

MAXILLARY AIR SINUS AUGMENTATION

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ABSTRACT

Maxillary sinus augmentation also known as sinus lift technique is done in posterior maxilla when the tooth is extracted. It is done to regenerate the loss of alveolar bone to place dental implants. The aim of the study is to know which is best for maxillary sinus augmentation. The search was done in PubMed, Google scholar for relevant articles. Out of which, a few systematic reviews and original citations are cited in the review. The relevant articles are explained briefly with the findings, pros and cons and the limitation and future scope of the study is also discussed in the article below. It is concluded that the outcome for maxillary sinus augmentation, the best techniques that can be used for this augmentation and the best biocompatible material which can also be used.

KEYWORDS Biomaterial, lateral window technique, Maxillary air sinus, Maxillary sinus augmentation.

INTRODUCTION

Maxillary air sinus augmentation also known as sinus lift, a surgical procedure which aims to increase the amount of bone in the maxillary molar and premolar region by placing a bone graft (Carrao and DeMatteis, 2015; Palati et al., 2020). The pneumatization of the maxillary sinus, which may be seen after tooth extraction, can compromise the volume of the bone available for placement of dental implants (T et al., 2015). When a tooth is extracted in the maxillary posterior region, the alveolar process the deposition of (Abitha and Santhanam, 2019; Manohar and Abilasha, 2019) bone reduces and begins to degenerate and the height of the alveolar bone reduces, making it unsuitable for implants (T et al., 2015; Toffler, 2004); (Hema Shree et al., 2019).

Maxillary sinus augmentation procedure aims to increase the vertical bone height of the alveolar bone to allow the placement of dental implants. This has led to the development (Krishnan et al., 2018) of augmentation techniques, lateral window osteotomy has been routinely performed in the last few decades and has been regarded as the predictable procedure (Schimming and Schmelzeisen, 2004). Grafting the maxillary sinus floor is one of the most popular surgical interventions that increase the height of an alveolar bone before the putting endosseous dental implants in the posterior maxilla. The earliest known augmentation was done by Hilt Tatum and Oscar Hilt Tatum Jr in the year 1974 (Schimming and Schmelzeisen, 2004; Vivan et al., 2016). In the early days, since augmentation was done using inflatable catheters. Over the years, maxillary sinus grafting had become a routine treatment. It allows dental implants to be positioned using the stimulation or a staged procedure in the sites of the posterior maxilla region historically considered unsuitable for installation of implants due to inadequate bone thickness. Recent studies have shown (Ahad and Gheena, 2016; Harrita and Santhanam, 2019) that repeated

excellent long-term survival rates for implants placed into augmented maxillary sinus ([Cha et al., 2019](#)). Nowadays, many new techniques ([Hannah et al., 2018](#)) have come which have less complication and high survival rates. Materials like deep proteinised bovine bone, highly bioactive glass ceramics, titanium space maintainers, and biphasic calcium phosphate are also being widely used.

METHODOLOGY

The present review was performed using the key words “sinus augmentation”, in Google scholar, PubMed revealed hundred plus relevant articles. Out of which, a total of 21 articles systematic review and the original citations included in this review. The level of evidence of the reviewed articles were categorized as per the criteria of Centre for Evidence-Based Medicine, Oxford, UK ([CEBM, 2011](#)).

Biomaterials:

Bioactive glass ceramics

The bioactive glass ceramics is highly bio active and the glass bonds with the bone. Like other bioactive ceramics, this is due to the reaction of silica and phosphate and calcium present in it. Bioactive glass is a very compatible material. That was first introduced in the 1970s used in a wide range. It is included in ridge prevention and sinus augmentation, and the repair of the periodontal bone defects ([Ahmed et al., 2017; Cha et al., 2019](#)).

Biphasic Calcium Phosphate

In sinus augmentation surgeries, macroporous biphasic calcium phosphate was used as the sole substitute for bone. The macroporous biphasic calcium phosphate enveloped by new bone and implants is easy to target 10 months pre surgery. Macroporous biphasic calcium phosphate is used in conjunction with several other bone graft matter as a grafting tool for sinus floor augmentation ([Ahmed et al., 2017; Cha et al., 2019; Fu, 2010](#)).

Titanium Space - Maintaining Mesh:

Numerous methods and techniques are there for maxillary sinus augmentation. In this titanium mesh for lateral window sinus floor lifting without bone grafting. Post - surgeries CBCT performed and showed the formation of the new bone growth, the use of titanium micro - mesh as a space maintaining device after schneiderian membrane elevation is a dependable technique to uplift the floor of the sinus without grafting ([Ahmed et al., 2017](#)).

Tissue - Engineered - Bone

Alloplastic material for bone reconstruction have been used in craniofacial surgeries and have their drawbacks, new periosteum- derived - tissue engineered bone can form lamellar bone with in a span of three months of transplantation and also can also provide a very suitable conditions for second insertion of the dental implants ([Schimming and Schmelzeisen, 2004](#)).

