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Effect of Two Kinds of Bone Replacement Materials on Bone Formation in Repairing Bone Defects Around Mandibular Posterior Area: a Case Study of Bone Defects Around Mandibular Posterior Area Caused by Boxing

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Abstract: Objective: To investigate the effect of two kinds of bone replacement materials on bone formation in repairing bone defect around mandibular posterior area. Methods: A total of 60 patients with Bone defects around mandibular posterior area caused by boxing were selected from a hospital from January 2020 to June 2020. They were divided into Perio Glas (group P) and Bone Plant (group B) by random number table method, with 30 patients in each group. Perio Glas Bone graft was used in group P and Bone Plant graft was used in group B. The vertical height and buccal lingual bone plate width of the two groups were observed at baseline and after treatment, and the success rate of implants was compared between the two groups. Results: The success rate of implant in group P was significantly lower than that in group B ($P < 0.05$). The vertical height and buccal lingual bone plate width in group P were significantly lower than those in group B ($P < 0.05$). Conclusion: Compared with Perio Glas, Bone Plant can better maintain the vertical height and buccal lingual Bone plate width of patients with Bone defects around mandibular posterior area caused by boxing, and has better effect of inducing Bone regeneration and osteogenesis.

Keywords: Materials; The Mouth; Bone Regeneration; Implant

1. Introduction

Oral and maxillofacial injuries are the most common injuries in boxing. Oral and maxillofacial injuries caused by boxing are characterized by high incidence, high treatment cost and long treatment time, etc., and have long been the issue of highest concern []. Guided bone regeneration technology has been clinically established in the field of bone graft repair of bone defects []. At present, Perio Glas and Bone Plant are artificial inorganic Bone replacement materials commonly used in oral and maxillofacial bone grafting to repair bone defects. Perio Glas and bone plant have different physical and chemical properties and osteogenic properties. There are few reports on the effect of Bone regeneration and osteogenesis induced by Perio Glas and bone plant in repairing bone defects around mandibular posterior area. In order to provide reference for the clinical treatment of the bone defects around the mandibular posterior teeth caused by boxing, the effects of two kinds of bone replacement materials on the bone formation of the defects around the mandibular posterior teeth were studied.

2. Material and methods

2.1 General information

A total of 60 patients with Bone defects around posterior teeth caused by boxing were selected from A hospital from January 2020 to June 2020. They were divided into Perio Glas (group P) and Bone Plant (group B) by random number table method, with 30 patients in each group. P group, gender: 18 males, 22 females; The age ranged from 52 to 79 years, with an average of (68.81±5.25) years. Group B, gender: 17 males and 23 females; The age ranged from 53 to 80 years, with an average of (68.43±5.14) years. Inclusion criteria: Cone-beam CT examination indicated bone defects around the mandibular posterior tooth area, and immediate implant treatment was planned; The remaining buccal and lingual width of the implant

site and the height of the remaining bone were sufficient. Exclusion criteria: severe bone defect, periodontal disease and gingivitis; Malocclusion, night bruxism and lateral mastication.

2.2 Material

Perio Glas (manufacturers: American states biological products co., LTD., approval number: feed the drug safety machinery (into) the word no. 2003585, 2015 materials and ingredients: silicon dioxide, sodium oxide, calcium, phosphorus pentoxide, biocompatibility: good, indications: periodontal bone defects, maxillofacial surgery, bone defect filling, adverse reactions: Not). Bone Plant (Manufacturer: EZEKIEL Company, Korea, Approval No. : China Food and Drug Administration Wu (Jin), 2015 No. 3510312, material composition and composition: hydroxyapatite, tricalcium phosphate, biocompatibility: good, indication: periodontal Bone defect, maxillofacial surgery Bone defect filling, adverse reaction: none).

2.3 Surgical method

Minimally invasive flap implantation was used in both groups. 0.2% compound chlorhexidine gargled for 2.0-3.0 min, routine disinfection area of iodophor was covered with towel, local infiltration of lidocaine anesthetized mandibular rear tooth planting area, residual teeth were extracted, granulation tissue was removed, and physiological saline was rinsed. Alveolar ridge top horizontal incision to stick under the periosteum, buccal do zhang incision reduction, stripping periosteum separator sticky periosteal flap, exposed alveolar bone, pioneer drilling and reaming, parallel bar detection embedded direction, step by step to enlarge Kong Bei hole diameter, default saline flushing, observe the granulation tissue residue, implants implanted suitable types, manual torque, torque wrench Ensure that the implant torque > 35 N•cm to ensure the initial stability of the implant, implant covered with screws. Perio Glas or Bone Plant were implanted into the Bone defect area around the implant, and bio-Gide bio-collagen membrane was cut into appropriate size to cover the Bone replacement material, and the window was tightly sutured to ensure no Bone powder and periosteal exposure in the operative area. Postoperative oral antibiotics for 6 d, oral losolprofen sodium tablets or ibuprofen sustained-release capsules for local analgesia, 1 week later, stitches removed. Six months after the operation, the abutment was installed and repaired, the abutment horizontal impression model was made, the fixed denture was made, and the abutment was connected and fixed by 4 ~ 6 longitudinal screws.

