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study

To bury or not to bury? GBR combined with implant installation

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Background

Guided bone regeneration (GBR) in combination with implant installation is a standard technique for jaw-bone reconstruction when a small volume of augmentation is needed, such as in dehiscence defects. A common approach is the use of a particulate bone substitute material together with a bioresorbable collagen membrane.

A recent systematic assessment of the literature indicated that dehiscence defects are resolved after GBR in an average of about 8'% of cases, but a wide range of defect resolution (56.4%-97.1%) was also observed.

It has been considered that this wide variation may result from differences in the type of healing – i.e., whether a submerged approach aiming at primary-intention healing or a transmucosal approach with secondary-intention healing was implemented.

Recent clinical studies have not revealed any notable differences between the two approaches. Peri-implant bone level in those studies was assessed with peri-apical radiographs – i.e., no relevant information was provided on the outcome of GBR in relation to the extent of buccal bone regeneration. Thus, whether the type of healing influences the outcome of GBR remains unclear.

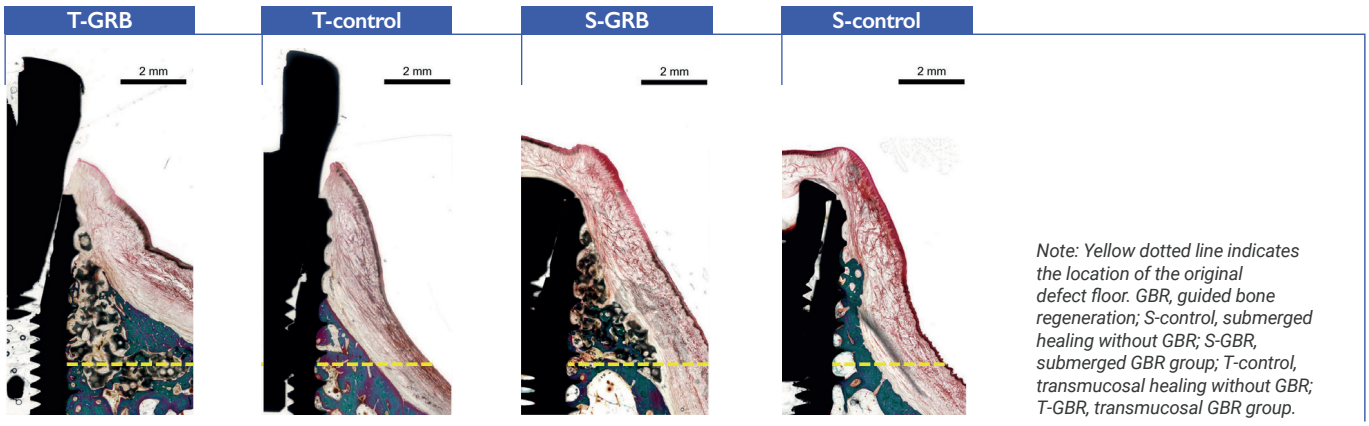
Aim

The aim of this preclinical *in vivo* study was to assess histologically the impact of the healing approach on the outcome of GBR, when performed together with implant implementation.

