



# Can placement of an immediate bone level tapered implant and subperiosteal xenograft help maintain bone architecture in esthetic areas?

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## 1. Introduction

The healing of a tooth socket includes multiple steps starting with clotting and a platelet plug and ending with mature bone. Within a month, more than three quarters of the extraction wound consists of mineralized osseous component.<sup>1</sup> Therefore, the socket can be considered as a self-healing surgical wound. It is well recognized that surgical tooth removal causes reduction in bone volume.<sup>2</sup> Most of this loss is on the labial/buccal and marginal areas, and the edentulous area of the alveolus often becomes more triangular with time.

Immediate placement of dental implants after extraction is popular as it shortens treatment time.<sup>3</sup> Surgical implant placement can be performed using either an immediate or “early” implant placement approach. It is generally advisable to place implants within six months of extraction as longer periods of time lag may lead to a greater risk for alveolar atrophy.<sup>4</sup> Immediate implant placement does have one drawback in that many investigators have shown that there is always some degree of buccal plate resorption associated with it.<sup>5–9</sup> This resorption can be minimized by packing voids in the socket with biomaterials like demineralized bovine bone.<sup>10–12</sup> Saying that, such packing of bone substitutes within the socket delays healing,<sup>13</sup> thereby requiring a minimal healing time of 12 weeks.<sup>14</sup>

In summary, most current data demonstrating efficacy of socket preservation does not directly evaluate study outcomes to control sites, and so it is hard to make evidence-based conclusions. Generally speaking, it is agreed that socket preservation techniques minimize remodeling and resorption, but can not eliminate them.<sup>15</sup> Several recent systematic reviews and meta-analysis have asserted that socket

preservation is not always as helpful as retained in preventing dimensional socket changes,<sup>16–18</sup> stated that even if socket preservation is successfully achieved with different techniques, the natural resorbing process of the buccal plate and the remodeling of the alveolus is in no way impeded. This phenomenon could be also related to the patients’ biotype and the resorption is likely to affect the periodontal fibers.<sup>19</sup>

Buccal Plate Preservation (BPP) is an alternative to traditional socket preservation.<sup>20</sup> It aims to maintain the buccal plate through a different mechanism compared to the socket preservation technique. The surgical intervention includes bone graft placement outside rather than inside the socket. The intent of BPP is to counteract changes in esthetic zone soft tissue contour while permitting natural socket healing.<sup>21</sup> The technique has been shown to be effective in previous clinical trials.<sup>22</sup> BPP can be successfully used in different conditions, at different implant insertion times, and with different loading protocols.<sup>23</sup> The use of a xenograft material is highly suit for this procedure because it is more stable due to its slow resorption rate, taking into account its preparation process to obtain a purer and more crystalline material.<sup>24</sup> The aim of this study is to verify if this technique can be applied using a new implant design and a different grafting material and be successful in the mid-term duration.

## 2. Materials and methods

Twenty consecutive, ASA 1 patients with no history of smoking who required extraction of a tooth in the esthetic zone (bicuspid to bicuspid) were included in the study. Other inclusion criteria were that the selected teeth had to be periodontally health and have intact 4-wall