2.4 Observation target

Implant success rate: evaluated 12 months after treatment, success was defined as no loosening of the implant, radiology suggested no low-density shadow around the implant, bone absorption less than 0.2mm after implant loading, and no discomfort, pain, numbness and other symptoms.

Bone tissue indicators: Cone-beam CT was taken at baseline and 12 months after treatment to measure the width and vertical height of buccal and lingual bone plates. The width and height of alveolar bone in the dental implant area were measured along the buccal and lingual bone plates, respectively, and the mean value of 3 measurements was taken.

2.5 Statistical method

All data were statistically processed by SPSS 20.00 statistical software. If the measurement data were normally distributed, the comparison between groups was performed by independent sample T test in the form of mean ± standard deviation (). The counting data were expressed in the form of N (%) by chi-square test. Test level α=0.05.

3. Results

3.1 Comparison of implant success rate between the two groups

The success rate of implant in group P was significantly lower than that in group B ($P < 0.05$). See table 1.

Table 1 Comparison of implant success rate between the two groups [N (%)]

Group	Number of implants	Failure	Successful
P	67	12（17.91）	55（82.08）
B	65	4（6.15）	61（93.84）
X^2			4.281
P			0.000

3.2 The vertical height and buccal lingual plate width of the two groups were compared at baseline and after treatment.

The vertical height and buccal lingual bone plate width in group P were significantly lower than those in group B (P < 0.05). Are shown in table 2.

Table 2 Comparison of vertical height and buccal and lingual plate width between baseline and after treatment [$\bar{x} \pm s$]

Group	Vertical height（mm）	Width of the buccal-tongue side bone plate（mm）
P（*n*=30）		
Baseline period	1.46±0.25	4.66±0.45
Post-treatment	4.15±0.33	5.09±0.46
B（*n*=30）		
Baseline period	1.44±0.27*	4.60±0.54*
Post-treatment	5.13±0.48△	6.27±0.51△

Note: Compared with P group, t=0.297, 0.467, *P > 0.05; T =9.215, 9.410, △P < 0.05.

4. Discussion

After the defect of bone around the mandibular posterior area, the alveolar bone is absorbed due to the increase of occlusal load and lack of corresponding physiological stimulation, and the residual alveolar bone width is often insufficient. Oral implant repair In order to achieve good oral aesthetics and long-term implant stability, patients treated with implant implantation need guided bone regeneration therapy to support the required bone mass during implant implantation []. Guided bone regeneration technology uses biofilm barrier to protect bone defects and bone replacement materials, block the external influence on the bone graft area, promote the generation of bone regeneration fibrocells, and support the space required for osteogenesis of osteoblasts, which can effectively solve the problem of bone defects encountered in implant surgery.

In Perio Glas, calcium and phosphorus can form carbonate hydroxyapatite layer under the influence of P-H value, causing calcium and phosphorus plasma migration, calcium phosphate and silicon release, stimulating osteoblast proliferation, further generating collagen fibers, forming bone-bioglass interaction interface, and mediating bone regeneration. However, Perio Glas has certain limitations. Perio Glas bioglass has high brittleness, and the planting effect is not ideal for planting areas with excessive pressure load []. Bone Plant is a new concept 3D-channel matrix porous massive Bone replacement material, which is designed and improved on the basis of traditional Bio-OSS theory. It is composed of 60% hydroxyapatite and 40% tricalcium phosphate, and is a hexahedral tubular honeycomb structure. Compared with the traditional Bio-OSS particles, the defects of bone meal loss and difficult to maintain the spatial structure of the defect site in the process of bone grafting can be solved to a certain extent. For large bone defects, the matrix porous block bone structure can retain the block shape. For small bone defects, the bone can also be crushed into granular shape, with flexibility and practicality. After Bone Plant is broken, it becomes a cavity structure instantly due to the special 3D-channel structure, which is stably fixed at the Bone defect site and can maintain a certain area of Bone graft. After gently pressing, the cavity structure is closed instantly, forming a dense and closed Bone graft effect, which significantly reduces material flow, dispersion and displacement. Secondly, the porous structure of Bone Plant can absorb part of blood to play a hemostatic role, and can increase the contact

between artificial Bone meal and blood hemoglobin factor, providing blood supply and nutrients for new Bone regeneration. The porous structure of Bone Plant can effectively absorb Bone marrow blood, thus leading to Bone conduction and inducing Bone tissue regeneration. Therefore, Bone Plant has more advantages in maintaining the spatial structure stability of regenerated Bone [].

5. Conclusion

In order to more objectively verify the effect of two bone replacement materials on bone formation in repairing the bone defect around mandibular posterior area, t test was used to compare the bone tissue indexes of vertical height and buccal and lingual bone plate width of the two groups at baseline and after treatment, and chi-square test was used to compare the success rate of implants between the two groups. The results showed that the success rate of implant in group P was lower than that in group B. The vertical height and buccal lingual bone plate width of group P were lower than that of group B. In conclusion, compared with Perio Glas, Bone Plant can better maintain the vertical height and buccal lingual Bone plate width of patients with Bone defects around the mandibular posterior area caused by boxing, and has a better effect of inducing Bone regeneration and osteogenesis.

In conclusion, this study investigated the effect of two bone replacement materials on bone formation in repairing the bone defect around the mandibular posterior area.

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