Materials & methods

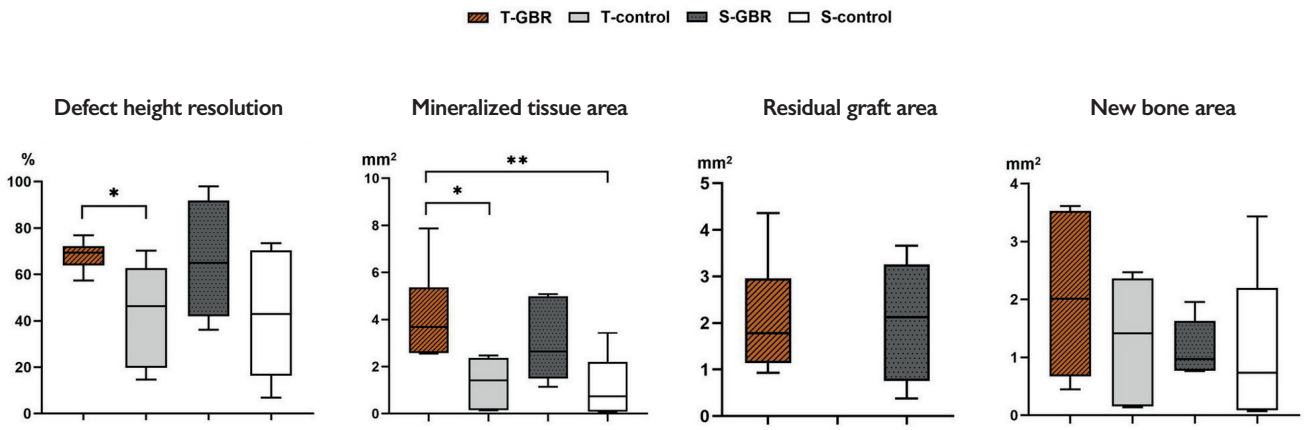
- Six dogs with posteriorly edentulate mandibles.
- Two bone-level implants were installed in each side of the mandible.
- Surgically created dehiscence type defects (5mm length x 5mm height x 3mm depth) were made at the buccal aspect of the implant.
- The GBR procedure was performed with a synthetic particulate bone substitute made of hydroxyapatite and β-tricalcium phosphate (60:40 ratio by weight) and a cross-linked collagen membrane composed of type 1 collagen.
- Four experimental groups were randomly assigned:
  - GBR and transmucosal healing (T-GBR).
  - GBR and submerged healing (S-GBR).
  - No GBR and transmucosal healing (T-control).
  - No GBR and submerged healing (S-control).
- Histological analysis was performed after five months of healing.

Figure 1: Representative histological sections of the four experimental groups



Note: Yellow dotted line indicates the location of the original defect floor. GBR, guided bone regeneration; S-control, submerged healing without GBR; S-GBR, submerged GBR group; T-control, transmucosal healing without GBR; T-GBR, transmucosal GBR group.

Figure 2: Box plots of results (mean, interquartile range, minimum, and maximum)



*Note: Defect height resolution is the percentage resolution of the 5-mm dehiscence defect. Mineralised tissue area is the sum of residual graft area and the new bone area. The graph for the residual graft area contains only two groups that had guided bone regeneration performed (T-GBR and S-GBR groups). Statistical significance between groups is annotated by * and **. GBR, guided bone regeneration; S-control, submerged healing without GBR; S-GBR, submerged GBR group; T-control, transmucosal healing without GBR; T-GBR, transmucosal GBR group.*

Results

- In the T-GBR and the S-GBR groups, bone-substitute particles with variable degrees of integration within newly formed bone were found at the buccal aspect of the implants.
- The T-GBR group showed superior outcomes compared with the other three groups in most of the analysed parameters, but without statistically significant differences compared with the S-GBR group.
- Defect height resolution was 68.3% (±5.9) for the T-GBR group vs. 66.3% (±23.7) for the S-GBR group.
- In the non-GBR groups, defect-height resolution was 43.2% (± 20) for the T-control group and 42.5% (±26.5) for the S-control group; the difference between the T-GBR group and the T-control group was statistically significant.
- In the T-GBR and T-control groups, the junctional epithelium stopped at some level in the healing abutment, and connective tissue was found in direct contact with the base of the abutment and the coronal aspect of the implant.
- No treatment group achieved bone coverage on the most coronal 1mm of the implants.

Limitations

- The character (acute) and morphology (box-type) of the defects used in this study may not adequately replicate the challenges of dehiscence type defects in the clinic.
- All implants in this study were placed with good initial stability in alveolar bone of good quality.
- The collagen membrane used in this study was made of crosslinked collagen, and exhibited a certain degree of stiffness; thus, results may not apply to softer non-crosslinked collagen membranes.
- The study may have been underpowered to be able to disclose differences between groups in terms of new bone area.

Conclusions & impact

- Transmucosal healing after GBR in combination with implant installation does not seem to compromise the outcome in terms of the extent of bone regeneration at the buccal aspect of the implant.
- GBR using a synthetic particulate bone substitute made of hydroxyapatite and β-tricalcium phosphate (60:40 ratio by weight) and a cross-linked collagen membrane, in combination with implant installation, does not lead to bone regeneration up to the collar of the implant.

JCP Digest 123, published in April 2024, is a summary of "Is transmucosal healing of an implant as effective as submerged healing when simultaneous guided bone regeneration is performed? A preclinical study". *J Clin Periodontol.* 2024: 51(03):330-337. DOI: 10.1111/jcpe13913

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