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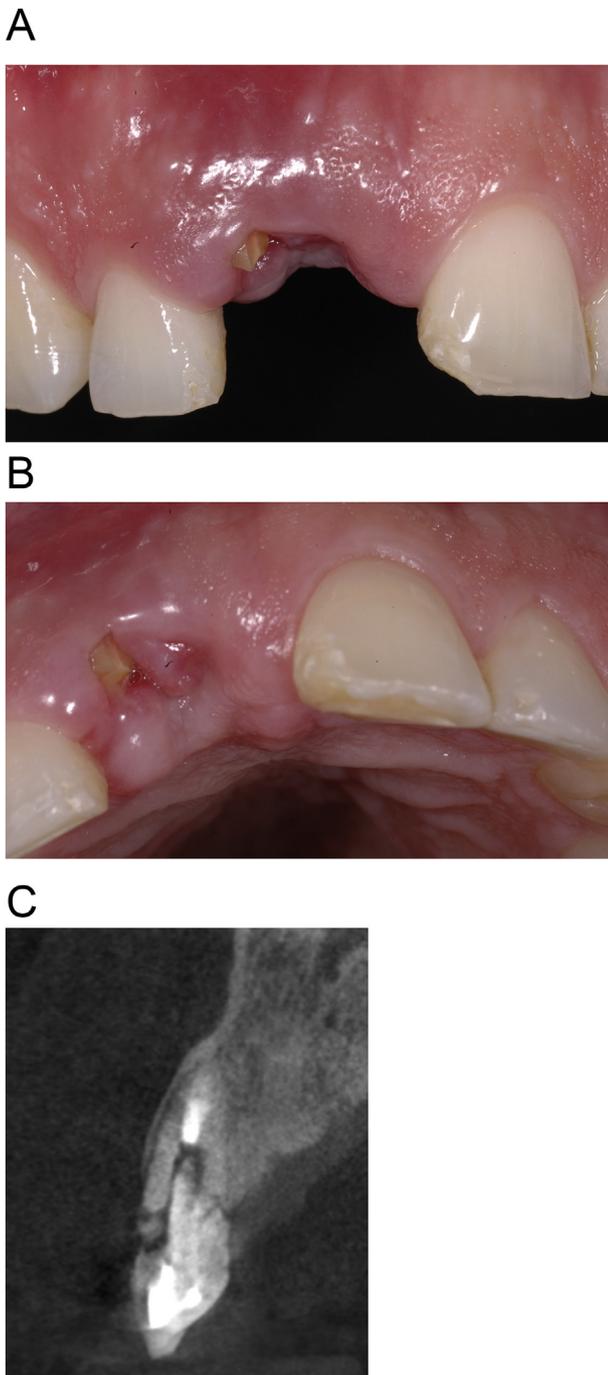
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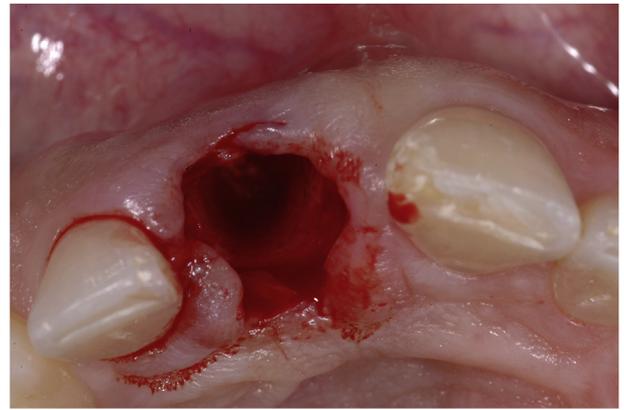


**Fig. 1.** Non-restorable tooth in the esthetic zone. a. Frontal view. b. Occlusal view. c. Radiographic appearance.

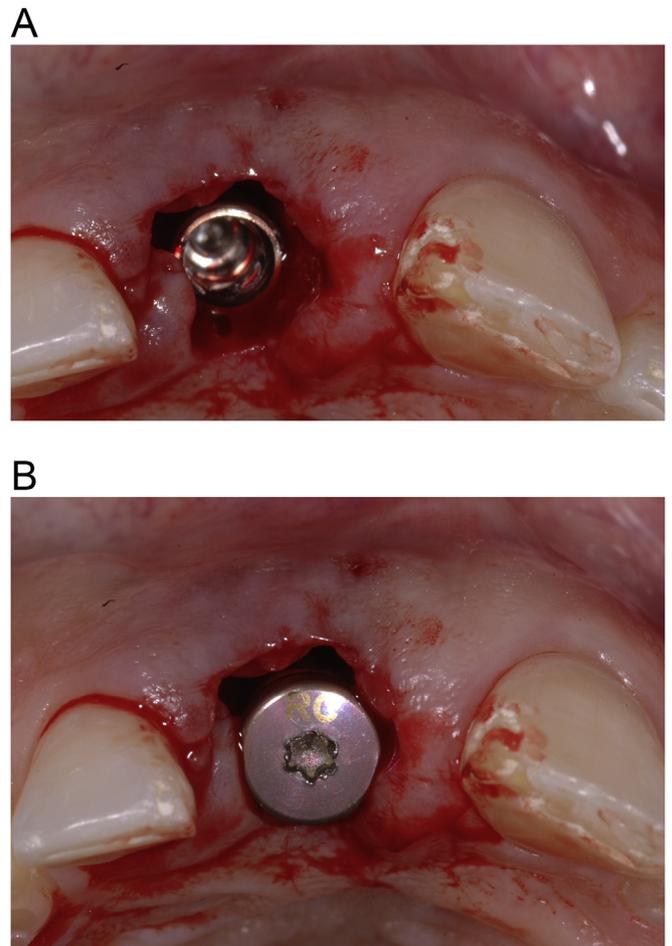
extraction sockets following extraction. Institutional review board approval was obtained from Boston University. Each patient had a single tooth removed and BPP performed with concomitant placement of an implant (Figs. 1–3a).

