant placement and the sinus floor elevation procedure.	All procedures were successfully performed with no obvious Schneiderian membrane perforation. The sinus floor was augmented with a mean height of 4.8 mm (range: 2.8 to 7.4 mm). 12 implants healed uneventfully with healing abutments. Peri-implant marginal bone was stable, with a mean follow-up of 49.4 months (range: 33 to 71 months). No complications were observed during follow-up.	According to the limited data collected in this study, the novel crestal sinus lift approach could effectively lift the sinus floor and reduce the incidence of postoperative complications. Results showed good primary stability of dental implants, and the mean of the sinus floor elevation was high with Bio-Oss®. Additional cases with long-term follow-up are needed to confirm and improve this crestal sinus lift technique.

Beta-Tricalcium Phosphate

Authors and year	Titles	Materials and methods	Results	Conclusions
Leonardo Trombelli, Giovanni Franceschetti, Claudio Stacchi, Luigi Minenna, Orio Riccardi, Rosario Di Raimondo, Alessandro Rizzi and Roberto Farina 2013 *J Clin Periodontol*	Minimally invasive transcrestal sinus floor elevation with deproteinized bovine bone or b-tricalcium phosphate: a multicenter, double-blind, randomized, controlled clinical trial	38 sites in 38 patients were treated with the Smart Lift technique in association with deproteinized bovine bone mineral substitute DBBMS (n = 19) or β-tricalcium phosphate, β-TCP (n = 19). The extent of the sinus lift (SL) and the height of the graft apical to the implant apex were assessed on periapical radiographs taken immediately after surgery and at 6 months following surgery. Inclusion criteria: age ≥18 years; systemic and local conditions suitable for implant placement and sinus floor elevation procedures; indication for the placement of at least one implant with a length of 8 mm or more simultaneously with transcrestal approach and patient willing and fully capable to comply with the study protocol, at least 6 months elapsed from tooth loss; residual bone height (RBH) (as intra-operatively assessed with the Probe Osteotome) amounting to 4 mm or more and absence of endodontic lesions at teeth adjacent to the implant site.	All 38 patients included in the study completed the experimental phase. 19 patients received DBBMS, whereas the remaining 19 patients received β-TCP. A significant graft remodeling was observed from post-surgery to 6-months in the β-TCP group. At 6 months after surgery, no implant failure was recorded, and the prosthetic rehabilitation was finalized at all implant sites.	The Smart Lift technique in conjunction with the additional use of either DBBM or β-TCP may provide a substantial elevation of the maxillary sinus floor along with limited post-surgical complications and post-operative pain/discomfort.
L. F. de O.Gorla, R. Spin-Neto,F. B. D. J. Boos, R. dos S.Pereira, I. R. Garcia-Junior, E. Hochuli-Vieira 2015 *Int. J. Oral Maxillofac. Surg.*	Use of autogenous bone and beta-tricalcium phosphate in maxillary sinus lifting: a prospective, randomized, volumetric computed tomography study	22 patients (16 women and six men, ranging in age from 40 to 77 years) with a total of 36 sinuses were operated on. Of the 36 sinuses, 12 were grafted with autogenous bone, 12 with β- TCP (ChronOS; DePuy Synthes, Paoli, CA, USA) mixed with autogenous bone in a 1:1 ratio, and 12 with B-TCP alone. inclusion criteria: panoramic radiograph taken before treatment planning, patients with edentulous posterior maxillary bone regions, a bone height of less than 5 mm, and who required bone augmentation for dental implant placement. Exclusion criteria: uncontrolled periodontitis, a sinus pathology, or the presence of a residual root in the maxillary sinus, smokers and patients who had received radiation treatment in the head and neck.	The results showed an average resorption of 45.7 +_18.6% for the autogenous bone group, 43.8+_18.4% for the autogenous bone + β-TCP group, and 38.3+_16.6% for the β-TCP group. No statistically significant differences in CBV were found between the biomaterials tested.	The similarity of β-TCP to autogenous bone in relation to the maintenance of the graft volume after 6 months for the anchoring of implants, suggests that β-TCP can be used safely for maxillary sinus lifting, with the advantage of not requiring a donor site, thus minimizing risks and avoiding morbidity.
Justine Loin, Jean-Daniel Kün-Darbois, Bernard Guillaume, Smail Badja, Hélène Libouban, Daniel Chappard 2019 *J Mater Sci Mater Med*	Maxillary sinus floor elevation using Beta-Tricalcium-Phosphate (beta-TCP) or natural bone: same inflammatory response	40 sinuses (20 patients) were included retrospectively and divided into 2 groups according to the biomaterial that was used: synthetic biomaterial (BTCP group), natural bone with a mix of Bio-Oss® and autologous bone (BONE group). A control group (CTRL group) was constituted by the non-grafted maxillary sinuses. Twelve measurements per sinus were realized on pre- and post-operative computed tomography and averaged to provide the sinus membrane thickness value. Computed tomography (CT) was performed before and six months after sinus augmentation in all participants. Exclusion criteria: sinus pathology, local or systemic infection, poor oral hygiene, metabolic or auto-immune disorders, history of chemotherapy, radiotherapy or immunosuppression, current or past anti-resorptive drug treatment, previous history of steroids or non-steroidal anti-inflammatory drugs.	Sinus membrane thickness value was thicker post-operatively in the BTCP and BONE groups in comparison with the CTRL group and in comparison with pre-operative measurements.	The use of a synthetic biomaterial (β-TCP) induced a local inflammatory reaction (edema) similar to a natural bone graft when used in sinus lift surgery. β-TCP granules can then be safely used for sinus augmentation with the advantage of not requiring a donor site and avoiding morbidity.

Juan Manuel Aragoneses Lamas, Margarita Gómez Sánchez, Leví Cuadrado González, Ana Suárez García and Javier Aragoneses Sánchez 2020 *Medicina (Kaunas)*	Vertical Bone Gain after Sinus Lift Procedures with Beta-Tricalcium Phosphate and Simultaneous Implant Placement A Cross-Sectional Study	128 sinus lift procedures (utilizing a synthetic ceramic containing 99.9% tricalcium phosphate as a bone substitute) and simultaneous implant placements were performed on 119 patients. The lateral window approach surgical protocol for maxillary sinus lift was performed on the patients. The implants were evaluated using cone-beam computed tomography (CBCT) at 6 months following placement. The vertical bone gain was considered a primary variable, while implant length, diameter, and location were considered secondary variables. Inclusion criteria: good overall systemic health; more than 20 years of age; need of a prosthetic fixed rehabilitation of unitary elements supported by implants; presence of edentulous spaces with sufficient keratinized gingiva in the maxilla; insufficient residual bone quantity in the maxillary sinus for implant placement; and sufficient residual bone quantity in horizontal (more than 4.5 mm from buccal to palatine bone) for the implant diameter. Exclusion criteria: presence of systemic disorders; sinusitis or other sinus pathologies; diagnosis of periodontal disease; bruxism; contraindication for oral surgical procedures; previous bone augmentation procedures in the maxillary region; individuals undergoing chemotherapy, radiotherapy or treatment with bisphosphonates; drug allergies; and pregnancy.	260 implants were placed, The average vertical bone gain obtained was 8.5 ± 0.3 mm per implant following maxillary sinus augmentation with β-TCP.	This study concluded that there was vertical bone gain with the usage of β-TCP in maxillary sinus lift surgical procedure with immediate implant placement and that implant variables like length and diameter had a significant influence on the average bone gain values. The implant position did not have a statistically significant influence but there was considerable variation in the bone gain between first, second premolar, and molar regions.
Hala A. Hamed, Ahmed M. Shaaban, Lydia N. Melek 2022 *Journal of Stomatology J Stomatol Oral Maxillofac Surg.*	Evaluation of trephine osteotomy technique in direct sinus lifting with simultaneous implant placement	12 patients were included and have been subjected to lateral sinus lifting using trephine osteotomy with simultaneous implant placement. A bone graft used in sinus floor augmentation has been prepared using autogenous bone resulting from implant site preparation in addition to β-tricalcium phosphate. Inclusion criteria: patients who needed implant placement in the posterior maxilla with residual bone height between 4 - 6 mm and ridge width ≥ 4 mm were included. Non-smoker patients with good oral hygiene, ages ranging from 20 –50 years. Patients confirmed to be free from any sinus pathoses. If patients had performed a recent extraction, it should have been performed at least 4 months before the sinus lifting procedure. Exclusion criteria : any sinus pathology, any medical condition compromises the surgery (uncontrolled diabetes, uncontrolled hypertension, metabolic bone disorders, immunocompromise, including HIV), heavy smokers (those who smoke greater than or equal to 25 or more cigarettes a day), active oral infections, poor oral hygiene, patients receive radiotherapy or chemotherapy.	After 6 months, the difference between the primary stability and implant stability was statistically significant p-value ≤ 0.05. After 6 months, the mean vertical bone height reached 11.71+_ 0.72 mm. The mean volume of the newly formed bone of the grafted area recorded after 6 months was 1126.7+_ 82.94 mm^3.	Trephine osteotomy technique in sinus lifting, and implant site preparation allows preservation of autogenous bone. It resulted in a satisfactory outcome in terms of postoperative pain, edema, implant stability, vertical bone height gained, and the volume of the grafted bone. A statistically significant bone height gain was obtained after 6 months of follow-up, the β-TCP was used for its osteoconductive effect

Putty

Authors and year	Titles	Materials and methods	Results	Conclusions
Kunal Jodia, Bipin S. Sadhwani, Babu S. Parmar, Sonal Anchlia, Shaili B. Sadhwani 2013 *J. Maxillofac. Oral Surg.*	Sinus Elevation with an Alloplastic Material and Simultaneous Implant Placement: A 1-Stage Procedure in Severely Atrophic Maxillae	All the 12 patients were partially edentulous with posterior maxillary alveolar ridge height of >5 mm and were in the age group of 20–50 years. Bioactive glass putty, bio-absorbable collagen membrane were used. Patients were evaluated clinically and radiographically 6, 18, 30 months after placement of implants to assess increase in residual ridge height, peri-implant condition (marginal bone loss, plaque and gingival index) and implant stability. Inclusion criteria: Age between 20 and 50 years, residual alveolar bone height above 5 mm at the edentulous posterior maxillary region, buccolingual and mesiodistal bone dimension should be <6 mm, quality of bone D3 and D4, a delay of at least 6 months between tooth extraction and an implant placement, absence of maxillary sinusitis, presence of normal healthy adjacent teeth or restored teeth. Exclusion Criteria: uncontrolled systemic illness, presence of periapical pathology, radiotherapy in maxillofacial region, oral destructive habit, debilitating temporomandibular joint pathosis, inadequate mouth opening which cannot allow placement of instruments necessary for implant insertion.	Increase in residual ridge height ranged from (71.43 to 133.33 %) as measured by Denta-Scan. Implant survival rate was 100 %. Marginal bone loss ranged from 0.68 to 1.22 mm. Implant stability was measured by periotest (-2.7 to -3.6). Only one patient had perforation of sinus membrane, but it was sealed satisfactorily by bio-absorbable membrane.	The use of this procedure is recommended in the posterior maxilla when the residual bone height >5 mm. Bioactive glass putty has several advantages like its cohesive and graft retentive properties, easy manipulation during surgery, no risk of immunogenic response and infection transmission and very low chances of graft infection because antibiotics readily penetrate into it due to its hydrophilic nature. Also, there is formation of bony tissues noted in the bone graft. Its only disadvantage is its high cost.
Udatta Kher, MDS, Ziv Mazor, DMD,Panagiotis Stanitsas, MSc and Georgios A. Kotsakis, DDS 2014 *Implant Dent*	Implants Placed Simultaneously With Lateral Window Sinus Augmentation Using a Putty Alloplastic Bone Substitute for Increased Primary Implant Stability: A Retrospective Study	17 patients who had been treated with simultaneous implant placement in sites with, 5 mm of vertical bone height using a modified direct sinus lift technique were included. Implants placed in adjacent sites with at least 5 mm of bone height were included as quasi-controls. Inclusion criteria: noncontributory medical history, smoking10 cigarettes per day, at least 6 months of postloading follow-up, and an implant site with ,5 mm of VBH preoperatively in each sinus. Exclusion criteria: history of acute sinus infection, history of previous maxillary sinus surgery, and/or medications that may affect bone healing (chronic steroid regimen, oral, or intravenous bisphosphonates, etc).	A total of 30 implants were inserted with a maximum insertion torque number <20 N/cm2. Logistic regression analysis failed to show any association between residual bone height and primary implant stability. Implant survival was 96,67% during a mean follow-up of 15,74 months post-loading	The placement of implants simultaneously with direct maxillary sinus lift in severely resorbed posterior maxillary sites using alloplastic bone substitute is a viable treatment option when adequate primary stability can be achieved.
Umesh Y. Pai, Shobha Rodrigues, Puneeth Hegde, Nikita Khurana 2017	Indirect Sinus Lift Done Using "Autogenous Core Lift" Technique in Combination with Alloplastic Phosphosilicate Putty in	36 years old female patient missing 26 Inclusion criteria: systemic health, no history of sinus pathosis, CBCT analysis revealed that the region of interest showed residual bone height to be around 4 mm	The patient was followed-up over a year after the procedure with clinical and radiographic evaluation, and the evaluated parameters were found to be within acceptable limits.	The autogenous core lift technique in conjunction with alloplastic calcium phosphosilicate putty and osteotomes allows for atraumatic indirect sinus lifts, thereby providing greater bone volume and stability in the posterior maxilla for predictable implant

Contemp Clin Dent	Atrophic Maxillary Posterior Region: A Clinical Report with 1-Year Follow-Up	Exclusion criteria: recent radiation therapy in maxilla, uncontrolled systemic diseases such as diabetes mellitus, Acute/chronic maxillary sinusitis, heavy smoker, alcohol abuse		therapy. A 1-year follow-up showed stable bone volume in the peri-implant area.
Dushyant Malik, Mohinder Panwar, Manab Kosala, Jacqueline Jacinta Dias 2018 *J Int Clin Dent Res Organ*	Comparative Evaluation of Efficacy of Calcium Silicophosphate Putty versus Particulate Xenograft in Maxillary Sinus Augmentation Procedure: A Clinical and Tomographical Study	20 patients with the residual alveolar bone height between 3.5 and 6.5 mm in the edentulous maxillary posterior region requiring direct maxillary sinus lift were selected for the study and divided into two groups. In Group A, calcium silicophosphate putty (NovaBone ® Dental Putty) was used as graft material and in Group B, particulate xenograft (Bio-Oss®) was used. In both the groups, simultaneous implant placement was done after maxillary sinus elevation. Patients were assessed radiographically (cone-beam computed tomography) after a period of 6 months for increase in bone height and density of new bone formed.	The mean increase in bone height postsinus elevation was found to be statistically significant with xenograft (9.8 ± 1.21 mm). It was also found that the new bone formed postsinus elevation was much more denser than existing bone in cases where xenograft was placed in cavity postsinus membrane elevation (759 ± 211 Hounsfield unit).	All the implants placed were successfully rehabilitated. Statistically significant difference was observed an increase in bone height and density of new bone formed with xenograft.
Cathryn Beryl Padma Felix, Anjana Kurien, Ashwin Devanarayanan, Deepak Kumar, Velliangattur Ramasamy Thirumurthy, Yuvaraja Arakonam Bindhoo 2022 *J Clin Transl Res*	Subantral sinus augmentation using hydraulic lift system and alloplastic phosphosilicate putty followed by simultaneous implant placement for the rehabilitation of an atrophic posterior maxilla: A case report.	The article presents the case of a 58-year-old partially edentulous female who underwent rehabilitation of the right maxillary molar region using the indirect sinus floor elevation technique. The hydraulic lift system was used followed by immediate implant placement. Cone-Beam computed tomography revealed that the available bone height from the alveolar crest to the sinus floor was 4 mm.	The use of the hydraulic lift system and the alloplastic phosphosilicate putty resulted in a sinus lift of 8 mm and an even distribution of the graft material; hence, immediate implant placement was performed. After 5 months of healing period, gain in vertical height from the crest of the ridge to the floor of the sinus was observed.	This technique incorporates the advantages of both the lateral wall and crestal approaches for sinus elevation and is associated with a lower incidence of sinus membrane perforation and minimum bone loss.

