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Neurophysiological Changes After Implant Placement Associated With Augmentation Procedures

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Objectives

Quantitative Sensory Testing (QST) of the German Research Network on Neuropathic Pain (DFNS)[1] is an established psychophysiological approach to detect and quantify sensory disturbances. The protocol was adapted for extra- and intraoral use in the innervation region of the inferior alveolar nerve[2]. This enables the measurement of neurophysiological changes associated with implant placement. To perform an implant placement, augmentation procedures have to be implemented in cases with an atrophied jaw. Defect size indicates the type of augmentation procedure. Test hypothesis of this study was that implant placement associated with augmentation procedures will increase the possibility for sensory disturbances. Furthermore, various hard and soft tissue augmentations might result in impaired quality of life during the healing period.

Methods

Patients (9 female, age 61±8.8 and 10 male, age 60±7.9) obtained an implant placement in the lower jaw combined with augmentation procedures.

- **Guided Bone Regeneration(GBR) one-stage surgery (A)**
- **Customized Bone Regeneration(CBR) two-stage surgery (B)**

Group A

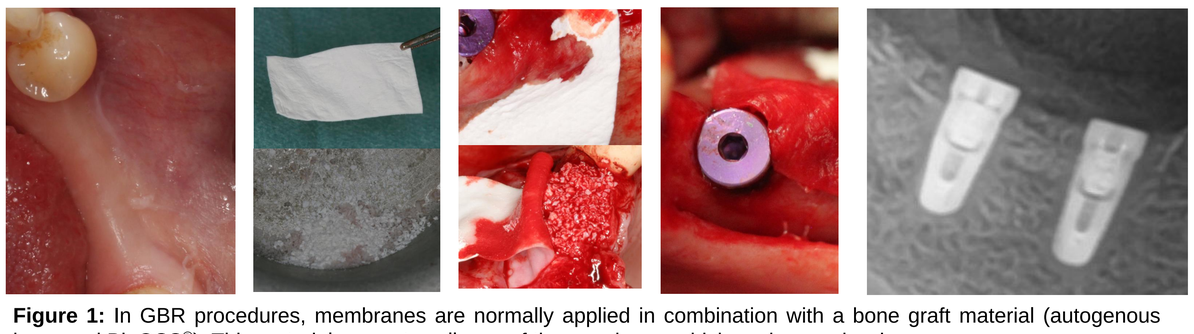

Figure 1: In GBR procedures, membranes are normally applied in combination with a bone graft material (autogenous bone and BioOSS®). This material prevents collapse of the membrane which works as a barrier.

Group B

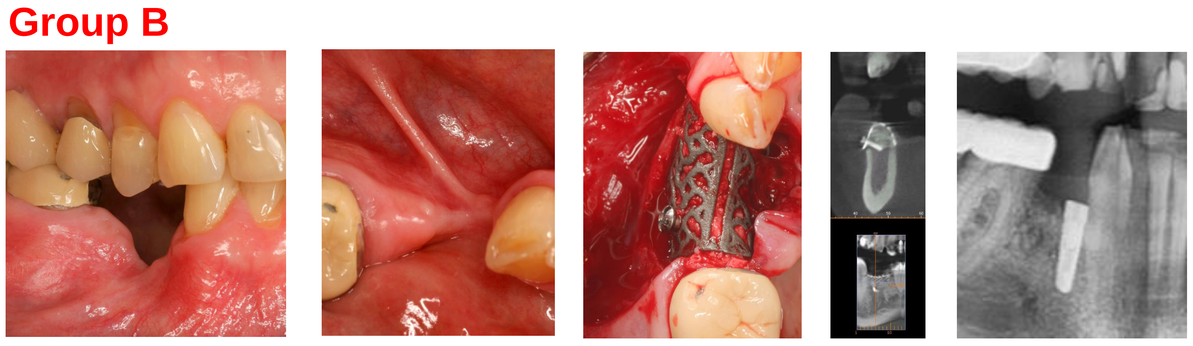

Figure 2: Defect size (horizontal and vertical deficit) obtaining a second-stage surgery including first augmentation with an individualized titanium lattice structure. Next step was removal of the mesh and implant placement.

Patients were tested bilaterally immediately or up to 8 month after implant exposure at the chin (extraoral) and the lower lip (intraoral). Mechanical and thermal sensation was evaluated. Additionally patients quality of life and mental state during the surgical procedures was assessed with the Oral Health Impact Profile (OHIP) and the Hospital Anxiety and Depression Scale (HADS).