Under local anesthesia with articaine 4% with epinephrine 1:100000, all indicated teeth were extracted atraumatically using routine technique (Figs. 1 and 2). All two-rooted first premolar teeth were sectioned with a handpiece. Extraction sites were curetted to remove debris. Eighteen, 4.1 mm diameter and two 3.3 mm diameter tapered implants (BLT) (Institut Straumann AG, Switzerland) were placed immediately in the sockets with overlying temporary healing abutments (Fig. 3b).

BPP was then completed as previously published (Fig. 4a and b).



**Fig. 2.** Socket after tooth extraction.



**Fig. 3.** Implant insertion. a. Occlusal view. b. After healing abutment connection.

Granules of bovine xenograft (Cerabone 0.5–1 mm, Botiss biomaterials, Germany) were used for the augmentation. Voids between the labial plate and implant were packed with xenograft (Fig. 4b). If necessary, suturing was performed with a 5-0 Ethilon suture (Ethicon US, LLC) but no sites were closed primarily. Chlorhexidine rinse was prescribed postoperatively. Temporary restorations were given in the 6th postoperative week. The final restorations were delivered three months after surgery (Fig. 6a and b).

Cone beam CT scans (CBCT) were taken at two times: immediately after implant insertion (T1) (Fig. 5) and 6 months postoperative (T2) (Fig. 6c). Both results were compared to determine the efficacy of BPP

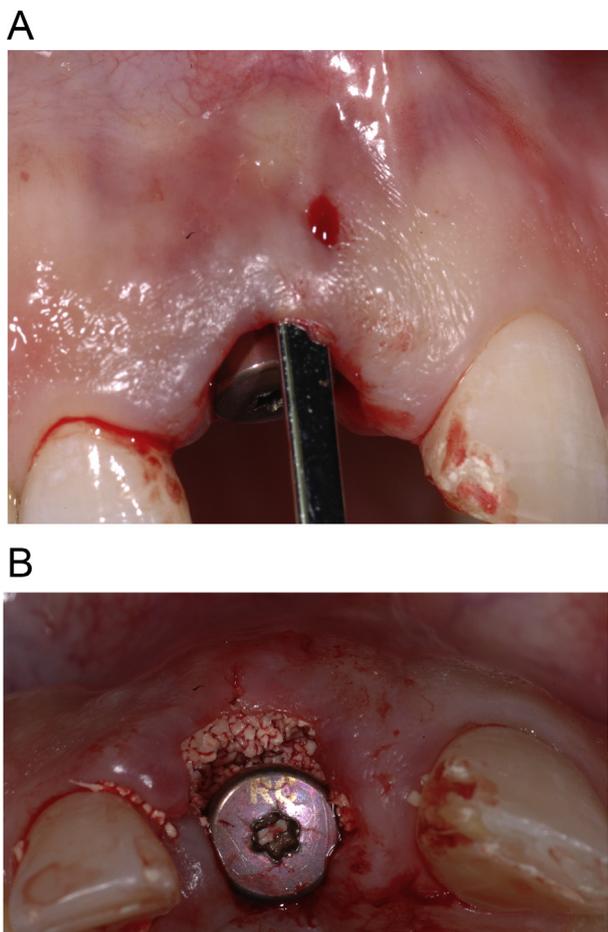


Fig. 4. Buccal Plate Preservation Technique carried out. a. Creation of a subperiosteal pouch. b. Xenograft inserted, occlusal view.