Authors and year	Titles	Materials and methods	Results	Conclusions
Mamit Kumar, Sumit Chopra, Debdutta Das, Monika Gupta, Jyoti Memoalia, Gaurav Verma 2018 *Ann Maxillofac Surg*	Direct Maxillary Sinus Floor Augmentation for Simultaneous Dental Implant Placement	14 patients who fulfill the inclusion criteria, 10 were male and 4 were female with PRF with Bio-OssTM. For each patient, bone level was assessed preoperatively and postoperatively after 1, 6, and 12 months with a panoramic X-ray and radiovisiography to evaluate the vertical bone height from the shoulder of the implant to the most apical end. Inclusion criteria: posterior edentulous maxilla with available vertical bone 3–5 mm, age between 18 and 65 years, ASA type 1 and 2 patients, and adequate quality of native bone to achieve primary stability. Exclusion criteria: patient who were chronic smokers, acute maxillary sinusitis, any condition, diseases, or medication that might compromise healing or osseointegration, any cyst/tumor, and patients who were treated with radiation therapy and severe bruxism.	12 months postoperatively, the endosinus bone gain noted was 7 mm, which indicated the use of PRF with bovine bone graft as a reliable filling material during simultaneous sinus lift and implantation.	PRF with bone graft (Bio-Oss) is used as an augmentation material after direct maxillary sinus lift, and the resulting bone formation was adequate for placement of dental implant.
Horia Mihail Barbu, Claudia Florina Andreescu, Monica Raluca Comaneanu Daniel Referendaru, and Eitan Mijiritsky 2018 *BioMed Research International*	Maxillary Sinus Floor Augmentation to Enable One-Stage Implant Placement by Using Bovine Bone Substitute and Platelet-Rich Fibrin	14 cases of one-stage sinus lift surgeries during which we placed 30 standard implants. Cone beam computed tomography (CBCT) was performed to measure the I bone height. PRF clots were prepared in two different ways: some were transformed in small fragments and mixed with particulate bone substitutes, obtaining an easy-to-use mixture as graft material, and others were transformed in membranes for covering the bone grafting material before wound closure. Inclusion criteria: posterior edentulous subjects with 4-5 mm of crestal bone height, pathology-free sinus, and being without active periodontal diseases. In all cases, the alveolar bone ridge was wide enough for simultaneous implant placement. Exclusion criteria: diabetes, hemocoagulation disorders, immunological deficiency, previous radiation therapy of the head-neck area, or patients undergoing treatment with bisphosphonates.	All patients were followed up after the 1st week, the 1st month, 3 months, and 6 months postoperatively. The mean vertical bone height gain was 10.12 mm, 6months after surgery, and the mean postoperative follow-up time was 43.79 months. Post-operative radiographic assessment revealed the presence of mineralized tissue in all cases without obvious signs of resorption.	No adverse effects or loss of implant was observed in any case during the follow up period and 6 months later. It can be concluded that one-stage sinus piezosurgery using particulate bovine bone substitutes and platelet-rich fibrin can be applied as a predictable and effective technique in the treatment of the posterior edentulous maxilla ensuring 4-5 mm vertical bone height.
Sebastian Dominiak, Ewa Karuga-Kuźniewska, Paweł Popecki, Paweł Kubasiewicz-Ross 2021 *Adv Clin Exp Med.*	PRF versus xenograft in sinus augmentation in case of HA-coating implant placement: A 36-month retrospective study	30 sinus lifts with simultaneous implantation were conducted with xenograft (group 1 (G1)) or PRF (group 2 (G2)) as a filling material. In each case, the measurements taken were probing pocket depth (PPD), height of keratinized tissue (HKT), clinical attachment level (CAL), recession depth/width (RD/RW), and, on panoramic X-rays, marginal bone loss (MBL), grafted sinus high (GSH), and bone gain (BG). Pre and post-operative treatment was applied to reduce the chance of infection. Inclusion criteria: a minimal width of 7 mm for the alveolar ridge in the region of interest, approximal plaque index (API) ≤35, and plaque index (PI) ≤25 Exclusion criteria: previous grafting procedures in the area of interest and systemic or local diseases that could affect the healing or osteointegration processes, smokers and patients with bruxism.	The survival rate of implants was 100% with no implant mobility, pain, paresthesia, or inflammatory processes in the direct vicinity of the implants observed, except in 1 patient. After 36 months of follow-up, the radiological assessments for G1were: GSH 4.5 mm, MBL 0.46 mm and BG 4.53 mm; and for G2: 3.4 mm, 0.6 mm and 3.4 mm, respectively. Results of the clinical measurements were for G1: HKT after 36 months (HKT36) 2.46 mm, CAL 0.47 mm and PPD 2 mm; and for G2: HKT36 3.13 mm, CAL 0.6 mm and PPD 2.07 mm.	After 3 years of follow-up, the results of sinus lifting solely using PRF with simultaneous implantation were promising, especially in terms of soft tissue management. Therefore, PRF can be regarded as an alternative to previously used materials.

Graftless

Authors and year	Titles	Materials and methods	Results	Conclusions
A. P. F. Bassi, R. Pioto,L. P. Faverani, D. Canestraro, F.G.K.Fontão 2015 *Int J Oral Maxillofac Surg*	Maxillary sinus lift without grafting, and simultaneous implant placement: a prospective clinical study with a 51-month follow-up	17 patients: 20 maxillary sinus regions were operated on and a total of 25 implants were placed. The sinus mucosa was lifted together with the anterior wall of the osteotomized maxilla and supported by the implants placed. Computed tomography (CT) scans were obtained immediately postoperative (Tinitial) and at 3 (T1) and 51 (T2) months postoperative for the measurement of linear bone height and bone density (by grey tones). Inclusion criteria: Patients who were systemically controlled, non-smokers, requiring rehabilitation in the posterior region of the maxilla, with a minimum of 5 mm of remaining alveolar ridge (mean 5.56 mm) confirmed by CT, and with no maxillary sinus pathologies.	Only 1 implant was lost in the first stage (96% success). After dental prosthesis placement and during up to 51 months of follow-up, no implant was lost (100% success, second stage). The difference in mean bone height between $T_{initial}$ (5.94 mm) and T_1 (13.14 mm), and between $T_{initial}$ and T_2 (11.57 mm), was statistically significant (both $P < 0.001$); comparison between T_1 and T_2 also presented a statistical difference ($P < 0.001$).	The results of this study, after a 51-month follow-up, show that the maxillary sinus lift technique with immediate implant placement, without the use of biomaterials, may be performed with a high success rate, reducing the surgical morbidity of autogenous grafts and some of the limitations of other osteoconductive grafting materials.
M. Falah, D.-S. Sohn, S. Srouji 2016 *Int J Oral Maxillofac Surg*	Graftless sinus augmentation with simultaneous dental implant placement: clinical results and biological perspectives	30 graftless sinus lifting procedures were performed and 72 dental implants placed in 18 consecutive patients. Clinical and radiological follow-up was conducted throughout the 6- month healing period. Biopsies of 30 cases were collected at 6 months post-treatment: 15 biopsies were taken from the newly formed bone near the basal floor and 15 from the newly formed bone near the elevated membrane. Inclusion criteria: patients physically healthy, with no medical history of systemic or local diseases, such as certain bone metabolism disorders that could contraindicate sinus or implant surgery. A ridge bone height of at least 4 mm, required for primary stabilization of the implants.	6.14 +-1.34 mm of bone-gain in the maxillary sinus was apparent 6 months after sinus augmentation, Based on histological analysis and histomorphometric data, the consolidated bone in the augmented sinus comprised 56.7+-11.9% to 59.9+-13.4% vital bone tissue.	Out of the 72 implants placed, only 4 failed, indicating a 94% overall implant survival rate. Based on this case series, blood clot can be considered autologous osteogenic graft material, to which osteoprogenitors can migrate, differentiate, and regenerate bone. The procedure was associated with a high success rate and reduced the surgical morbidity associated with autogenous grafts, as well as some of the limitations of other osteoconductive grafting materials.
Sebastian Stefanski Börje Svensson Andreas Thor 2016 *Clin. Oral Impl. Res.*	Implant survival following sinus membrane elevation without grafting and immediate implant installation with a one-stage technique: an up-to-	19 patients had sinus-lift with dental implants placement simultaneously inserted in the residual bone, creating a membrane elevation. Resorbable collagenous membrane was used to seal the lateral access of the maxillary sinus after implant placement. Clinical and radiological follow-up was carried out up to 40 months after implant installation. A total of 28 implants were placed, with an average residual bone height of 5.25 mm (SD = 1.48). Inclusion criteria: availability to participate in the study after the completed treatment, and there were no exclusion criteria.	All implants remained stable, with a survival rate of 100%. An increase in mean bone height of 4.75 mm (SD = 1.13) was gained. The marginal bone levels relative to the coronal aspect of the implant shoulder exhibited a mean change of 1.01 mm (SD = 0.49) from the baseline. Of the 19 patients, none showed a plaque index or gingival	This study indicates that with a moderate residual bone height and with a primary stability of the implants bone grafts or bone substitute materials may not be needed for augmenting the maxillary sinus floor when placing implants in this region, the study successfully demonstrated a new bone formation around the implants in the posterior part of the maxilla.

	40-month evaluation.		index greater than 2, and 14 patients showed no presence of plaque.	
Sofia Lundgren DDS Anders S Johansson MD, DDS, PhD, Giovanni Cricchio DDS, PhD, Stefan Lundgren DDS, PhD 2019 *Clin Implant Dent Relat Res.*	Clinical outcome and factors determining new bone formation in lateral sinus membrane elevation with simultaneous implant placement without grafting material: A cross-sectional, 3-17 year follow-up study	111 patients previously treated with graft-less SLWSIP. The first follow-up visit, which occurred after a mean of 5 years after surgery, included a clinical examination, cone beam computerized tomography, and panorama or intraoral radiography. The second follow-up included panorama or intraoral radiography, and it was conducted after a mean of 8 years. Inclusion criteria: patients treated with the same surgeon with graft-less LSFE between 2000 and 2010. Patient who accepts clinical investigations such as CBCT, panorama or intraoral radiography.	Overall, 218 implants were placed in 127 sinuses. Nine of the 218 implants failed resulting in an overall implant survival of 95.9%. The average bone gain at the follow-up was 4.0 ±2.0 mm.	The graft-less SLWSIP was found to be an excellent choice for sinus floor augmentation of the posterior edentulous maxilla where atrophy of the alveolar process compromises the possibilities for implant treatment. The implant-supported rehabilitation achieved using graft-less SLWSIP was stable over time, and there was no or little impact on sinus health. Furthermore, it was concluded that the new bone formation and the amount of bone gain is proportional to the length of the implant protruding into the sinus cavity.
Aditi Rawat, Himanshu Thukral, Anson Jose 2019 *Ann Maxillofac Surg*	Indirect Sinus Floor Elevation Technique with Simultaneous Implant Placement without Using Bone Grafts	A total of 26 implants were placed in 21 patients using indirect sinus lift with simultaneous implant placement without using bone grafts. Intra-oral periapical radiographs were taken to determine residual bone height, endosinus bone (ESB), and crestal bone level. Inclusion criteria: Patients who required implant treatment in the posterior maxilla, bone height between the crest and sinus floor was not ≥8 mm at least on one side of the implant. Exclusion criteria: Patients with a history of maxillary sinus disease, immunocompromised conditions, unrealistic expectations and psychological problems.	All the implants were clinically and radiographically stable at the end of 6 months follow-up. All the implants showed ESB gain, with mean being 1.97 mm and 1.99 mm on mesial and distal sides, respectively.	The findings of this study indicate that successful osseointegration is predictable using osteotome sinus floor elevation without bone graft. Spontaneous new bone formation seemed to be expected with implants placed using indirect sinus lift.
Varsha Sunil Manekar 2020 *National Journal of Maxillofacial Surgery*	Graftless crestal hydraulic sinus lift with simultaneous implant insertion	17 patients and 26 implants were inserted. the sinus floor sinus floor is filed with a blood cloth from surrounding bleeding. The clinical as well as radiological follow-up was during 1 year. The outcome variables were the gain in bone height and implant survival. Inclusion criteria: Physically healthy individuals with no systemic or local diseases which can contraindicate the implant or sinus surgery, subantral bone between 4 and 8 mm, patients with controlled diabetes mellitus, no sinus pathology. Exclusion criteria: Uncontrolled diabetes mellitus, smokers, history of repeated sinusitis, patients unfit for minor surgery.	Mean bone height gain is 5,6mm. Mean torque used 32mm. Mean age of the patients was 53 years.	Blood clot can be considered autologous osteogenic graft material, to which osteoprogenitors can migrate, differentiate, and regenerate bone. The graftless technique is predictable and safe for the sinus lift. The gain of up to 5-6mm of subcentral bone is possible.

