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study

Immediate tooth replacement: to graft or not to graft?

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Background

The immediate replacement of an unsalvageable tooth with an immediate implant and provisional crown is a fascinating treatment modality that allows optimisation of operative times and costs as well as reducing surgical trauma for the patient.

However, when addressing the anterior maxilla, aesthetic complications – chiefly the risk of mid-facial recession of the buccal gingival margin – have been reported in clinical trials and in systematic reviews.

The occurrence of this complication is primarily related to the healing pattern of the post-extractive socket, and positive results have been observed when adopting interventions intended to promote the establishment of a favourable healing pattern in this environment.

These include placing the implant in the correct three-dimensional position, selecting cases with a thick gingival phenotype and buccal bone plate, grafting with bone substitutes, and immediately connecting the implant-supported crown.

The adjunctive use of a connective tissue graft (CTG) has been advocated to compensate for the volumetric contraction of the alveolar process and to prevent the apical migration of the gingival margin.

However, a deeper understanding of the effects that a CTG can exert during immediate implant placement and provisionalisation (IIPP) is still lacking.

Aims

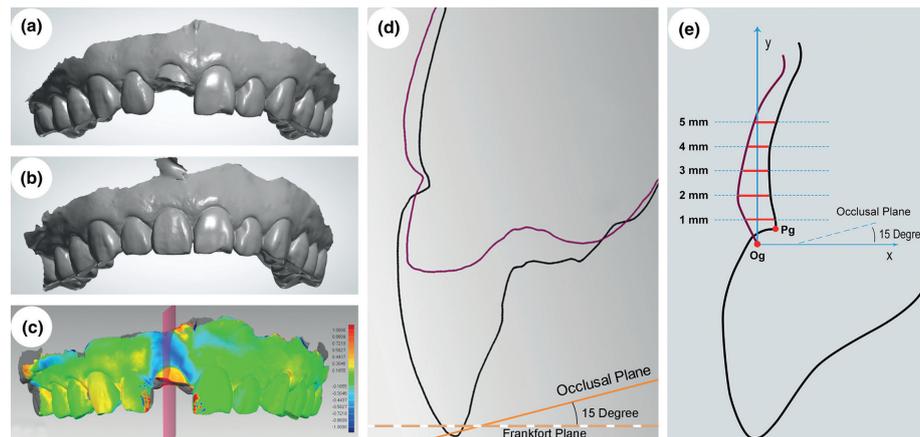
The aim of this study was to assess the adjunctive effects that a CTG can provide at the hard- and soft-tissue level during IIPP, over a healing period of six months.

Materials & methods

- A randomised controlled clinical trial with 42 systemically healthy adult patients (20 to 65 years), presenting with a single unsalvageable maxillary incisor (12 to 22), with healthy adjacent natural teeth and with an intact buccal bone wall, enrolled at Peking University.
- Exclusion criteria: history of periodontitis, buccal-plate deficiency after extraction, a bone phenotype unsuitable for IIPP, pregnancy, a smoking habit of more than 10 cigarettes/day, or any other contraindication for IIPP.
- All patients received a flapless IIPP. After extraction and identification of an intact buccal bone wall, an immediate implant with a 3.5mm diameter was placed palatally within the socket, and the residual gap was filled with deproteinised bovine-bone mineral. An immediate screw-retained restoration was placed within 24 hours. In the test group, a CTG (15 x 5 x 1.5 mm) was harvested from the posterior palate and placed beneath the buccal mucosa using a tunnel approach, while no additional treatment was provided to the control group.
- Cone-beam computed tomography (CBCT) and intra-oral scanning were performed prior to surgery and six months postoperatively, to assess both hard- and soft-tissue remodelling by comparing measurements performed over cross-sectional planes on superimposed images.
- The primary outcome was the change in the mid-buccal position of the gingival margin from baseline to six months, while secondary outcomes were changes of the buccal soft-tissue contour (assessed over horizontal lines at 1 to 5 mm from the gingival margin) and bone volume (buccal plate resorption ratio [BPR]).