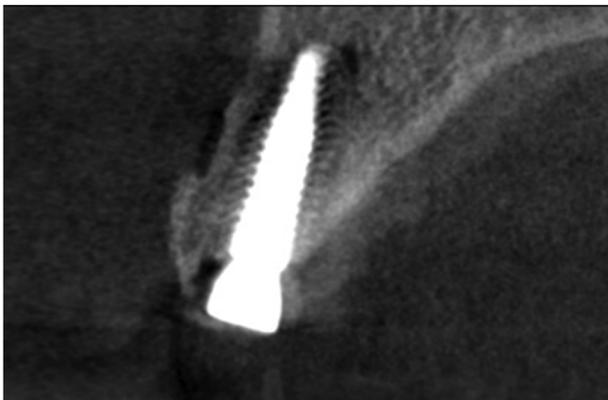


Fig. 5. Post-operative Radiographic appearance (T1).

in counteracting labial plate resorption. The radiographic imaging technique and study measurements (2 points- M1 and M2) were similar to a previously published article.<sup>2</sup> An independent examiner who had no access to T1 radiographs made T2 measurements. Differences in T2 and T1 values were calculated to determine changes in the bone dimensions. A p-value of < 0.05 was considered significant for statistical analysis.

### 3. Results

8 females and 12 males participated in the study. The mean age of the sample was 51.3 years (range 23–64 years). There was no implant