Bio-Oss® VS Graftless

Authors and year	Titles	Materials and methods	Results	Conclusions
Rabah Nedir, DMD; Nathalie Nurdin, PhD; Paul Khoury, DDS, MS; Mark Bischof, DMD 2015 *Clin Implant Dent Relat Res*	Short Implants Placed with or without Grafting in Atrophic Sinuses: The 3-Year Results of a Prospective Randomized Controlled Study	8 millimeter implants were placed by OSFE (osteome sinus floor elevation) in sinuses randomized to receive anorganic bovine bone or no grafting material. Healing time before prosthetic rehabilitation was 10 weeks. Peri-implant bone levels were measured on standardized periapical radiographs. Inclusion criteria: Patient requires implant treatment in the posterior maxilla. Tooth extraction at the implant sites was performed at least 4 months before surgery. RBH between the alveolar bone crest and the sinus floor, measured on panoramic radiograph at each implant site, is 24 mm. OSFE is performed with or without grafting mate- rial according to the randomization process. Implants of 4.1/4.8mm in diameter and 8 mm in length are placed. Patient agrees to avoid wearing a removable pros- thesis at the implant site during the healing period. Absence of medical history of acute or chronic sinusitis. Absence of active periodontal disease, diabetes and metabolic bone disease.	37 implants (17 test, 20 control) were placed at a mean RBH of 2.4 +_ 0.9 mm. 3 implants failed during the 3-year follow-up. After 3 years, all implants had gained endosinus bone (test: 4.1 +_ 1.0 mm; control: 5.1 +_ 1.2 mm; $p = .001$). Mean bone gain was stable between 1 and 3 years in both groups.	Grafting is unnecessary to achieve bone augmentation of 4.1 mm; however, more bone is gained with grafting. Bone gained over 1 year was retained. Atrophic posterior maxillae can be predictably rehabilitated using OSFE and simultaneous placement of 8-mm implants.
Manuel Cara-Fuentes, Jesús Machuca-Ariza, Alberto Ruiz-Martos, Ma-Carmen Ramos-Robles, Ildefonso Martínez-Lara 2016 *Med Oral Patol Oral Cir Bucal.*	Long-term outcome of dental implants after maxillary augmentation with and without bone grafting	This is a retrospective study on 2 groups of patients who underwent elevation of the sinus membrane and simultaneous implant placement, in each group, 38 implants were placed. The grafting technique was applied to one group, while the other had no graft. An alveolar ridge height of 4 to 7 mm was necessary. Radiological control was undertaken at 6 months and one year post-prosthetic loading. In each group 38 implants were placed. Inclusion criteria: sinus elevation with bone reformation or grafting and simultaneous insertion of the implants, with an alveolar ridge height of between 4 and 7 mm; availability of at least the initial panoramic radiograph and the 1-year post-prosthetic-loading control radiograph; clinical control of the patient at least a year after the prosthetic loading; no irreparable sinus membrane perforation; and absence of any maxillary sinus pathology. Those cases lacking any of the inclusion criteria were excluded from the study.	No significant behavioural differences were observed in the implants. Implant failure was observed in 2 implants from the bone grafting group (success rate 93%) and in 1 implant from the reformation group (success rate 97%). In this group, bone formation was observed on both sides of each implant, the bone gain was measured using image management software (2.7±0.9mm mesial and 2.6±0.9mm distal). There was no correlation between mesial and distal bone gain and implant's length.	The graftless technique entails a series of advantages over conventional maxillary sinus elevation with subantral graft: it does not involve grafting, there is less morbidity, a lower infection risk, it is cheaper, and it is better accepted by the patient.
Rabah Nedir Nathalie Nurdin Semaan Abi Najm	Short implants placed with or without grafting	37 (17 test, 20 control) implants were placed in 12 patients in sites with a residual bone height (RBH) of ≤4 mm. Before surgery, sinuses were randomized to receive anorganic bovine bone (control) or no graft (test). After 10 weeks of healing, implants	3 failures occurred. The success rate was 91.9% (94.1% test, 90.0% control). All implants gained endo-sinus bone (3.8 1.0	Atrophic posterior maxillae can be predictably rehabilitated using OSFE with a simultaneous implant placement. The new bone formed

Marc El Hage Mark Bischof 2016 *Clin Oral Implants Res*	into atrophic sinuses: the 5-year results of a prospective randomized controlled study	were functionally loaded with single crowns. Bone levels were measured from standardized peri-apical radiographs. Inclusion criteria: patients who requires implant treatment in the posterior maxilla, tooth extractions at the implant sites were performed at least 4months before surgery, residual bone height <4mm, implants of 4,1/4,8mm of diameter and 8mm of length will be placed, the patient agrees to avoid wearing a removable prothesis at the implant site during all the healing period, absence of medical history of acute or chronicle sinusitis, sinus disease and previous sinus surgery, absence of periodontal disease, diabetes and metabolic bone disease.	mm test, 4.8 1.2 mm control; P = 0.004). Mean crestal bone loss (CBL) was 0.6 1.1 mm, without a significant difference between the groups (P = 0.527). Mean bone gain and CBL did not change significantly between 1 and 5 years (P = 0.249 and P = 0.293, respectively).	around implants after 1 year was stable after 5 years, irrespective of the presence or the absence of graft. Grafting was unnecessary to achieve an average bone augmentation of 3.8 mm, but more bone was gained with grafting.
Waleed Fouad BDS, MSc Ahmed Osman MSc, Mohammed Atef PhD Maha Hakam PhD 2018 *Clin Implant Dent Relat Res.*	Guided maxillary sinus floor elevation using deproteinized bovine bone versus graftless Schneiderian membrane elevation with simultaneous implant placement: Randomized clinical trial	17 patients and 20 sinuses where operated for sinus lift with simultaneous implant placement. Deproteinized bovine bone (Xenograft) was used as a filling material in control group while nongrafted sinus lifting was performed in the test group. Multislice CT was obtained preoperatively and CBCT were obtained immediately postoperative and 6 months after operation. Osstell readings were taken at the time of implant placement and implant exposure (6 months) Inclusion criteria: patients with missing upper posterior teeth and atrophic posterior maxilla having a residual bone height ranging from 4 to 6 mm and 18-year old or elder that can understand procedure. Exclusion criteria: patients who are heavy smokers, patients suffering from any sinus pathosis, and those suffering from any systemic disease or under any medication that may interfere with normal bone healing.	Mean bone height gain in the xenograft group was 8.59+_0.74 while that of the tenting group was 4.85+_0.5 and it was statistically significant (P < .05). Mean bone density values in the xenograft group was 375.59+_49.38 while that of the tenting group was 269.08+_16.27 and it was statistically significant (P<.05). Mean ISQ values for the xenograft group was 78.3+_5.08 while that of the tenting group was 74+_3.19 and it was statistically significant (P < .05).	Within the limitation of this study, sinus lift procedures with simultaneous implant placement using xenograft as a filling material or graftless technique are considered reliable procedures, however, the use of xenograft provide better results in all aspects regarding (bone height gain, bone density, and implant stability).
Shu-jiao Qian, Jia-ji Mo,Mi-si Si, Shi-chong Qiao, Jun-yu Shi, Hong-chang Lai 2020 *J Clin Periodontol*	Long-term outcomes of osteotome sinus floor elevation with or without bone grafting: The 10-year results of a randomized controlled trial	45 patients assigned into 2 groups: Group 1 (OSFE (osteomyelitis sinus floor elevation) with deproteinized bovine bone mineral) and Group 2 (OSFE without grafting). The patients were recalled at 1, 3, 5 and 10 years after surgery. Inclusion criteria: >18 years and in good health; partial edentulism in the posterior maxillae for at least 6 months from tooth extraction; available residual bone height from the alveolar crest to the sinus floor, ranging from 2 to 8 mm, as measured on the pre-treatment panoramic radiographs; sufficient alveolar bone width for the placement of implants with 4.1/4.8 mm diameter; sound antagonist teeth; absence of systemic and local conditions incompatible with implant placement and sinus floor elevation; and willing to provide informed consent and capable of complying to the study protocol. Exclusion criteria: uncontrolled diabetes mellitus, metabolic bone disease or other systemic disorders; untreated periodontal lesions, endodontic disease or other oral disorders; acute or chronic rhinitis or sinusitis; heavy smokers (10 cigarettes or more per day); insufficient implant stability; and previous implant failure or bone augmentation at the implant site.	40 patients attended the 10-year examination. 37 patients fulfilled the criteria of survival. Mean residual bone height was 4.58 ± 1.28 mm. The 10-year cumulative survival rate was 90.7% for Group 1 and 95.0% for Group 2. The PBH was 5.89 ± 1.24 mm for Group 1 and 5.74 ± 1.43 mm for Group 2 at 10 years. The ESBG (endosinus bone gain) of both groups remained stable after 3 years and was around 3mm at the end of the 10 years follow-up. 2/3 of the implants were free of hardware complications. No significant differences in MBL (marginal bone loss) and peri-implant tissue parameters were found.	Osteomyelitis sinus floor elevation, with or without grafting both yielded predictable clinical outcomes with similar PBH (peri-implant bone height)

Shuhuai Zhang, BD; Xiaoping Lu, BD; Zhimin Chen, BD 2022 *Altern Ther Health Med.*	Clinical effects of simultaneous implant placement in hydraulic maxillary sinus lift without bone grafting	68 patients went under sinus lift surgery with simultaneous implant placement and were divided in two groups, one receiving bone graft and one graftless. Inclusion criteria: >18years old, maxillary tooth absence, had occlusal spacing of that missing-teeth area that was greater than 4mm, and had detailed case data available. Exclusion criteria: any tumors, cardiovascular or cerebrovascular diseases, autoimmune disease or organ dysfunction, osteoporosis or osteosclerosis; had received radiotherapy, chemotherapy, surgerv, or antibiotics within the six months prior to admission, had a drug allergy, and weren't successfully followed up for the prognosis evaluation.	The graftless group had a significantly lower incidence of postoperative adverse reactions, lower intraoperative blood loss, and shorter operation time than did the control group (al P<.05). After surgery at week I, the graftless group showed significantly lower levels of inflammatory factors than the control group did (all P<.05). Postoperatively at month 6, the intervention group had a significantly higher implant retention rate than did the control group (P<.05).	Simultaneous implant placement without bone grafting can deliver favorable therapeutic effect, with a high safety profile, which can effectively optimize the surgical process, improve patients post-operative feelings, and reduce surgical expenses, making it easy to popularize clinically.

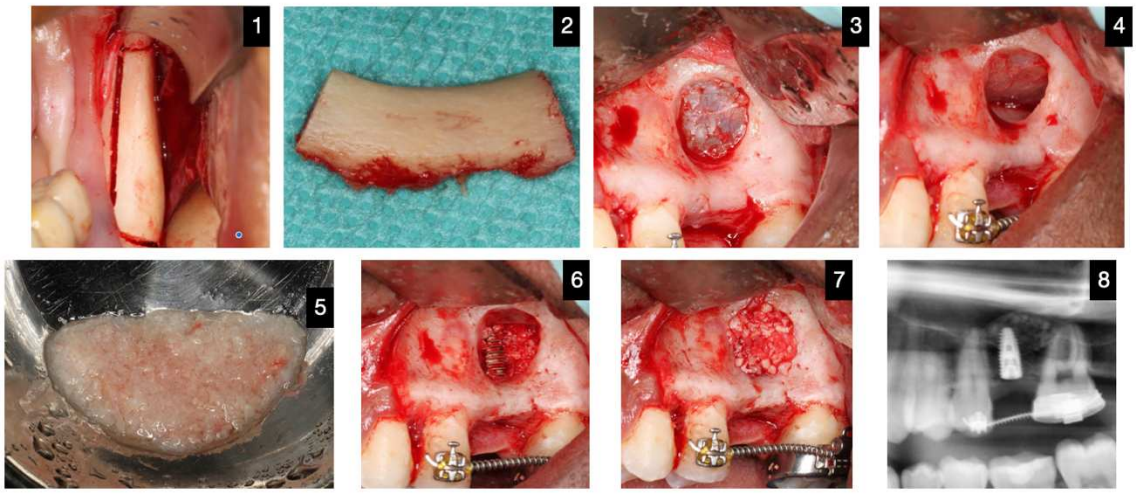
5. Discussion

5.1 Graft Materials

Autogenous bone

The use of autogenous bone grafts has a long history of clinical success in sinus augmentation procedures due to its unique osteoinductive, osteoconductive, and osteogenic properties. Autogenous bone is considered "the gold standard" bone graft. Autogenous bone graft involves harvesting bone from another site in the patient's body such as the iliac crest of the hip or the femoral bone and transplanting it into the sinus cavity to provide a framework for new bone growth.

Intraoral autologous bone could be harvested from mandibular symphysis, mandibular ramus, retromolar trigone, and tuber maxillae. The mandibular symphysis provides excellent quantity of bone, and generally is even able to offer a greater bone volume compared to the mandibular ramus.



1. Removal of autogenous bone in the retro-molar area
2. Autogenous bone harvested
3. Window access to the sinus
4. Elevation of the sinus membrane
5. Autogenous bone crushed moisten with physiological serum and collocated in the space created
6. Implant placement
7. Addition of autogenous bone
8. X-ray of the implant placed in simultaneous with the sinus lift elevation using autologous bone

Figure 2: Sinus lift with simultaneous implant placement using autogenous bone as the graft material. Pictures from Dr Luigi BERTAUD

lip and mental region. Compared to the symphysis, the use of the mandibular ramus as

donor site is normally associated with less postoperative morbidity and with a lower risk of complications such as dehiscence and infection of the surgical wound, gum recession, and especially neurosensory disorders. [10]

PRF (Platelet-Rich Fibrin)

PRF was firstly reported by Choukroun in 2001, and ever since, the concentrate has found wide application in oral surgery.[11]

The process to obtain PRF begins with venous blood from the patient being centrifuged immediately after collection without anticoagulants. With this procedure, coagulation starts during centrifugation. Centrifugation divides the blood sample into 3 parts: a red blood cell base at the bottom, an acellular plasma as a supernatant and a PRF clot in between. The PRF clot is transformed into a membrane through compression.[9]

PRF is a bio-graft material that is an autologous fibrin matrix with leukocyte and platelet growth factors that stimulate the differentiation and proliferation of osteoblasts, showing that PRF has regenerative potential.[12]

PRF has a 3D fibrin scaffold structure that is rich in platelets and various cytokines, which can effectively promote the regeneration of soft and hard tissues and control the inflammatory reaction.[13]

It is easy to handle and to procure. The biological attributes of PRF membranes include the impact of numerous viable blood cells, but also the capacity for cell proliferation and cell adhesion of PRFs in healing process and overall tissue engineering.[11]

It protects the sinus membrane from perforation during elevation of the membrane and helps maintain sufficient height for bone formation. Several reports have described significant bone gain after sinus floor elevation using PRF.[14]

One of the important disadvantages to be mentioned include the long-term period required for new bone formation and the unpredictable results of future augmented height, resulting from rapid PRF degradation.[11] The composition of PRF can vary depending on the patient's age, gender, and medical history, as well as the technique used to prepare it. Also, compared to other grafting materials, PRF must be used immediately after preparation and cannot be stored for future use. Although the risk of infection is low, there is always a risk associated

with any surgical procedure such as external factors that can influence the final result including the use of PRF.