Technologies and Techniques

Sinus Lift Technique

Piezoelectric-Assisted-osteotome-mediated techniques, the author says osteotome techniques have been usually used for minor surgeries (minor sinus augmentation), the method is highly predictable ([Sarbeen et al., 2016](#)) but there is high technical demand for its method. It aims for predictable implant placement, the author states that this technique has advantage of performing osteotomy of the sinus floor and states that patient are more comfortable with the procedure done([Fu, 2010](#))

Osteotome- Mediated

Osteotome-mediated maxillary sinus augmentation technique with or without using grafting material. This transalveolar sinus augmentation technique could be a variable treatment in case of localized atrophy in the posterior maxilla even in case of minimal residual bone height. The prognosis can be more favorable when the residual ridge is at least 5mm in height (Del Fabbro *et al.*, 2012).

Deproteinized Bovine Bone

There were no qualitative analysis difference in histological analysis among the group, similar radiology bone height in the augmented area was observed and the implant survival rate was 100%, both techniques were effective for maxillary sinus augmentation and after 6 months of healing, the amount of regenerated bone or the amount of graft integrated into the newly formed bone were high when compared to the other techniques (Nizam *et al.*, 2018).

Platelet-rich Fibrin

Platelet-rich fibrin showed no statistical difference in survival rate, new bone formation and contact between newly formed bone substitutes when compared to techniques like direct/little window technique, minimal invasive technique, balloon technique, Cone-Beam computed tomography technique (Jeong *et al.*, 2014).

DISCUSSION

This study was undertaken to (Prasanna and Gheena, 2016; Uma *et al.*, 2018) know the various techniques of maxillary sinus augmentation. From the articles collected and reviewed about maxillary sinus augmentation. There are many techniques for sinus argumentation like direct/little window technique, minimal invasive technique, balloon technique and Cone-Beam computed tomography technique. Different biomaterials that are used are alloplastic material, biphasic calcium phosphate, bioactive glass material, titanium space maintaining mesh done for sinus upliftment placement.

The most popular technique used for maxillary sinus augmentation is lateral window technique because most doctors follow this technique and it is more (Gunasekaran and Abilasha, 2016; Sukumaran and Padavala, 2018) than other techniques and have less complications. The second most used technique is minimal invasive technique and osteotome technique both equally used for easy doing and for the success rate. The most common material used for argumentation is bioactive glass material because of its high bone rate formation when compared to other materials and the least used material and alternative material is ballon technique. The main reason is it is a new technique (Gunasekaran and Abilasha, 2016) and it is not known and is less popular and can be seen as an alternative form because of its good success rate in the bone formation.

The limitations of the review is the population is different for different studies and the outcomes may not be similar in all the studies; maximum of the studies are taken from recent work in finding so there are more elements to this day. Future scope there are many new techniques that are very successful and have very few complications but are not known or popular, new techniques with success rate and less communication must be found and made popular and should be known .Even conducting the survey(Sheriff *et al.*, 2018) is a better option to know which is best .

CONCLUSION

The most followed technique is maxillary sinus augmentation is lateral window technique and the material used is bio active glass material but other techniques are also better option (Palati *et al.*, 2019) is to be used for maxillary sinus augmentation.

CONFLICT OF INTEREST

None declared.

AUTHOR CONTRIBUTION

Arun Kishore RN: Literature search, data collection, Analysis , Manuscript Drafting

Gifrina Jayaraj : Data Verification, Manuscript Drafting, Gayatri Devi : Data Verification, Manuscript Drafting

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Table 1: Description and quality of included studies

Author	Year	Study	Qualitative analysis	Description of included studies
Ronald Schimmer , Rainer Schmelzeisen(<u>Schimming and Schmelzeisen, 2004</u>)	June 2004	Clinical study	Level 4	new periosteum- derived - tissue engineered bone is used .
RR Vivan (<u>Vivan et al., 2016</u>)	2016	Therapeutic study	Level 2	bioactive glass ceramics is highly bio active and binds to the bone due to the presence of silica and phosphate
Jae-kook Cha, Jung - Chul Park(<u>Jeong et al., 2014</u>)	2014	Clinical and radiographic study	Level 4	Macroporous Biphasic calcium phosphate can be used as substitute for bone in sinus augmentation surgeries
M.Ahmed , R.M Hardy(<u>Ahmed et al., 2017</u>)	2017	A Split- Mouth Study	Level 1	the use of titanium micro - mesh as a space maintaining device
Jee-Won Moon(<u>Moon et al., 2011</u>)	2011	Therapeutic Study	Level 2	implant survival rate was 100%

Wheeler SL (<u>Wheeler, 1997</u>)	1997	Study based	Level 3	High survival rate and this technique has advantage of performing osteotomy of the sinus floor
Massimo Del Fabber (<u>Del Fabbro et al., 2012</u>)	2012	Case study	Level 4	This transalveolar sinus augmentation technique could be in case of localized atrophy in the posterior maxilla
Hirsch JM (<u>Hirsch and Ericsson, 1991</u>)	1991	Randomised controlled study	Level 3	There were no qualitative analysis difference
Esposito M(<u>Esposito et al., 2014</u>)	2014	Case study	Level 4	provide a very suitable conditions for second insertion of the dental implants
Nejat (<u>Nizam et al., 2018</u>)	2018	A Split-Mouth study	Level 1	Platelet-rich fibrin showed no statistical difference in survival rate , new bone formation