Results

We evaluated QST parameters for the implanted and augmented side in n=19 patients and compared them to the contralateral side. All QST parameters revealed no significant differences as shown in the Z-score profile for the mechanical parameters (Fig. 3). Additionally no painful sensation was perceptible for thermal stimuli (45 or 0 degree Celsius).

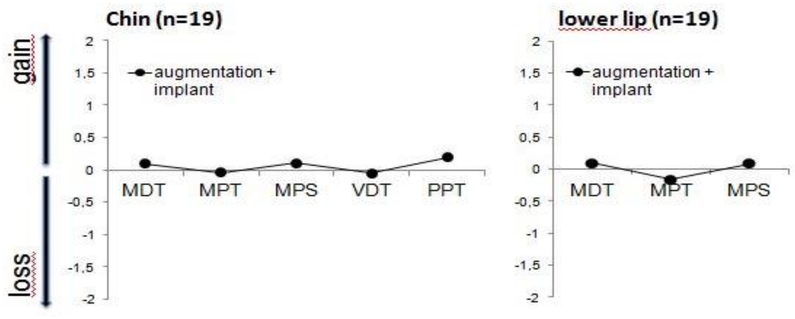

Fig.3:
Z-score QST profiles of the chin and lower lip (mechanical parameters)
The mean of the implanted side showed no significant changes and the variance was within the natural variation.
MDT=Mechanical Detection Threshold
MPT=Mechanical Pain Threshold
MPS=Mechanical Pain Sensitivity
VDT=Vibration Detection Threshold
PPT=Pressure Pain Threshold
Measurement of VDT and PPT was not possible at the lower lip.

Regarding the two groups (GBR and CBR) who have undergone different augmentation procedures, mechanical QST parameters showed no significant correlation in all qualities provided by the inferior alveolar nerve.

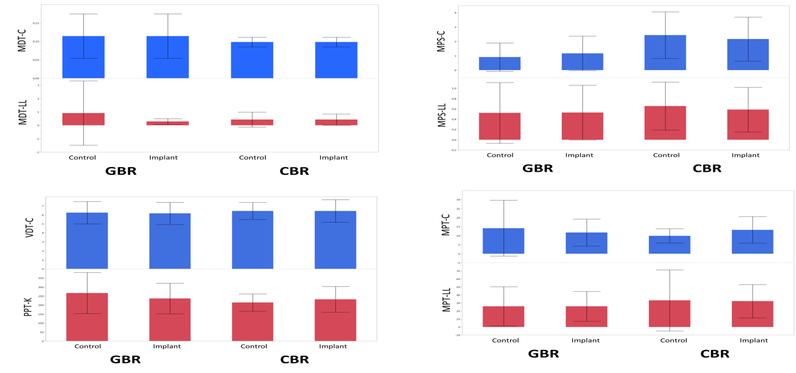

Fig.4:
Univariate analysis between control and augmentated/implanted side was not significantly different neither in the GBR (n=14) nor the CBR (n=5) group in all mechanical parameters.

Evaluation of quality of life (OHIP score GBR 4.1±5.3; CBR 5.2±9.6) and psychological factors (HADS score GBR-A 2.6±3.2; GBR-D 2.5±2.9; CBR-A 6.2±3.1; CBR-D 5±4.2) showed no statistical differences between patients undergone GBR (A) or CBR (B).

Discussion

The present study applied the QST in order to specify neurophysiological changes after implant placement combined with augmentation procedures. Our test hypothesis could not be proofed. In general, augmentation procedures did not increase sensory disturbances, indicating no changes in the neurophysiological pathways. Extended augmentation procedures as performed in group B (GBR) did not lead to sensory changes either. Various hard and soft tissue augmentations did not result in impaired quality of life or modified anxiety and depression scores during the healing period.
In conclusion, augmentation procedures should not be avoided in healthy patients. Priority should be given to correct implant position according to the common guidelines in sense of backward planning.

1. Rolke, R. *et al.* Quantitative sensory testing: a comprehensive protocol for clinical trials. *Eur J Pain 2006;* 10, 77-88
2. Hartmann, A. et al. Neurophysiological changes associated with implant placement. Clin. Oral Impl. Res. 2016; 00, 1–6

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