Figure 3: illustration of the PRF membrane production from the blood patient. Pictures from Inara BELHAOUES

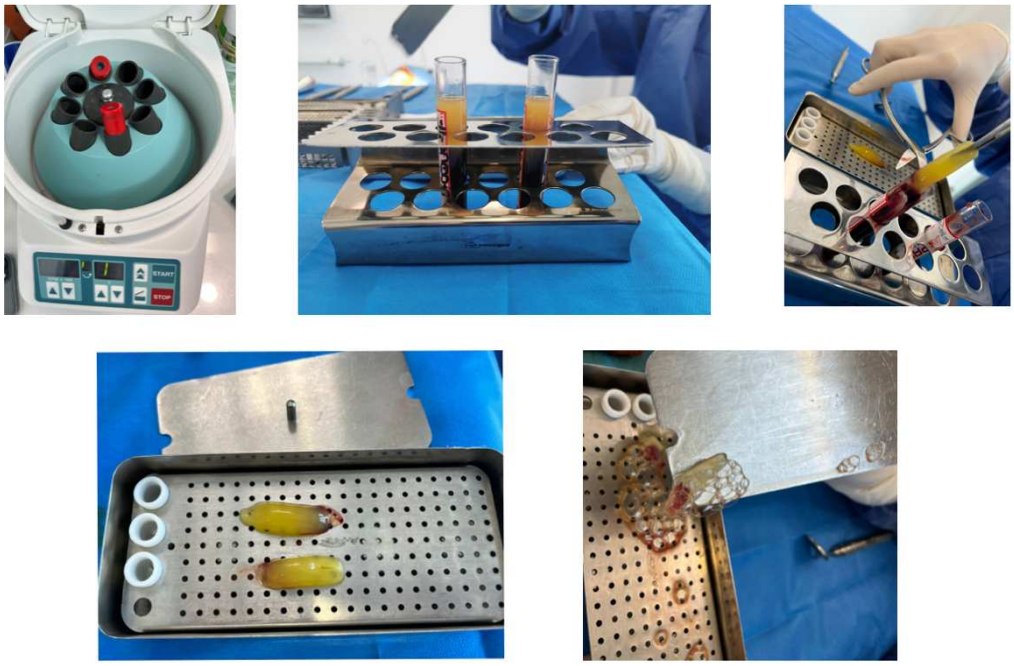


Illustration of the PRF membrane production process from the blood of the patient

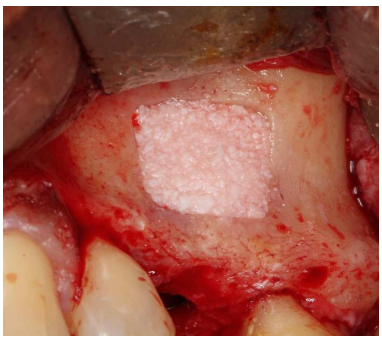
Deproteinized Bovine Bone (Bio-Oss®)

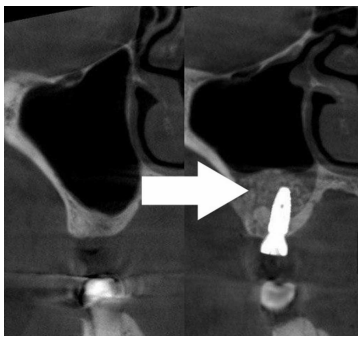
Although autogenous bone is considered an option for bone grafts in oral surgical procedures, some disadvantages, such as a second surgical site, a limited amount of bone in intraoral sites, and donor-site morbidity, should be considered.

Xenografts, are the most popular bone substitutes used in maxillary sinus floor elevation, surgery (MSFES), especially those produced from inorganic bovine bone, [7]

Bio-Oss® is easy to handle and can be easily formed into the desired shape which leads it to be the best known commercially and the most used worldwide.

Bio-Oss® is a type of dried deproteinized bovine bone mineral with a porous structure similar to autogenous bone. [7] The deproteinized bovine bone mineral substitute is one of the most commonly used material for augmenting the sinus after membrane elevation, it has an osteoconductive potential which provide a stable structure along which angiogenesis and osteogenesis can take place, it has been reported that new bone formation occurs near to the bovine bone particles and there was a close contact between these particles and the newly formed bone histologically. [15]





Deproteinized bovine bone (BioOss®) used as the graft material in the sinus lift with simultaneous implant placement.

Figure 4: BioOss® used in the sinus lift with simultaneous implant placement. Pictures from Dr Luigi BERTAUD

Beta-Tricalcium Phosphate

In recent years, the use of beta-tricalcium phosphate (β-TCP) as a synthetic material for sinus grafting procedures has received increasing attention in implant dentistry, making it one of the most popular substitutes for bone augmentation, due to the similarity of its structural composition to that of human bone.[16] β-TCP is the most used synthetic biomaterial for bone reconstruction in maxillofacial surgery. It is biocompatible, and presents good bioresorption and osteoconductive properties.[17]

The bioresorption process into the organism, leads to a liberation of ions of calcium and phosphate that are necessary for new bone formation.

This alloplastic biomaterial has osteoconductive properties, allowing the osteoprogenitor cells to proliferate throughout the bone surface and inside its pores; these later differentiate

into osteoblasts that will produce bone. [16] One of the most known worldwide are Ceros® and ChronOs®.

The β-TCP is cheaper than the other biomaterials usually used. Although the β-TCP induce bone regeneration, the healing process may be longer with β-TCP than with the other biomaterials.

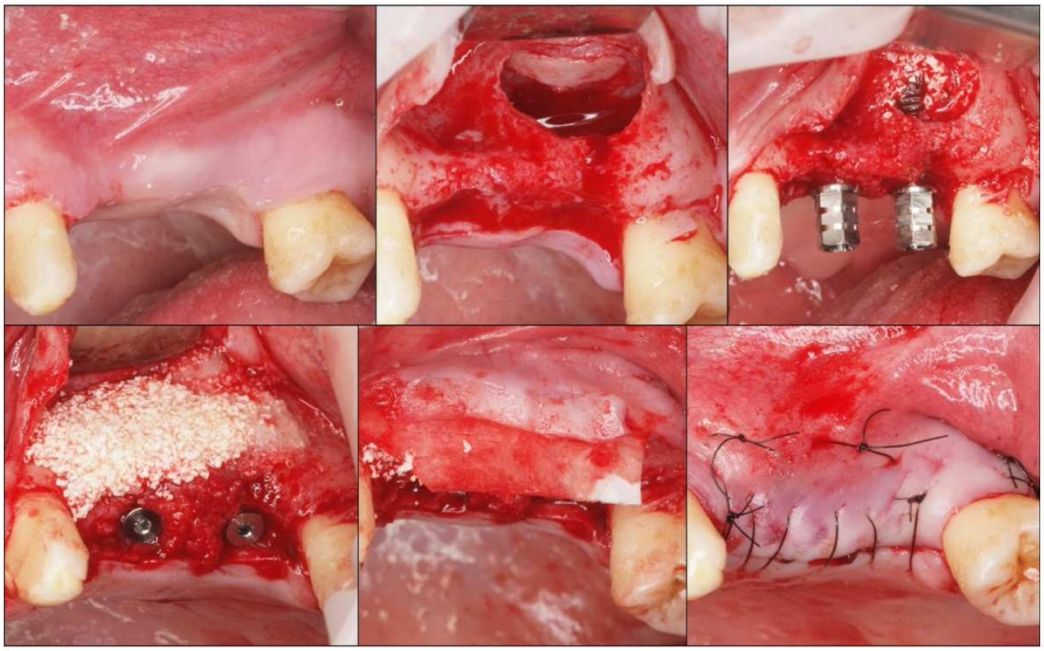


Figure 5: Clinical photographs showing the sequence of sinus lift with the B-TCP graft and the simultaneous placement of the implants. Vertical Bone Gain after Sinus Lift Procedures with Beta-Tricalcium Phosphate and Simultaneous Implant Placement

Alloplastic Putty graft material

Dental Putty which is a viscoelastic calcium phosphosilicate alloplastic putty is available in the market and is widely used nowadays in bone regeneration including sinus augmentation procedure because of improved handling property and ease of manipulation. Calcium silicophosphate putty is the next generation bioactive graft material, the most use worldwide is commercially known as NovaBone®.

Calcium silicophosphate graft material in the form of putty is available in the market and is widely used nowadays in bone regeneration including sinus augmentation procedure because of improved handling property and ease of manipulation. [18]

After placing at a particular site, the smaller calcium silicophosphate particles diffuse calcium and phosphorous ions into the adjacent area. The binder resorbs in 1 week exposing the larger particles to blood. Once the clot is organized, the porous network is created by the dissolution of binder and the smaller particles. Within few hours, there is the formation

of calcium phosphate nodules which subsequently crystallize, and a new surface apatite layer (hydroxycarbonite apatite) is formed. This apatite layer is essential for the stimulation of osteoprogenitor (undifferentiated) cells to produce transforming growth factor by the release of silicon from the surface. [18,19]

The bone putty material is osteoconductive and facilitates new bone formation around it and incorporating itself in the newly formed bone. [20] The limitations of calcium silicophosphate putty are faster rate of resorption and poor mechanical strength.[18]

Novabone® is more expensive than the usual graft materials and has a limited lifetime. Althought Novabone® is a synthetic biomaterial, there is a potential risk of allergic reaction or rejection.

PRF and Bio-Oss®

The combination of those two biomaterials is interesting in our study due to the advantages of those two biomaterials with a worldwide use.

PRF preparations which are rich in growth factors may contribute to an accelerated tissue regeneration process.[21]

The association of particulate bovine bone graft (Bio-Oss®) with PRF could allow faster healing and could increase the success rate of bone grafting and thus earlier rehabilitation.[22]

The combined use of PRF and Bio-Oss® can provide additional benefits to the sinus lift surgery such as reduced healing time and increased quality of bone regeneration that can lead to a better comfort for the patient and a better implant stability. The advantages of those both biomaterials combined can lead to better results. The faults of one of the biomaterial can be filled with the use of simultaneous bone graft biomaterials.

5.2 Surgery technique

Sinus lift

Long-term edentulism may result in resorption of the alveolar process and, as a result, in difficulties in placing dental implants[23]

Augmentation of the floor of the maxillary sinus is a well-established procedure used to increase the height of the bone in the atrophic posterior maxilla to allow placement of dental implants. The "sinus lift" procedure with bone grafting was reported by Tatum in 1975 and published for the first time by Boyne and James in 1980. Among the variety of sinus floor elevation techniques described in the literature, two approaches, the crestal approach and the lateral window approach, have been mostly used. [21]

After elevating the sinus lining from the floor, bone graft was placed. Implant can then be installed immediately or at a later stage depending on residual bone height.[1]

The one-stage technique is a newer approach to sinus lift surgery that involves the implant placement simultaneously with the sinus-lift in a single surgery. This technique is also called the "immediate implant placement with simultaneous sinus lift" or "transcrestal sinus lift technique". One concern is that the one-stage approach may not be suitable for patients with severe bone loss or other factors that may increase the risk of complications. The main advantage of this technique is that it reduces the overall treatment time for the patient and the dentist, and it may result in less postoperative discomfort and less edema compared to the two-stage technique.

A healing period of approximately 6 months has been the standard of care for implants placed with simultaneous sinus floor elevation.[24]

The two-stage technique involves two separate surgical procedures, with a healing period around 4 to 6 months between them. In the first stage, the sinus lift surgery is done. In the second stage of the procedure, the bone graft success of the sinus lift is verified before the implant placement. The two-stage sinus lift technique is a safe and effective way to increase bone volume in the posterior maxilla for implant placement. However, it requires a longer treatment time and multiples surgeries, which can be inconvenient for the patient and increase the risk of complication associated with any surgical procedure.

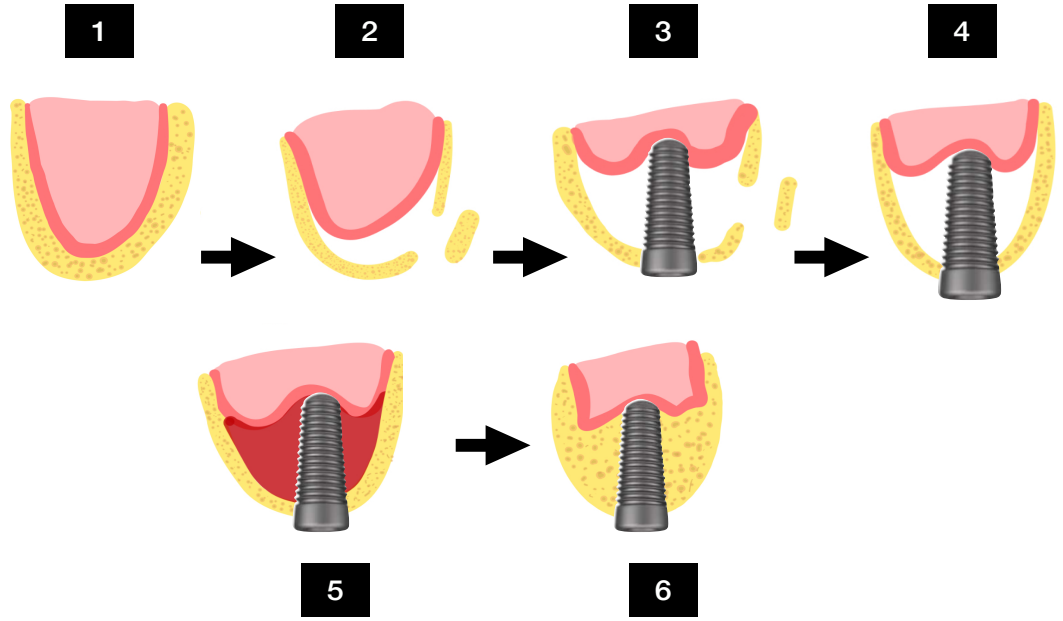
The use of bone grafts for sinus augmentation, irrespective of the technique utilized has been associated with high success rate.[1]

Various types of grafting material have been successfully utilized for sinus augmentation.[21] The most used graft materials in the sinus floor elevation surgery are : autogenous bone, PRF, xenograft bone such as Bio-Oss®, Beta-Tricalcium Phosphate, Dental Putty, combinations of those biomaterials or without using any bone grafts known as the "graftless technique".

The technique of sinus floor elevation has expanded prosthetic options by enabling the placement of additional implant support in maxillary segments with atrophic ridges and pneumatized sinuses. The most commonly described intra-operative complication of sinus floor elevation is perforation of the Schneiderian membrane because of the indirect view for the elevation of sinus floor. [1]

Graftless surgery technique

The use of bone grafts for sinus augmentation, irrespective of the technique utilized has been associated with high success rate, although it has certain demerits such as second



Legend: schematic drawings of the cross-sectional aspect in the bunco-lingual direction.
1* Before surgery
2* A dissected bone flap after osteotomy
3* Positioned implant working as a tent pole
4* A replaced bone flap
5* Coagulum formation

Figure 6: Schematic illustartion of the sinus lift with simultaneous implant placement using the graftless technique

surgical site for autogenous bone harvesting, increased rate of complications, higher cost, and increased surgical time. The maxillary Schneiderian sinus membrane has innated osteogenic potential and has a possible contribution to bone regeneration in sinus lifting procedures. [1]

The necessity of placing grafting material under the elevated sinus membrane is increasingly being questioned. A certain amount of intrasinus bone volume can be regenerated around implants placed without any grafting material. By elevating the schneiderian membrane, a compartment is created, which fills with a blood clot from surrounding bleeding. The clot is thus protected and serves as a matrix for bone regeneration. [25] This blood clot can be considered autologous osteogenic and osteoconductive graft material, to which osteoprogenitors can migrate, differentiate, and regenerate bone. The blood clot formed under the lifted Maxillary sinus lining appears to be of critical importance in bone neoformation potential, precluding the need for exogenous graft materials. Elevation of the Schneiderian membrane creates a compartment, in which a fibrin clot is stabilized and is protected from the external trauma, other than intra-sinus air pressure.[26]

The graftless technique is less invasive than traditional sinus lift surgery, as it does not require the use of graft materials. It has a shorter recovery time for the patient than the traditional sinus lift as it does not involve the use of graft material which can take time to integrate and heal.