Figure: Tissue contour analysis using Standard Tessellation Language (STL) file superimposition.

(a) STL file from an intra-oral scan before extraction; (b) STL file from intra-oral scan six months after surgery; (c) three-dimensional superimposition of the STL file before and six months after surgery (a cross-sectional plane [pink] was used to evaluate the soft tissue contour changes); (d) cross-sectional image of an actual participant (purple outline indicates the tissue profile before extraction, black outline represents the tissue profile six months after surgery, orange line indicates the occlusal plane, and dotted orange line indicates the Frankfort plane); (e) schematic drawing of the cross-sectional plane for analysis (purple outline indicates the tissue profile before extraction but the outline of the residual tooth is not shown, and black outline represents the tissue profile six months after surgery).



Results

- **Baseline data:** No statistically significant differences were found between the two groups for all baseline socket parameters, including buccal-plate thickness (BPT) and initial socket width.
- **Patient retention and implants survival:** 40 out of 42 patients completed the six-month follow-up, implant survival rate was 100% in both groups.
- **Primary outcome:** The mid-facial gingival margin showed a minor recession at six months (0.16 ± 0.60 mm in the test group and 0.26 ± 0.54 mm in the control group), with no statistically significant differences between groups.
- **Secondary outcomes – soft-tissue changes:**
 - The buccal-tissue profile collapse was significantly smaller at test implants in the area from 2 to 5mm apical to the gingival margin.
 - The difference was highest at 5mm (test = 0.18 ± 0.74 mm; control = 0.99 ± 0.82 mm; $p = 0.002$), progressively reduced in the coronal direction, and was not statistically significant at 1 mm (test = 0.89 ± 0.48 mm; control = 1.07 ± 0.45 mm; $p = 0.183$).
- **Secondary outcomes – bone changes:**
 - The buccal bone resorption ratio (BPR) was highly relevant, at $92.8 \pm 27.8\%$ in the test and $77.5 \pm 44.5\%$ in the control group, with no statistically significant differences ($p = 0.23$).
 - In several cases, bone resorption extended to the basal bone of the maxilla beyond the root apex.
 - In both groups, patients with a thick buccal bone plate (>1 mm) showed limited resorption.
 - All coordinate values and linear measurements regarding the bone-plate position and thickness showed no statistically significant differences between the groups.

Limitations

- The follow-up was limited to six months and no definitive restoration was placed during this period.
- No aesthetic evaluation was performed, despite the overall purpose of adding a CTG to IIPP being to improve the peri-implant aesthetics.
- It could be useful to know which type of CTG was used, which type of receiving bed was prepared (full- or split-thickness), at which position the CTG was stabilised with respect to the gingival margin, and which emergence profile was provided for the immediate provisional restoration.
- The study may be underpowered, as the standard deviation for the buccal gingival recession in the test and control groups (0.53 ± 0.60 mm) was higher than the one used in the power calculation (0.45 mm).

Conclusions & impact

- The adjunctive use of a CTG with a flapless IIPP protocol is a suitable means to sustain the buccal-tissue profile in a submarginal position (2-5 mm apical to the gingival margin), but no impact was observed in the first millimetre apical to the gingival margin.
- Both groups experienced a minor recession of the gingival margin and a mild collapse of the soft-tissue profile in its most coronal millimetre.
- Even if adopting a minimally invasive flapless protocol, a significant amount of hard-tissue remodelling occurs at the post-extractive site, especially if a thin buccal bone wall (<1 mm) is present.
- The adjunct use of a CTG had no impact on the hard-tissue remodelling of the socket.
- When delivering an IIPP in the anterior maxilla, the adjunctive use of a CTG allows the reduction of the buccal soft-tissue collapse at the submarginal level. However, a minor recession of the gingival margin and a collapse of the gingival profile in its most coronal millimetre should be expected.

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