

Bone Augmentation Techniques in Dentistry and Research Progress

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Abstract

Oral problems can have adverse effects on people's physical health, tooth aesthetics, daily eating and communication, etc. It is necessary to cultivate awareness of oral health care, regularly go to the hospital for oral health checks, and if problems are found, seek medical treatment in a timely manner. Analyze the current numerous illnesses. It is common to find that the problem of insufficient alveolar bone mass is a common issue in the treatment of dental diseases. If this problem is not effectively solved, it will affect patients with dental defects. The effectiveness of dental implant treatment requires doctors to conduct alveolar bone mass examination on patients who come for treatment and receive implant surgery. If there are any deficiencies. The situation requires bone augmentation technology treatment first, followed by implantation surgery, in order to achieve the ideal implantation effect for missing or fractured teeth. In this study, We conducted research and analysis on the application of several commonly used bone augmentation techniques in clinical practice, in order to provide experience summary for the effective application of this technology in the future.

Keywords

Bone Augmentation Techniques; Oral Implants; GBR; Alveolar Bone.

1. Introduction

Tooth loss is a common oral disease for which implant technology is the main restorative method. Insufficient bone volume in the implant site can lead to implant exposure and lack of initial stability when implants are placed, which in turn can affect the efficacy of implant restoration. In order to achieve good long-term implant results, the remaining bone mass and shape of the alveolar ridge required for implantation must meet certain conditions. Research has shown that the minimum implant bone mass is 4mm horizontally and 7mm vertically, but in clinical practice, this alveolar bone mass is not sufficient to meet the needs of restoration and aesthetics. After implantation, a bone mass of 1-1.5mm should be reserved on the buccal and lingual sides of the implant, and a safe distance of more than 2mm should be kept between the implant and the adjacent tooth root and nerve canal. In the aesthetic area, the bone wall thickness on the lip side of the implant should be thicker than 2.2mm to reduce the risk of gingival recession on the lip side. When the thickness of the lip side bone plate is less than 0.5mm, a large amount of bone absorption and obvious gingival recession can be seen six months to one year after implantation. However, it is extremely common in clinical practice to have insufficient bone mass and poor bone quality in the implant area. Statistics show that about 40% to 60% of implant patients have insufficient alveolar bone mass.

2. Induced Bone Regeneration Barrier Membrane Procedure

The ideal barrier membrane should have properties such as good biocompatibility and accelerated tissue repair, sufficient mechanical strength to maintain a stable space and increase maneuverability, excellent cell closure to prevent epithelial cell migration, biodegradable and free of serious immune reactions, and capable of active induction [1]. With the continuous development of various materials and technologies, the research field of membranes is expanding. Modification of membranes, application of composite membranes, functional gradient membranes, and promotion of membrane physicochemical properties, antibacterial properties, and osteogenic properties are the research directions of many scholars. The development of implant technology has been promoted, and the scope of application of implants has been broadened, thus the scope of adaptation of implant technology has been expanded.

3. Autologous Dental Implant Technique

In recent years, autodontics has gradually become an emerging bone replacement material because of its excellent biocompatibility and accessibility. In *ex vivo* experiments, dental tissues possess both bone-guided and osteoinductive properties, especially dentin. [2-3]. Based on these characteristics, autogenous dental pellets are now used for guided bone regeneration, maxillary sinus surgery, positional preservation and immediate implantation [4]. Schwarz et al [5] used autogenous dental roots for the restoration of bone defects and showed that after 6 months, a bone augmentation effect of approximately 6.5 mm could be obtained and would be lower compared to the resorption rate of autogenous bone Kim et al [6] placed demineralized human dentin particles into the subcutaneous muscle pockets of nude mice, and after 2 weeks, osteoblasts, mineralized collagen and osteocytes were visible on their surface. Some studies have also confirmed that type I collagen scaffolds, which can be used as carriers for BMPs, have a lasting promotional effect on bone defect areas [7].

4. Tent Peg Technology

The tent peg technique uses tent pegs to provide and maintain osteogenic space, it improves bone augmentation and has a low technical sensitivity, it is considered as an alternative option for bone augmentation and has received widespread attention [10]. In all directions of osteogenesis and site preservation, tent pegging has been clinically effective. le et al [11] used the tent pegging technique for reconstruction of vertical bone defects of the alveolar ridge and ultimately obtained a vertical bone gain of approximately 9.7 mm, noting that the size of the vertical bone defect may affect the effectiveness of the technique. pourdanesh et al [12] reported Chasioti [14] and Reddy et al. used this technique to preserve the reduced extraction sockets, and in five patients no significant resorptive reconstruction was seen in the alveolar bone, and all patients received sufficient bone density for implant needs. All indications are that the tent peg technique, supported by tent pegs or titanium pegs, creates a stable growth space for bone regeneration and can be effective in improving osteogenesis [15].

5. Other

Ji Ping [16] found that 3D printed personalized titanium mesh as a barrier membrane made entirely of metal with superior mechanical properties and good biocompatibility can precisely reconstruct the alveolar bone contour, avoid intraoperative manual bending and trimming steps, shorten the surgical time, and its rounded edges have better clinical application prospects compared to traditional finished titanium mesh. Plasma matrix, as an autologous blood product, can efficiently promote vascularization at the site of tissue defects, while also recruiting stem cells, reducing inflammatory response and promoting bone regeneration. The main applications of plasma in bone volume augmentation are plasma films and plasma bone blocks [17].

6. Conclusion

Adequate bone density is an important factor in the success or failure of implants, but in clinical practice, there is often insufficient bone in the implant area, which affects the implant placement direction in the implant. Therefore, the restoration and reconstruction of the alveolar ridge is particularly important in order to ensure the success and stability of the implant. When performing bone augmentation, the operator should carefully evaluate the alveolar bone condition, and fully consider the differences in bone removal volume, postoperative complications, and bone graft resorption rate in different donor areas. Therefore, the incremental method should be flexibly selected according to the specific situation of patients before surgery, so as to achieve the best effect of surgery and repair. How to achieve better bone augmentation with less trauma, how to avoid complications and postoperative bone resorption, and new bone augmentation equipment will become the focus of future research.

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