A sinus lift without grafted bone material or with an autologous graft is a very natural and attractive approach. [9]

Bio-oss® versus Graftless

The use of bone-grafting materials in sinus-lift elevation has been long promoted and has predictable results. However, favourable clinical results of sinus-lift elevation without bone grafting have also been reported.[27]

Comparing results with xenograft technique regarding bone height gain, bone density and implant stability values when compared to graftless tenting technique, to confirm if both

techniques are considered reliable procedures for vertical augmentation of posterior maxilla.[15]

Bio-Oss® has been shown to maintain its structure and volume over time, providing a stable environment for bone growth.

Graft shrinkage/resorption appears to be a common problem following bone augmentation procedure in the maxillary sinus.[26]

5.3 Comparisions of the biomaterials

Autogenous bone compared to another biomaterial.

M Santagata et al, in 2013 made a clinical and radiographic report. Thirty-five patients were treated with SLWSIP with a total of 40 sinus graft procedures and 93 implant were installed in this study, using a mixture in a 1:1 ratio of autologous bone harvested from the maxillary tuberosity and Bio-Oss®. In the present study, only one of 93 implants had to be removed. Consequently, the survival rate was 98,92%. In conclusion, it would appear from the clinical and radiographic results that the sinus lift procedure with autologous bone graft harvested from the maxillary tuberosity combined with Bio-Oss® allows for a predictable outcome regarding the amount of bone formation in sinus floor augmentation and the immediate placement of implants, when possible, is recommended.[28]

In 2015, *Meloni S et al*, compared the outcome of implants inserted in maxillary sinuses augmented with Bio-Oss® grafts compared with those augmented with mixed 50:50 Bio-Oss® and autologous bone grafts. 20 sinuses were divided in two groups to be grafted with 50:50 Bio-Oss® and autologous bone or Bio-Oss® alone. A total of 32 implants have been placed, 16 in each group. There was no reported mobility, infection, or fracture of any implant, all of which were stable at the end of the 12months of the study. This study evidences the use of Bio-Oss® alone as a suitable in graft in the maxillary sinus. However, implants inserted in sinuses grafted with Bio-Oss® alone compared with those grafted with 50:50 Bio-Oss® and autologous bone, are comparable. Further controlled trials with more patients and longer follow-up are needed to provide better evidence, with the purpose of avoiding the use of autologous bone for grafting maxillary sinuses.[3]

In the study of *Maddalone M et al* in 2018, 58 implant were placed in SLWSIP surgeries using autologous bone graft from mandibular ramus alone as grafting biomaterial. The 100% survival rate reported in the study could be partially favored by the fact that there were no smoker patients included in the sample. The main conclusion of this study was that the use of autologous bone grafts from intraoral donor sites for SLWSIP allows dimensional graft stability in the mid-long term.[10]

Gorla L et al in 2015, have made a study with 22 patients. 36 sinus lift surgeries were performed in 3 groups, 12 were grafted with autogenous bone, 12 with β-TCP mixed with autogenous bone in a 1:1 ratio, and 12 with β-TCP alone. In the present study, the group treated with autogenous bone showed similar results to the other two groups evaluated. An average resorption of 43% was seen for autogenous bone associated with β-TCP 1:1 and an average of 38% for β-TCP alone. The similarity of β-TCP to autogenous bone in relation to the maintenance of the graft volume after 6 months for the anchoring of implants, suggests that β-TCP can be used safely for maxillary sinus lifting, with the advantage of not requiring a donor site, thus minimizing risks, and avoiding morbidity.[16]

PRF

In the scientific article *of Aoki.N and Kanayama T et al* in 2016 studied two patients, in the first patient, two implants were placed using the SLWSIP surgery, However, the implant in the first molar region showed mobility and was unfortunately removed at 24 months after surgery, the reason for this loss was considered to be occlusal overloading by parafunctional habits. The second patient undergone a two-stage sinus lift surgery, which is not include in this study. The results lead to new bone formation confirmed histologically. Based on the findings, at 24 months after surgery, the use of PRF alone should be sufficient to maintain natural new bone around the implant, it can be easily obtained, is cost-effective and has the potential to promote new bone regeneration.[29]

In 2016, *Kanayama T et al* in a study including 27 patients where 39 implants were placed in a SLWSIP surgery with PRF as the bone graft material arrived at the conclusion that the use of PRF as the sole grafting material during SLWSIP is a safe and reliable method. However, more randomized controlled studies are needed to understand how various

factors such as length of the implant, types and amount of grafting materials could affect endosinus bone gain.[14]

Liu Z, Zhou Y et al, in 2018 arrived at the same conclusion in a study conducted on 1 patient with a 10 months follow-up, that simultaneous dental implant placement in the sinus floor elevation using PRF as the only graft material is viable in the edentulous posterior maxilla. Moreover, the use of PRF reduced the healing period and the global time of the treatment and expanded the use of PRF in the sinus lift surgery.[24]

In the scientific article of *Wang H, Zhou Y et al*, in 2019, one of the same authors from the previous study made this similar study one year later. This research was conducted on one patient, one implant was placed the conclusion is in line with the previous studies, using PRF as the only grafted material is viable and the advantages of this techniques are as followed: PRF promotes tissue healing, postoperative adverse reactions of the patient are reduced and the indication of the use of PRF in the sinus lift surgery is expanded.[13]

A survey of *Barbu H et al* in 2021, in which 19 implants were placed using the SLWSIP surgery with up to 4 years of follow-up shown that the use of PRF can lead to successful outcomes in terms of bone grafting and implant integration. Within the limitations of the study, using PRF as a sole graft material, at the same time as implant placement, is indicated to simplify treatment from requiring multiple stages to being a one-stage surgery for sinus augmentation, even in complicated cases with significant tearing of the Schneiderian sinus membrane.[11]

In 2022, *Choudhary S et al* reach the same conclusion as the other previous studies, this research studies the assessment of 24 SLWSIP surgery in 24 study subjects. The current survey suggests that in the sinus lift surgery with implant placement in simultaneous, utilizing PRF increased residual alveolar ridge height and implant stability with fewer problems than previous sinus lift procedures in the posterior maxillary are.[12]

Also in 2022, the scientific group of *Leighton Y et al*, did a retrospective study over 40 months on 20 patients in which 21 implants were placed, using the SLWSIP surgery. This study has a 100% of the implant success, including cases with Schneiderian membrane perforation, observing no biological complications during the 40 months of follow-up. They also come to the same conclusion that the use of PRF as a single graft biomaterial during the maxillary sinus lift procedure combined with immediate implant placement may be a reliable clinical alternative, even to repair the sinus membrane.[30]

Bio-Oss®

In 2013, a scientific study of *Torres Garcia-Denche J et al*, 104 patients completed the study, patients received a total of 278 implants including deferred placement in 74 sinus and simultaneous placement in 61. In this study, only the cases using the SLWSIP surgery will be analyzed. In all the sinus lift surgeries of this research, deproteinized bovine bone mineral substitute (DBBMS), commercially known as Bio-Oss® was used as the graft material. During the entire observation period, 265 implants survived and 13 failed, resulting in a 95.3% implant survival rate. In this study, significant differences in implant failure were found between simultaneous and delayed placed implant. This might be attributed to the difficulty in obtaining primary stability and adequate tissue coverage upon simultaneous dental implants placement. In sinus lifting procedures implant survival rate seems to be influenced by timing of implant placement, Schneider's membrane thickness, treatment with antihypertensive drugs and smoking habits.[31]

The study *of Luo Z et al* in 2017 leads to the same conclusions as the previous one. 11 patients underwent SLWSIP surgery technique and 12 implants were simultaneously placed. No complications were observed during a follow-up with a range of 33 to 71 months which does a mean of 49,4 months of study. Results showed good primary stability of dental implants, and the mean of the sinus floor elevation was high with Bio-Oss®. Moreover, with antibacterial properties added to Bio-Oss®, it could reduce the risk of infective complications caused by small sinus membrane perforation.[32]

Beta-Tricalcium Phosphate

In 2013, *Trombelli L et al*, compared two groups of 19 patients each, using β-TCP as the graft biomaterial in the first group and DBBMS in the second group in the SLWSIP surgery. At six months of surgery, no implant failure was recorded and the prosthetic rehabilitation was finalized at all implants sites. A significant graft remodeling was observed form post-surgery to 6 months in the β-TCP group. The conclusion of this double-blind randomized controlled study is that the use of either DBBMS or β-TCP may provide a substantial

elevation of the maxillary sinus with limited post-surgical complications and post-operative pain or discomfort. However, the study failed to find significant differences in clinical outcomes and post-operative morbidity between sites treated with DBBMS and β-TCP.[33]

In a prospective, randomized, volumetric computed tomography study of *Gorla L et al* in 2015, 36 sinuses were operated, of the 36 sinuses, 12 were grafted with autogenous bone and 12 with β-TCP and 12 with a ratio of 1:1 of autogenous bone and β-TCP. No statistically significant differences in changes in bone volume were found between the biomaterials tested. This study led to the conclusion that the similarity of β-TCP to autogenous bone in relation to the maintenance of the graft volume after 6 months for the anchoring of the implants, suggests that β-TCP can be used safely for SLWSIP with the advantage of no requiring a donor site, thus minimizing risks and avoiding morbidity.[16]

In 2019, *Loin J et al*, have made a similar study comparing the use of autologous bone graft and β-TCP as graft materials. This study has been done on 20 patients and 40 sinuses were lifted. The population was divided in three groups, one receiving β-TCP, another receiving a mixture of Bio-Oss® and autogenous bone harvested at the mandible or at the parietal bone and the last group was constituted by the non-grafted maxillary sinuses. The sinus membrane thickness value was thicker post-operatively in the β-TCP group and the heterologous bone grafted group in comparison with the graftless group. No perforation of the sinus membrane occurred during the surgical procedures in all patients. No other surgical or post-operative complications were reported. No difference in the quality of the newly-formed bone could be observed clinically. No significant differences post-operatively was found between the β-TCP group and the heterologous bone graft group. But significant differences were observed comparing the post-operative bone level gain in this two groups with the graftless group that presented a lower value of bone gain. They arrived at the same conclusion as the previous study: the use of β-TCP, a synthetic biomaterial as bone graft material induced the same inflammatory reaction similar to a natural bone graft when used in sinus lift surgeries. Then, β-TCP granules can be safely used for SLWSIP, with the advantage of not requiring a donor site and avoiding morbidity.[17]

Recently, *Lamas J et al* in 2020, analyzed the bone gain in the SLWSIP when β-TCP is used as a bone graft material, thus over 128 sinus lift surgeries and 260 implants were placed over a follow-up period of 6 months. After six months, in the clinical and radiographic review prior to prosthetic rehabilitation, it was observed that all the surgical sites demonstrated

uneventful healing and the implants did not exhibit clinical mechanical looseness, peri-implantitis, or fracture during the follow-up period. The results obtained from the present study observed that β-TCP bone substitute achieved clinical results with substantial vertical bone gain at 6 months in all the study participants where the biomaterial was placed along with immediate implant placement. β-TCP can be reabsorbed and replaced by bone within a short interval of time like six months as it is evaluated radiographically in this study. It was also reported that the average bone gain varied between the implant lengths and diameter, and it had a significant positive correlation with implant variables. The implant position did not have a statistically significant effect on the average bone gain but there was reduced bone gain in the first premolar region when compared to the second premolar and molar regions in the maxillary arch. [8]

Hamed H et al, in 2022 realized a study including 12 patients, and have been subjected to a SLWSIP surgery, using a preparation of β-TCP in addition with autogenous bone resulting from implant site as bone graft material. There was a statistically significant difference between the primary stability and implant stability after 6 months. The difference between the volume of the grafted bone at 3 and 6 months postoperatively was found to be statistically significant, resulting in a significative augmentation at 6 months. Despite the positive results in terms of pain, edema, implant stability, vertical bone height, and volume of the grafted bone, complications such as sinus membrane perforation occurred. One patient experienced sinus membrane perforation during the sinus lift preparation. This study is consistent with the conclusions of the previous studies. A statistically significant bone height gain was obtained after 6 months of follow-up, the β-TCP was used for its osteoconductive effect.[34]

Alloplastic Putty graft material

The scientific article of *Jodia K et al*, in 2013 remember that the bone augmentation is expected to result in primary stability, promote osteointegration and provide long term implant success. They consider the changes in the marginal bone level around the implants the major criterion to evaluate the implant success. 12 patients were included in this study, 13 implants were placed using the SLWSIP surgery. The bone graft material, an alloplastic

bone graft (Bioactive glass, Novabone® putty) was placed in the lateral window and the implant surface was covered with the same. Only one patient had perforation of sinus membrane, but it was sealed satisfactorily by bio-absorbable membrane. The increase in residual ridge height was very significant after sinus floor augmentation over the period of 6 months following surgery. Whereas differences in residual ridge height between 18 and 30 months post-operatively were found to be statically non-significant. Difference in implant stability between 1 and 2 years after loading was statically non-significant. After two years of follow-up, radiographically, all the 13 implants showed absence of peri-implant radiolucency, and implant survival rate was 100%. The alloplastic bone graft putty has several advantages like its cohesive and graft retentive proprieties, easy manipulation during surgery, no risk of immunogenic response and infection transmission and very low chances of graft infections because antibiotics can penetrate into it due to its hydrophilic nature. Also, there is formation of bony tissues noted in the bone graft. The only disadvantage for *Jodia K et al* is the high cost of this bone graft.[35]

The restrospective study of *Kher U et al* in 2014 conclude that the prerequisite in the SLWSIP surgery is an adequate primary stability of the implant and not a fixed minimum bone height level. 17 patients who had been treated with SLWSIP were included, with a total of 30 implants placed. The implant survival was 96,7% during a mean follow-up of 15,74 months. The difference between the initial vertical bone height and the bone height at the time of loading displayed a highly statistically significant difference. It is assumed in this study that the primary stability of the implant was obtained from the anchorage in the remaining crestal bone and in the putty present in the augmented cavity. However, additional prospective controlled studies are required to verify the findings of this study and provide definitive guidelines for SLWSIP procedures.[36]