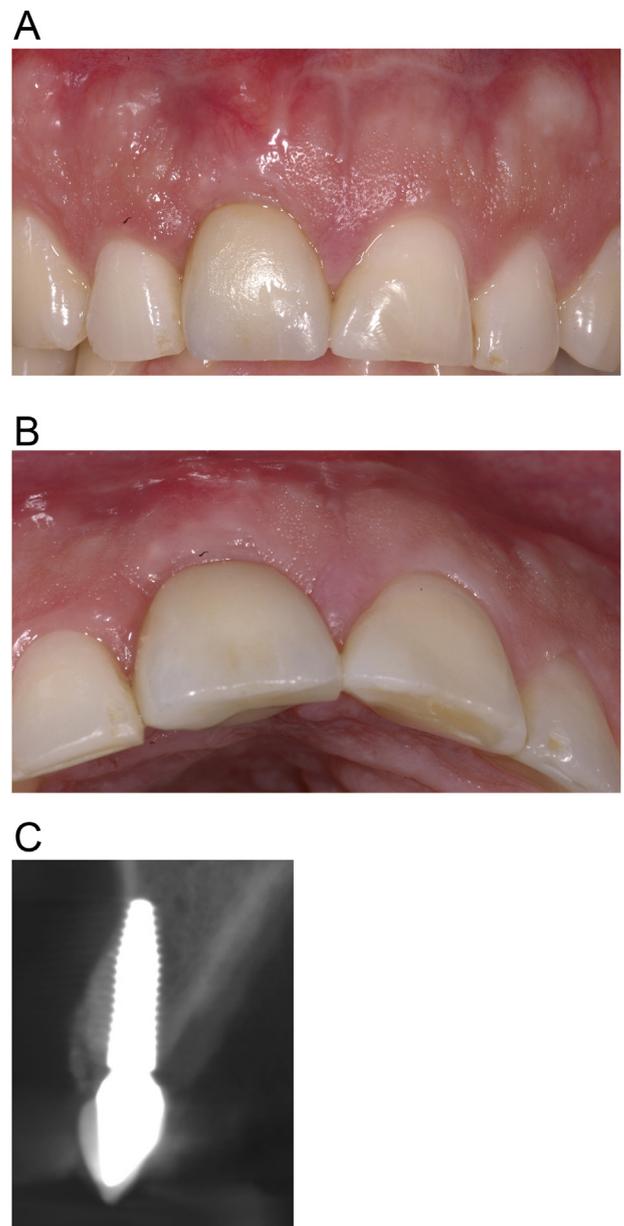


Fig. 6. Clinical and Radiographic appearance at 6 months. a. Frontal view: the soft tissue contouring is well preserved. b. Occlusal view: The root eminence appearance is maintained. c. Radiographic Image: The Xenograft is well incorporated into native bone.

loss at the six-month follow up (success rate 100%) and all the implants were functional. The results showed excellent stability of the buccal plate contour at both measured points. Mean bone thickness was 2.86 mm (range 1.4–5.3) at T1 at the 1 mm point, and 3.09 mm (range 1.8–5.3) at the 4 mm point. At T2, the thicknesses were 2.49 mm (range 1.2–4.9) at M1, and 2.83 (range 1.5–5) at M2. At the 1 mm measurement, the mean of the difference between T1 and T2 was  $-0.19 \pm 0.85$ . At the 4 mm measurement, the mean of the difference between T1 and T2 was  $-0.05 \pm 0.99$ . The difference between the means at T1 and T2 was not statistically significant. Table 1 summarizes the results.

### 4. Discussion

Immediate implants are currently very much in demand and for optimal results, the soft- and hard-tissues need to be of adequate quality

**Table 1**  
Results of Measurements performed in the study.

Tooth Number	M1 (mm)		M2 (mm)	
	T1	T2	T1	T2
7	5.3	4.7	5.3	5.0
5	4.7	4.6	4.3	4.0
12	3.7	2.4	3.6	2.8
8	2.3	2.0	2.3	2.0
8	2.2	1.7	2.0	1.9
5	1.9	1.7	1.8	1.5
10	1.9	1.9	1.9	1.6
7	2.5	2.0	2.3	2.2
8	2.7	2.3	2.7	2.0
12	2.3	1.9	2.3	2.0
11	1.9	1.7	2.3	2.0
5	3.1	3.0	3.2	2.9
21	3.3	3.1	2.3	2.0
28	2.9	2.3	3.2	2.9
12	3.9	3.2	3.5	3.4
22	1.6	1.5	3.2	2.7
27	4.3	4.3	4.1	3.8
13	1.4	1.2	3.6	3.2
27	2.1	1.6	2.7	2.5
12	3.2	2.5	4.0	4.0

and quantity. Factors influencing the final outcome are often primarily related to 3-D positioning of the implant, but additional factors such as gingival biotype can play a role. Although the tendency for some gingival recession post tooth removal is inevitable, there is no consensus regarding how to predictably counteract it. Traditionally speaking, routinely recommended options for maintaining bone and soft tissue shape and volume following tooth removal are: 1) Socket preservation with particulate bone grafting, 2) Immediate implant placement, and, 3) Combination of both of the above. Literature has shown that immediate implant placement by itself may not prevent postoperative labial plate resorption.<sup>6,25</sup> Similarly, socket grafting alters rate of remodeling after extraction, but it may delay implant placement besides interfering with natural socket healing. Bovine xenografts may be recommended grating materials as they minimize bone remodeling, but their use delays implant placement usually by 4–6 months. In a nutshell, there is no optimal technique currently.

BPP is a relatively newly proposed technique, which has been previously shown to maintain or improve the vestibular bone volume after tooth extraction. It has the advantage of not interfering with wound healing since particulate bone grafting is performed outside and not inside the socket as conventionally recommended. The results of this pilot study show that BPP can be combined with immediate implant insertion; this combination shortens treatment duration and resists bone resorption and remodeling in the mid-term time range. While our preliminary results are encouraging, more studies are required to validate longer-term results.

#### Conflicts of interest

All authors of this manuscript acknowledge that there are no relevant conflicts of interest.

#### Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jobcr.2019.04.005>.

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