In the clinical report with 1-year follow-up of *Pai U et al* in 2017, on a patient missing one of the first molar in maxillary region, leads to other distinct advantages of using alloplastic putty, this procedure ensures the complete fill in the interstices around the implant and the sinus membrane. The patient was followed-up over a year after the procedure with clinical and radiographic evaluation, and the evaluated parameters were found to be within acceptable limits and shown stable bone volume in the peri-implant area. This technique provides an atraumatic elevation of the sinus lifting, thereby providing greater bone stability in the posterior maxilla for predictable implant therapy. The bone putty material is

osteoconductive and facilitates new bone formation around the implant. Other studies must be made to evaluate the bone volume stability over longer periods.[20]

Recently, in 2018, a comparative evaluation of the efficacity of Putty versus particulate of DBBMS in the SLWSIP of *Malik D et al* was made. In this study, a total of 20 implants were placed in 20 patients after sinus augmentation procedure with the SLWSIP surgery. The population of study was divided in two groups, in the first group, calcium silicophosphate putty (NovaBone® Dental Putty) was used as graft material and in the second group, Bio-Oss® was used. Six months postoperative, the mean gain in alveolar bone height was found to be statistically different in both groups as the Bio-Oss® group presents a higher mean bone gain. Also, the density of newly formed bone by using Bio-Oss® was higher than that obtained by using calcium silicophosphate putty. The survival rate of the implant was 100% in both groups. The present study achieved the same success rate in both groups. Although, radiological assessment showed improved results with Bio-Oss® material in terms of bone gain, height and density in the new bone formed. The limitations of calcium silicophosphate putty are faster rate of resorption and poor mechanical strength which probably is the reason for formation of new bone of lesser density in the first group. Further studies with large sample size are required to ascertain if Bio-Oss® has any added advantage over the alloplastic putty biomaterial or other graft materials in the SLWSIP. [18]

In 2022, *Beryl C et al* presented the case of 1 patient partially edentulous who underwent rehabilitation of the right maxillary molar region using the SLWSIP technique. The alloplastic bone graft putty material is used in this survey, and is continuously introduced via osteotomy, using a condenser and a rotary bone spreader, and evenly distributed. The implant is placed after the desired bone height is achieved through augmentation. After 5 months of healing period, gain in vertical height from the crest of the ridge to the floor of the sinus was observed.[19]

PRF and Bio-Oss®

In 2018, *Kumar M et al* used the combination of Bio-Oss® and PRF in the SLWSIP surgery as bone graft materials. 14 patients were included in their research. There was no postoperative complications such as sinus complaints and oroantral fistula and premature exposure of the implant after 1 week, 1month and 3 months. The prosthetic rehabilitation

was completed by the end of 24 weeks (6 months postoperatively). Radiographic analysis showed that the final bone gain was always very significant at 1 month, 6months and 12 months postoperatively. 12 months postoperatively, the follow-up resulted in high amount of bone around the implants, which suggested that the use of PRF added to Bio-Oss® is a reliable filling material in the SLWSIP as it promotes bone formation. Finally, this study shows us that PRF with Bio-Oss® acts as a reliable and effective grafting material for sinus lift procedure with immediate implant placement.[21]

Also in 2018, *Barbu H et al*, combined PRF and particulate of Bio-Oss® in their study of 14 cases of one-stage sinus lift surgery during which were placed 30 implants. After a post-operative follow-up of 43,79 months, no adverse effects or implant loss was observed, and radiographic assessment revealed the presence of mineralized tissue in all cases without obvious signs of resorption. No adverse effects or loss of any implant was observed in any case during the follow-up period. Therefore, it can be concluded that one-stage sinus lift surgery using Bio-Oss® and PRF can be applied as a predictable and effective technique in the treatment of the posterior edentulous maxilla ensuring a success rate of vertical bone height.[22] Thus, the two studies made in 2018 leads to the same conclusion: using a combination of PRF and Bio-Oss® acts as a reliable and effective grafting material in the SLWSIP.

Furthermore, a 36 month retrospective study made in 2021 of *Dominiak S et al*, conduct a clinical and radiological comparison of implantation with a simultaneous sinus lift using DBBMS or PRF clots. 30 SLWSIP were conducted with DBBMS as graft material for the first group or PRF for the second group. The survival rate of implant was 100%, with no implant mobility, pain, paresthesia or inflammatory process in the direct vicinity of the implant observed except in one patient. After 3 years of follow-up, the grafted sinus high was lower for the PRF group than the DBBMS group. Also, the bone gain value in the PRF group was much lower than the DBBMS material. The height of keratinized tissue, the clinical attachment level, and the probing pocket depth were higher in the PRF group compared to the DBBMS group. After 3 years of follow-up on the sinus lifting procedure solely using PRF with simultaneous implantation, the results obtained appear promising, especially regarding of soft tissue management. Thus, PRF can confidently be regarded as a credible alternative to previously used materials. [9]

Graftless surgery technique

In 2015, *Bassi A et al*, made a prospective clinical study with a 51 month follow-up in which 25 implants were placed using the SLWSIP surgery without bone graft materials. Only one implant was lost in the first stage, this leads to an implant success rate of 96%.

After dental prothesis placement and during up to 51 months of follow-up, no implant was lost thus, in the second stage the implant rate success was 100%. The difference in the mean bone height the bone height between the time immediately after implant placement and at 3 and 51 months postoperatively was statistically different. In conclusion, the results of this study, after a 51-month follow-up, show that the SLWSIP, without the use of biomaterials, may be performed with a high success rate, reducing the surgical morbidity of autogenous grafts and some of the limitations of other osteoconductive grafting materials.[37]

Another study made in 2016 by *Falah M et al*, agrees with the previous conclusion. 30 graftless sinus lifting procedures were performed and 72 implants were placed in 18 consecutive patients. Out of the 72 implants placed, only 4 failed, indicating a 94% overall implant survival rate. Of the failed implants, only one fixture was clinically mobile at the time of second-stage surgery at 6 months, and this implant was removed; the other implant failures arose due to insufficient primary stability in the residual bone height. All other implants were stable. Patients were followed for 1 year after prosthesis placement; no complications were observed. During the healing period, the patients had no significant complications or any other signs or symptoms of infection or diseases in the maxillary sinus, except for minor postoperative physiological swelling. As the only graft filler of this space between the sinus membrane and basal bone, the blood clot was later entirely replaced by newly formed bone. The newly formed bone on the maxillary sinus floor was clearly discernible around and on the apical side of the dental implants with good continuity with the native sinus floor and an apparent increase in alveolar bone height was observed radiographicaly. Biopsies of 30 cases were collected at 6 months post-treatment and histomorphometrically demonstrated relatively well-arranged trabeculae were observed, without evidence of inflammation or foreign body reaction. The blood-filled area contained arranged woven bone tissue. The histological analysis confirmed perfect vital bone

formation. The current clinical study confirms and further proves the authors' own assumptions and those of other authors that new bone formation arises from the (Maxillary Sinus Schneiderian Membrane) MSSM and floor upon graftless sinus lifting immediately followed by dental implant insertion. Based on this case series, blood clot can be considered autologous osteogenic graft material, to which osteoprogenitors can migrate, differentiate, and regenerate new bone through the healing process. The procedure was associated with a high success rate and reduced the surgical morbidity associated with autogenous grafts, as well as some of the limitations of other osteoconductive grafting materials.[38]

A 40 months follow-up studies of *Stefanski S, Svensson B and Thor A* in 2016 is in line with the same conclusions. 19 patients had sinus lift with dental implant placement simultaneously inserted in the residual bone, creating a membrane elevation, 28 implants were placed, and a clinical and radiological follow-up was carried out up to 40 months after implant installation.

All implants remained stable with a survival rate of 100%. This survey indicates that with a moderate residual bone height and with a primary stability of the implants, bone grafts or bone substitute materials may not be needed for augmenting the maxillary sinus floor when placing implants in this region, the study successfully demonstrated a new bone formation around the implants in the posterior part of the maxilla. The findings of the present study regarding the immediate placement of implants without the use of bone grafts or other bone substitute materials confirm that this is a successful approach for new bone formation around implants and with high survival rates of implants, as has been suggested and documented by other authors.[23]

The study of *Lundgren S et al* in 2019, is in concordance with the same conclusions. The study was conducted on 111 patients, previously treated with SLWSIP without grafting material with a follow-up between 3 to 17 years. Overall, 218 implants were placed in 127 sinuses. 9 of the implants failed resulting in an implant survival rate of 95,9% after 8 years. Early failure of implant occurred in four patients with one implant each that failed at 6, 6, 6, and 14 months, respectively. All implants lost early were replaced after 6 months of healing without need for further augmentation. These replaced implants were still functional at the last follow-up. Late failure occurred in four patients with five implants at 4, 4, 7, and 10 (x2) years of function. In the present study, it was shown that using the graftless surgical method, a predictable result was achieved, that is, only 5 of 190 implant

bone augmentations failed. Furthermore, and possibly more important, the generated bone supports implant functionality for many years. At the first follow-up, mean 5 years postoperatively, none of the 16 patients reported symptoms of sinusitis. The results from this surgical method regarding bone formation were stable over time (with a long follow-up time of more than 10 years on 40 patients). From the results of the present study, it was shown that good sinus health is maintained, and the studied surgical method should not be excluded due to fears of creating a sinus pathology. The graftless technique was found to be an excellent choice for sinus floor augmentation of the posterior edentulous maxilla where atrophy of the alveolar process compromises the possibilities for implant treatment. The implant-supported rehabilitation achieved using the graftless technique was stable over time, and there was no or little impact on sinus health. Nevertheless, this result does not provide the minimal amount of bone necessary for implant stability over time in terms of function. Furthermore, it was concluded that the new bone formation and the amount of bone gain is proportional to the length of the implant protruding into the sinus cavity.[39]

Another study made in 2019 by *Rawat A, Thukral H and Jose A*, also leads to the same conclusions. A total of 26 implants were placed in 21 patients using the SLWSIP surgery without using bone grafts. All the implants were clinically and radiographically stable at the end of 6 months of follow-up. Radiographs taken 6 months after implant placement showed that all implants had gained new endo-sinus bone, this post-operative increase in bone was considered to be statistically significant. The findings of this study indicate that successful osseointegration is predictable using SLWSIP without bone graft. Healing was predictable and therefore, the procedure reduced the number of surgical interventions, treatment time, and cost of implant placement in the atrophic posterior maxilla. The procedure can be immensely gratifying to the clinician and especially to the patients as it reduces the total duration of treatment. Due to the small sample size and short duration of the study, the long-term survival rate cannot be deducted, for which a long-term study and bigger sample size are required.[1]

Manekar Varsha Sunil in 2020, also join the previous conclusions. The study was conduced on 17 patients and 26 implants were inserted. A clinical and radiografical follow-up of one year has been done. All implants are successful with 100% survival rate. The blood clot formed under the lifted MSSM appears to be of critical importance in bone neoformation potential, not including the need for exogenous graft materials. The postoperative cross-

section of the implants shows that the bone is formed around the implant apex but not above it. The direct contact of the sinus lining may be the reason for this. Blood clot can be considered autologous osteogenic graft material, to which osteoprogenitors can migrate, differentiate, and regenerate bone. The graftless technique is predictable and safe for the SLWSIP surgery. The prospective clinical trial of longer follow-up duration and bigger sample size is needed.[26]

Bio-oss® versus Graftless

Bio-Oss® and the graftless technique are two commonly approaches in sinus lift surgery, each with its own advantages and disavantages.

Nedir R et al in 2015 made a 3 year results of a prospective randomized controlled study. 37 implants were placed and two groups were made one received Bio-Oss® as graft material and the other group was without graft material. The SLWSIP technique used in this study had an implant success rate of 91,9% after 3 years with successful integration and functional loading. Three failures (two early and one late) were recorded in this study, the early failures were related to the placement of implants, but not to the presence or lack of grafting material. The late failure occurred in a patient with a history of periodontitis, therefore, the late failure reported could be attributed to the periodontal status of the patient and not the SLWSIP procedure. In this study, the osteointegration of the implants into atrophic soft bone allowed functional loading of the definitive protheses after a healing time of just 10 weeks, which was sufficient to support functional loading over 3 years. Bone levels measured around implants at 1 year remained stable at 3 years. When implants were placed with grafting, a slight decrease in dome height above the implant apex was observed at the 3-year follow-up.

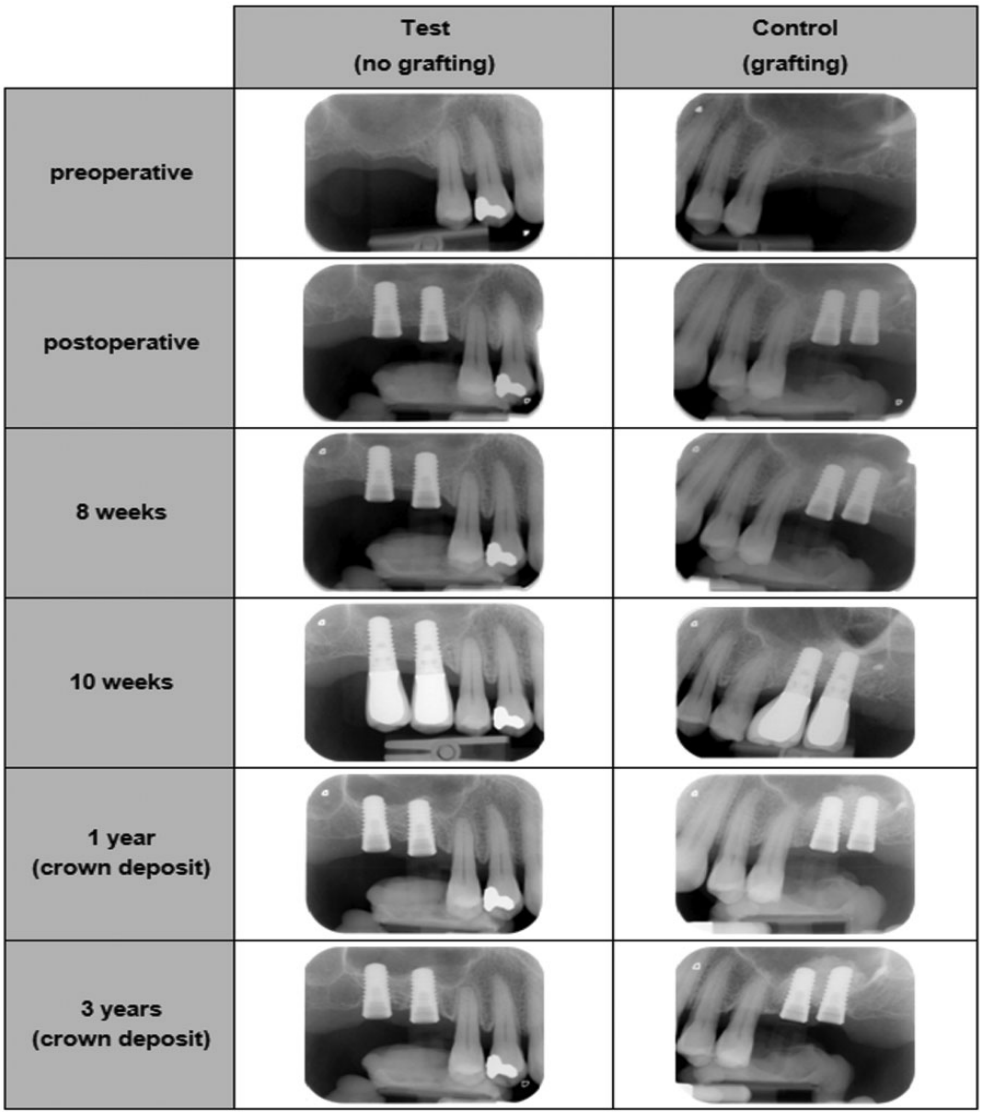


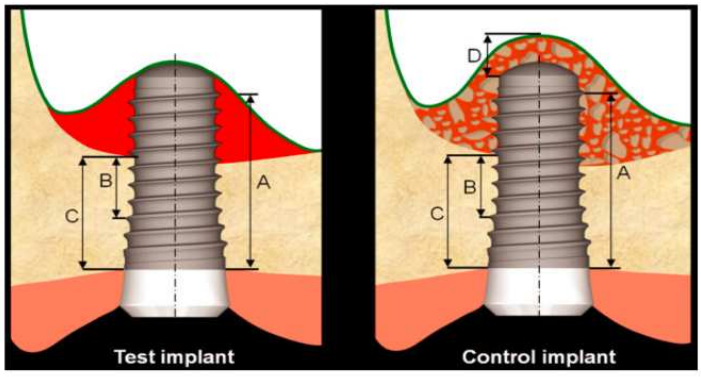
Figure 7: : radiographic evolution of sinus floor level over 3 years, Short Implants Placed with or without Grafting in Atrophic Sinuses: The 3-Year Results of a Prospective Randomized Controlled Study, Nedir et Al, 2015.

This study led to the conclusion that grafting is unnecessary to achieve bone augmentation, however, more bone is gained with grafting. Atrophic posterior maxillae can be predictably rehabilitated using SLWSIP without graft materials and this procedure offers patients a simpler and less invasive implant treatment for atrophic maxillae.[25]

On the other side, *Cara-Fuentes M et al* in 2016, made the same type of study in two separate groups using the SLWSIP surgery, one group using the graftless technique and another one was grafted with Bio-Oss® in each group 38 implants were placed. Implant failure was observed in 2 implants from the Bio-Oss® group leading to a success rate of 93% and in 1 implant from the graftless group resulting in a success rate of 97%. Side effects such as sinusitis, bleeding or suppuration were observed in 7 of 25 patients in the Bio-Oss® group and in 5 of 26 patients from the graftless group. No statistical difference was observed among the two groups after 70 months of follow-up. The graftless technique

entails a series of advantages over conventional maxillary sinus elevation with grafting biomaterials: it does not involve grafting, there is less morbidity, a lower infection risk, it is cheaper, and it is better accepted by the patient. The results of this study as well as those present in the literature, are similar, and even sometimes better than those achieved through the traditional elevation of the maxillary sinus, independent of the bone graft used. These results presents the technique as a clear alternative to elevation of the maxillary sinus with grafting material; it shows similar results, especially when considering practical issues such as safety and cost. Although the final validation of this technique must undoubtedly come from an analysis of the long-term success of the implants, it is also necessary to understand the intrasinus bone formation process, particularly those aspects relating to timing, quantity and arrangement, that determine when an implant can receive total functional loading, and the most effective number and arrangement of implants to be fixed in each situation. Studies involving a larger sample size and longer follow-up period are necessary for determining the factors that influence the degree of bone formation. [40]

The same author *Nedir R et al* in 2015 made a similar study as the one in 2015, but with a longer follow-up period of 5 years. As their previous study, they divided the patients in two groups, a total of 37 implants were placed in twelve patients one group of receiving Bio-Oss® as graft biomaterial in which 20 implants were placed and on the other group was used the graftless surgery in which 17 implants were placed. Three failure occurred which leads to a total success rate of 91,9%, 94,1% for the graftless group and 90,0% in the Bio-Oss® group. Moreover, the mean bone gain did not change significantly between 1 and 5 years post operatively, showing a stability in the new bone formed around implants irrespective of the absence or presence of graft material. Grafting was unnecessary to achieve a bone augmentation, but more bone was gained with grafting. As shown is this study, atrophic posterior maxillae can be predictably rehabilited using SLWSIP surgery



A, parallel to the implant axis and between the most coronal bone-implant contact and the most apical implant thread, was measured on both sides of each implant and averaged. A decrease in this mean value on consecutive radiographs, taken immediately after implant surgery and at 1 and 3 year after implant placement, was indicative of crestal bone loss. Distance **B**, between a reference coronal implant thread and the most apical implant-bone contact, was measured on both sides of each implant and averaged. An increase in this mean value on consecutive radiographs, taken immediately after implant surgery and at 1 and 3 years after implant placement, was indicative of endo-sinus bone gain. Distance **C**, between the most coronal bone-implant contact and the most apical bone-implant contact, was measured on both sides of each implant and averaged; graft height **D** above the control implant apex was also measured along the implant axis. **C** and **C + D**, respectively, expressed the available proximal bone anchorage for the test and control implants, respectively.

Figure 8: Radiographic measurements of crestal bone loss, endo-sinus bone gain, and proximal bone anchorage. Short Implants Placed with or without Grafting in Atrophic Sinuses: The 3-Year Results of a Prospective Randomized Controlled Study, Nedir et Al 2015.

without grafting materials, thus leading to the same conclusion as their previous study in 2015.[41]

On the other side, *Fouad W et al* in 2018, in the same type of study with two groups, for the test group sinus cavity was not augmented by any bone graft material while for the control group the sinus cavity was augmented by DBBMS in 17 patients and 20 SLWSIP surgeries were performed. Thirty-four implants were inserted in total for both groups. All patients showed uneventful healing with no signs of postoperative infection, dehiscence or oroantral communications. There was a significant increase in bone height gain and bone density value for the DBBMS group compared to the graftless group. The Implant quotient stability (ISQ) was significantly higher in the DBBMS group compared to the graftless group. The use of DBBMS helped to maintain the height of the sinus membrane along with the installed implants due to the slow resorption rate of the DBBMS unlike the graftless group where stabilization of the created space relied only on the installed implants, and the formed blood clot could not be solely maintained along the elevated height. This could be one of the factors responsible for why the DBBMS group showed significantly more bone formation than the graftless group. Moreover, both groups showed ISQ results values regarded acceptable for successful loading of implants in both groups. The conclusion leads us to SLWSIP surgeries using xenograft as a filling material or graftless technique are considered reliable procedures and can be used for implant placement in the posterior maxilla to restore function and esthetics. However, within the limitation of this study owing to the relative short follow-up period and limited sample size, the use of DBBMS in SLWSIP provides superior results regarding bone height gain, bone density and implant stability values when compared to graftless technique, however both techniques are considered reliable procedures for vertical augmentation of posterior maxilla. Further studies are required with larger sample size and longer follow-up periods to assess the definitive results of both interventions.[15]

Moreover, in the 10 years results of the study of *Qian S et al* in 2020, of 45 patients where one group of 23 patients had Bio-Oss® as the graft material and the other group of 22 patients one had the graftless surgery technique. Each patient contributed with one implant, thus 45 implants were placed. Three patients were excluded from the study due to Schneiderian membrane perforation during surgery. There was one patient in both groups that was lost to follow-up. Thus 21 patients from the Bio-Oss® group and 19 patients from

the graftless group completed the 10 years follow-up. The 10-year cumulative survival rate was 90.7% for the Bio-Oss® group with the lost of 2 implants and 95.0% for the graftless group with one implant lost. There were no significant differences in the endosinus bone gain (ESBG) between the two groups at follow-up visits. Nonetheless, repeated measurements revealed significant differences in ESBG between 1 year and the follow-up visits in both groups. The mean ESBG around the implants placed with or without grafting was gained mainly during the first 3 years and remained almost unchanged thereafter. In this study, no significant difference of survival rate was reported between different treatment groups, as well as implant length. Furthermore, there was no significant difference in the peri-implant bone height between the two groups at 10 years after the SLWSIP. The bone gain in both groups could satisfy the long-term functional need of the dental implant prothesis in the posterior maxillae. Along these lines, with or without grafting both yielded predictable clinical outcomes with similar peri-implant bone height. The result of the present study should be interpreted with its limitation on the sample size. Newly, in 2022, *Zhang S et al*, made a comparative study. 68 patients went under sinus lift surgery with simultaneous implant placement and were divided in two groups, one receiving DBBMS bone graft and the other one graftless. The graftless group had a significantly lower incidence of postoperative adverse reactions, lower intraoperative blood loss, and shorter operation time than did the DBBMS group. 1 week after surgery, the graftless group showed significantly lower levels of inflammatory factors than the DBBMS group did. Postoperatively at month 6, the graftless group had a significantly higher implant retention rate than did the DBBMS group. Simultaneous implant placement without bone grafting can deliver favorable therapeutic effect, with a high safety profile, which can effectively optimize the surgical process, improve patients post-operative feelings, and reduce surgical expenses, making it easy to popularize clinically.[42]

6. Limits

Despite the fact that all the articles have led to excellent success rate, the sample sizes of studies were not the same oscillating from 1 patient to 119 patients.

The follow-ups were different in terms of duration, varying from 5 months to 17 years of studies, giving rise to attrition bias.

Some of the implants placed were manufactured with biomaterials to strengthen the osteoinductive effects, but they were not used in all the studies, this may have skewed some results.

The surgical techniques of the approach of the maxillary sinus lift elevation were different in the scientific articles used, which may have influenced the results.

Also, the remaining bone height of the edentulous zone of the maxilla of the patients were different from a study to another.

In the researches, more grafting materials were found such as coral, hydroxyapatite, bioglass and more on other scientific databases other than PubMed, but not enough studies were made with this biomaterials to include them in our study.

Furthermore, the inclusion and exclusion criteria are very specific, making us miss many studies that do not exactly meet our criteria, thus excluding interesting results.

Moreover, our subject is of current interest, the goal being to find the ideal material for the sinus lift, the scientific articles are not sufficient or with short follow-ups on the material used, it was not found sufficient articles that were comparing the biomaterials between them, more studies are needed to support our findings.

Also the general fear of perforating the Schneiderian membrane using the graftless technique has conduced to less improvement in the studies thus leading to fewer results of scientific articles between year 2013 and year 2018.

However, in the research, we have found that many of the studies made on the graftless technique were conduced in 2022. We can then ask ourselves if COVID-19 has not had an impact on the stocks of the graft biomaterials, and if in order to continue to exercise the sinus lift surgery during this period, scientists have sought to circumvent the fact of using or not the graft biomaterials in the sinus lift surgery with simultaneous implant placement.

7. Conclusion

First and foremost, I believe that future clinical studies are needed to determine exactly the interest and effectiveness of the biomaterials used in the sinus lift surgery with the simultaneous implant placement to provide the maximum benefits in this surgery for the clinical practician and the patient.

Autologous bone and Bio-Oss® have shown similarity in relation to the graft volume, the stability of the implant, but autologous bone have the disadvantage of requiring a donor site, thus associating risks of morbidity of the harvest zone. Moreover, we can state that Bio-Oss® or autologous bone combined with osteoconductive biomaterials such as B-TCP or alloplastic bone graft putty has shown improved results in terms of bone gain, density of the new bone formed and stability of the implant.

The use of PRF alone as a sole grafting material has a shorter healing time and promotes new bone regeneration but lacks adequate primary implant stability. Combining Bio-Oss® with PRF can act as a reliable and predicable grafting procedure with a faster healing period, high bone gain and good implant stability.

β-TCP used as the only graft material has resulted in clinical bone gain comparable to autogenous bone or Bio-Oss® but has a faster time of resorption which is questionable in some cases.

The alloplastic bone graft putty, regardless of its easy manipulation and good diffusion when disposed, has a fast resorption, poor mechanical strength, and high cost.

The graftless technique has demonstrated a high success rate, avoiding the limitations of other osteoconductive biomaterials. It is a predictable method with a lower risk of infection, it reduces the surgical expenses, making it more appealing for the patients.
Although Bio-Oss® had a significantly higher amount of bone gain in the early follow-ups, the implant stability and the bone gain were very similar or even better with the graftless technique in the late postoperative phase. Therefore, simultaneous implant placement

without bone grafting can deliver favorable therapeutic effect with a high safety profile, optimizing the surgical process, improving patient's post-operative feelings, and reducing surgical expenses, making it easy to popularize clinically.

We can conclude that, the autologous bone can be substitute by PRF and Bio-Oss® in conjunction or with the graftless technique as it has showed very similar results and has better acceptance by the patients as the healing period is reduced, there is not the pain of two surgeries from a harvest site.

The hypothesis of this study was that the graftless technique was the best technique in the SLWSIP and could afford a good implant prosthetic rehabilitation can be considered as accepted.

As far as I am concerned, the graftless technique showed great promises by requiring only one surgery, it is a cheaper option, moreover, there is no risks of rejection of the graft material, in addition it allows to realize a complex treatment in less time, with a good implant stability and successful rates of implants, furthermore, the postoperative experience of the patient is upgraded with this technique. Hence, even if this technique requires more research and more studies with longer follow-ups and bigger sample sizes, it has a promising future.

8. Bibliography References

1. Rawat, A., Thukral, H. & Jose, A. Indirect sinus floor elevation technique with simultaneous implant placement without using bone grafts. *Ann Maxillofac Surg* **9**, 96–102 (2019).
2. Franceschetti, G. *et al.* The impact of graft remodeling on peri-implant bone support at implants placed concomitantly with transcrestal sinus floor elevation: A multicenter, retrospective case series. *Clin Oral Implants Res* **31**, 105–120 (2020).
3. Meloni, S. M. *et al.* Grafting after sinus lift with anorganic bovine bone alone compared with 50:50 anorganic bovine bone and autologous bone: Results of a pilot randomised trial at one year. *British Journal of Oral and Maxillofacial Surgery* **53**, 436–441 (2015).
4. Moraschini, V., Uzeda, M. & Sartoretto, S. META-ANALYSIS Pre-Implant Surgery Maxillary sinus floor elevation with simultaneous implant placement without grafting materials: a systematic review and meta-analysis. *Int J Oral Maxillofac Surg* (2017) doi:10.1016/j.
5. Beaudry, K. A., Geurs, N. C., Lemons, J. E. & Reddy, M. S. Bone Formation Under the Elevated Sinus Membrane Using Venous Coagulum. *Clin Adv Periodontics* **3**, 200–207 (2013).
6. Guillaume, B. Comblement osseux par β-TCP en chirurgie maxillofaciale: revue des indications. *Morphologie* vol. 101 113–119 Preprint at https://doi.org/10.1016/j.morpho.2017.05.002 (2017).
7. Canellas, J. V. D. S., Drugos, L., Ritto, F. G., Fischer, R. G. & Medeiros, P. J. D. Xenograft materials in maxillary sinus floor elevation surgery: a systematic review with network meta-analyses. *British Journal of Oral and Maxillofacial Surgery* vol. 59 742–751 Preprint at https://doi.org/10.1016/j.bjoms.2021.02.009 (2021).
8. Lamas, J. M. A., Sánchez, M. G., González, L. C., García, A. S. & Sánchez, J. A. Vertical bone gain after sinus lift procedures with beta-tricalcium phosphate and simultaneous implant placement—a cross-sectional study. *Medicina (Lithuania)* **56**, 1–10 (2020).
9. Dominiak, S., Karuga-Kuźniewska, E., Popecki, P. & Kubasiewicz-Ross, P. PRF versus xenograft in sinus augmentation in case of HA-coating implant placement: A 36-month retrospective study. *Advances in Clinical and Experimental Medicine* vol. 30 633–640 Preprint at https://doi.org/10.17219/ACEM/134202 (2021).
10. Maddalone, M. *et al.* Long-term stability of autologous bone graft of intraoral origin after lateral sinus floor elevation with simultaneous implant placement. *Clin Implant Dent Relat Res* **20**, 713–721 (2018).
11. Barbu, H. M. *et al.* Prf-solution in large sinus membrane perforation with simultaneous implant placement-micro CT and histological analysis. *Membranes (Basel)* **11**, (2021).
12. Choudhary, S. *et al.* Outcomes Following Hydraulic Pressure Indirect Sinus Lift in Cases of Simultaneous Implant Placement With Platelet-Rich Fibrin. *Cureus* (2022) doi:10.7759/cureus.28087.

13. Wang, H. *et al.* The endoscopically assisted transcrestal sinus floor elevation with platelet-rich fibrin at an immediate implantation of periapical lesion site: A case report. *Medicine (United States)* **98**, (2019).
14. Kanayama, T., Horii, K., Senga, Y. & Shibuya, Y. Crestal approach to sinus floor elevation for atrophic maxilla using platelet-rich fibrin as the only grafting material: A 1-year prospective study. *Implant Dent* **25**, 32–38 (2016).
15. Fouad, W., Osman, A., Atef, M. & Hakam, M. Guided maxillary sinus floor elevation using deproteinized bovine bone versus graftless Schneiderian membrane elevation with simultaneous implant placement: Randomized clinical trial. *Clin Implant Dent Relat Res* **20**, 424–433 (2018).
16. Gorla, L. F. D. O. *et al.* Use of autogenous bone and beta-tricalcium phosphate in maxillary sinus lifting: A prospective, randomized, volumetric computed tomography study. *Int J Oral Maxillofac Surg* **44**, 1486–1491 (2015).
17. Loin, J. *et al.* Maxillary sinus floor elevation using Beta-Tricalcium-Phosphate (beta-TCP) or natural bone: same inflammatory response. *J Mater Sci Mater Med* **30**, (2019).
18. Malik, D., Panwar, M., Kosala, M. & Dias, J. Comparative evaluation of efficacy of calcium silicophosphate putty versus particulate xenograft in maxillary sinus augmentation procedure: A clinical and tomographical study. *Journal of the International Clinical Dental Research Organization* **10**, 76 (2018).
19. Subantral sinus augmentation using a hydraulic lift system and alloplastic phosphosilicate putty followed by simultaneous implant placement for the rehabilitation of an atrophic posterior maxilla: A case report. *J Clin Transl Res* (2022) doi:10.18053/jctres.08.202202.002.
20. Pai, U. Y., Rodrigues, S., Hegde, P. & Khurana, N. Indirect sinus lift done using 'Autogenous Core Lift' Technique in combination with alloplastic phosphosilicate putty in atrophic maxillary posterior region: A clinical report with 1-Year follow-up. *Contemp Clin Dent* **8**, 627–631 (2017).
21. Kumar, M. *et al.* Direct maxillary sinus floor augmentation for simultaneous dental implant placement. *Ann Maxillofac Surg* **8**, 188–192 (2018).
22. Barbu, H. M., Andreescu, C. F., Comaneanu, M. R., Referendaru, D. & Mijiritsky, E. Maxillary Sinus Floor Augmentation to Enable One-Stage Implant Placement by Using Bovine Bone Substitute and Platelet-Rich Fibrin. *Biomed Res Int* **2018**, (2018).
23. Stefanski, S., Svensson, B. & Thor, A. Implant survival following sinus membrane elevation without grafting and immediate implant installation with a one-stage technique: an up-to-40-month evaluation. *Clin Oral Implants Res* **28**, 1354–1359 (2017).
24. Liu, Z. *et al.* Endoscopically controlled flapless transcrestal sinus floor elevation with platelet-rich fibrin followed by simultaneous dental implant placement. *Medicine (United States)* **97**, (2018).
25. Nedir, R., Nurdin, N., Khoury, P. & Bischof, M. Short Implants Placed with or without Grafting in Atrophic Sinuses: The 3-Year Results of a Prospective Randomized Controlled Study. *Clin Implant Dent Relat Res* **18**, 10–18 (2016).
26. Manekar, V. Graftless crestal hydraulic sinus lift with simultaneous implant insertion. *Natl J Maxillofac Surg* **11**, 213 (2020).

27. Qian, S. jiao *et al.* Long-term outcomes of osteotome sinus floor elevation with or without bone grafting: The 10-year results of a randomized controlled trial. *J Clin Periodontol* **47**, 1016–1025 (2020).
28. Santagata, M. *et al.* Maxillary Sinus Augmentation with Autologous and Heterologous Bone Graft: A Clinical and Radiographic Report of Immediate and Delayed Implant Placement. *Journal of Maxillofacial and Oral Surgery* vol. 13 401–408 Preprint at https://doi.org/10.1007/s12663-013-0569-5 (2014).
29. Aoki, N. *et al.* Sinus Augmentation by Platelet-Rich Fibrin Alone: A Report of Two Cases with Histological Examinations. *Case Rep Dent* **2016**, (2016).
30. Leighton, Y., Rosas, E., de Souza, R. F. & Borie, E. Simultaneous Implant Placement and Sinus Lift Using Leukocyte-Platelet Rich Fibrin: A Retrospective 40-Month Study. *Journal of Craniofacial Surgery* **33**, E706–E708 (2022).
31. Torres García-Denche, J. *et al.* Membranes over the lateral window in sinus augmentation procedures: A two-arm and split-mouth randomized clinical trials. *J Clin Periodontol* **40**, 1043–1051 (2013).
32. Luo, Z. bin *et al.* Performance of coralline hydroxyapatite in sinus floor augmentation: A retrospective study. *Clin Oral Investig* **17**, 2003–2010 (2013).
33. Trombelli, L. *et al.* Minimally invasive transcrestal sinus floor elevation with deproteinized bovine bone or β-tricalcium phosphate: A multicenter, double-blind, randomized, controlled clinical trial. *J Clin Periodontol* **41**, 311–319 (2014).
34. Hamed, H. A., Shaaban, A. M. & Melek, L. N. Evaluation of trephine osteotomy technique in direct sinus lifting with simultaneous implant placement. *J Stomatol Oral Maxillofac Surg* **124**, 101347 (2023).
35. Jodia, K., Sadhwani, B. S., Parmar, B. S., Anchlia, S. & Sadhwani, S. B. Sinus Elevation with an Alloplastic Material and Simultaneous Implant Placement: A 1-Stage Procedure in Severely Atrophic Maxillae. *J Maxillofac Oral Surg* **13**, 271–280 (2014).
36. Kher, U., Mazor, Z., Stanitsas, P. & Kotsakis, G. A. Implants placed simultaneously with lateral window sinus augmentation using a putty alloplastic bone substitute for increased primary implant stability: A retrospective study. *Implant Dent* **23**, 496–501 (2014).
37. Bassi, A. P. F., Pioto, R., Faverani, L. P., Canestraro, D. & Fontão, F. G. K. Maxillary sinus lift without grafting, and simultaneous implant placement: A prospective clinical study with a 51-month follow-up. *Int J Oral Maxillofac Surg* **44**, 902–907 (2015).
38. Falah, M., Sohn, D. S. & Srouji, S. Graftless sinus augmentation with simultaneous dental implant placement: clinical results and biological perspectives. *Int J Oral Maxillofac Surg* **45**, 1147–1153 (2016).
39. Lundgren, S., Johansson, A. S., Cricchio, G. & Lundgren, S. Clinical outcome and factors determining new bone formation in lateral sinus membrane elevation with simultaneous implant placement without grafting material: A cross-sectional, 3-17 year follow-up study. *Clin Implant Dent Relat Res* **21**, 827–834 (2019).
40. Cara-Fuentes, M., Machuca-Ariza, J., Ruiz-Martos, A., Ramos-Robles, M. C. & Martínez-Lara, I. Long-term outcome of dental implants after maxillary augmentation with and without bone grafting. *Med Oral Patol Oral Cir Bucal* **21**, e229–e235 (2016).

41. Nedir, R., Nurdin, N., Abi Najm, S., el Hage, M. & Bischof, M. Short implants placed with or without grafting into atrophic sinuses: the 5-year results of a prospective randomized controlled study. *Clin Oral Implants Res* **28**, 877–886 (2017).
42. Zhang S, BD, Lu X BD, Chen Z, BD. Clinical effects of simultaneous implant placement in hydraulic maxillary sinus lift without bone grafting. Altern Ther Health Med. 28(7):111-119 (2022) .

9. Annexes

Dear sir,
I am a dentist student on my last year of studies. I am currently working on my dissertation: "the ideal graft material in the sinus lift with simultaneous implant placement". I am very interested to include your pictures from your article: **Short Implants Placed with or without Grafting in Atrophic Sinuses: The 3-Year Results of a Prospective Randomized Controlled Study**
It would be very helpful to illustrate my contents. Thus, I would like to ask you your authorization to use this pictures.
Thank you for your time and consideration, I look forward to hearing from you soon.
Iris Benani
Iris.benani089@yahoo.fr

RN **Rabah NEDIR** hier
À : Iris Benani >

Bonjour Madame,
Merci pour votre message.
Vous avez mon autorisation pour utiliser l'iconographie de l'article que vous citez, je vous demande simplement de citer la source (donc moi lors de leur utilisation)
Je vous rend aussi attentive sur le fait que lorsqu'un article est publié, les droits des images reviennent de fait à l'éditeur du journal et ne sont plus propriété de l'auteur.
Bonne chance pour votre travail de thèse.
Vous pouvez m'en envoyer une copie par mail lorsqu'elle sera achevée 😊
Bien à vous
R. NEDIR

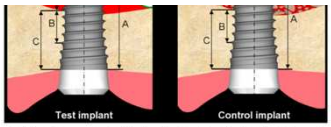


Fig. 2. Radiographic measurements. Crestal bone level: The distance (A), parallel to the implant axis, between the most apical implant thread and the most coronal bone-implant contact was measured on both sides of each implant and then averaged. A decrease in this mean value on consecutive radiographs was indicative of crestal bone loss (CBL). Endo-sinus bone gain (ESBG): The distance (B) between the most apical implant-bone contact and a reference coronal implant thread was measured on both sides of each implant and then averaged. An increase in this mean value on consecutive radiographs was indicative of ESBG. Protrusion into the sinus: The distance (D) between the implant dome and the most apical implant-bone contact was measured and averaged on both sides of each test implant. Apical graft height: The distance (E) was measured in the control group, along the implant axis. When the Schneiderian membrane was in contact with the implant dome, the (E) value was null. Available bone height: The distance (C) between the most coronal and the most apical implant–bone contact was measured and averaged on both sides of each implant. (C) and (C+E), respectively, express the available bone height for the test and control implants, respectively.

Plus

RN **Rabah NEDIR** 16:56
À : Iris Benani >

Bonsoir Madame,
Oui, vous avez également l'autorisation d'utiliser cette iconographie, aux mêmes conditions que celles de l'échange précédent .
Bon travail
Bien à vous
R Nedir

Le 8 mars 2023 à 16:41, iris benani <iris.benani089@yahoo.fr> a écrit :

ardentis
CLINIQUES DENTAIRES

MS **MARGARITA GOMEZ SANCH...** 09:01
À : Iris Cc : ANA >

Dear Iris,

After consulting the other authors, if the use of the pictures of our article is for the realization of a work and they are correctly referenced by us, there is no problem.

Regards,

Dra. Margarita Gómez Sánchez
Vicedecana de Odontología
Facultad de Ciencias Biomédicas y de la Salud
Universidad Europea
E-mail: margarita.gomez2@universidadeuropea.es
universidadeuropea.es

Universidad Europea

⚠ **WARNING:** This email originated outside the organization. Do not click links or open attachments unless you can confirm the sender and know the content is safe.

Dear Madam,
I am a dentist student on my last year of studies. I am currently working on my dissertation: "the ideal graft material in the sinus lift with simultaneous implant placement". I am very interested to include your pictures from your article: **Vertical Bone Gain after Sinus Lift Procedures with Beta-Tricalcium Phosphate and Simultaneous Implant Placement—A Cross-Sectional Study**
It would be very helpful to illustrate my contents. Thus, I would like to ask you your authorization to use this pictures.

ATTESTATION SUR L'HONNEUR

Je soussigné Monsieur BERTAUD Luigi, gérant de la SELARL du DOCTEUR BERTAUD Luigi domicilié sis 21 lotissement Les Orangers - Rue Jean Rivier - 97122 BAIE-MAHAULT, atteste sur l'honneur autoriser Mademoiselle BENANI OTHMANI Iris à exploiter les photos du cabinet qui lui seront remises à la date du 26 avril 2023.

Baie-Mahault, le 26 avril 2023

Fait pour servir et valoir ce que de droit.

Monsieur BERTAUD Luigi
Gérant

SELARL CHIRURGIEN-DENTISTE
Dr BERTAUD Luigi
21 Lot. les Orangers - Rue Jean Rivier
97122 BAIE-MAHAULT
Tél. 0690 51 86 16
Siret : 887 555 264 000 19 Ape: 8623Z

Attestation sur l'honneur

Je soussignée Madame BELHAOUES Inara, étudiante en 5ème année de médecine dentaire au CESPU et stagiaire à la clinique du Docteur EL-KHOURY Charbel domicilié au 101 rue Alexandre Dumas, 8000 Amiens, atteste sur l'honneur autoriser Mademoiselle BENANI-OTHMANI Iris à exploiter les photos du cabinet qui lui seront remises à la date du 26 avril 2023.

Gandra, 26 avril 2023.

Fait pour servir et valoir ce que de droit.

Madame BELHAOUES Inara