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Patient self-evaluation of intra-oral bone grafting treatment to the maxillary frontal region

Lars Andersson

Department of Oral & Maxillofacial Surgery, Central Hospital Västerås, Västerås, Sweden and Department of Surgical Sciences, Faculty of Dentistry, Kuwait University, Safat, Kuwait

Correspondence to: Prof. Lars Andersson DDS, PhD Odont Dr, Department of Surgical Sciences, Faculty of Dentistry, Kuwait University, PO Box 24923, Safat 13110, Kuwait
Tel.: +965 947 81 21
Fax: +965 532 60 49
e-mail: lars.andersson@hsc.edu.kw

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Abstract – Bone grafting to the anterior region of the maxilla is a treatment method often used for reconstruction after dental trauma when teeth have been lost. The purpose of this study was to interview patients who underwent bone grafting from the chin or lateral mandible to assess the patients' experiences, especially regarding morbidity of the donor site and their overall assessment of treatment and care. Twenty-six patients who had undergone bone grafting from the chin and lateral mandible regions before implant treatment were interviewed about their experiences of treatment and present status 3–5 years after surgery. The patients rated the quality of presurgical information, quality of care, postoperative discomfort, postoperative pain, present discomfort and satisfaction with the final results. The patients, in general, were positive to the presurgical information and the quality of care. Postoperative pain during the first week was rated higher when grafts were taken from the chin than from the lateral mandible. Patient satisfaction with the outcome was high 3–5 years after surgery. However, patients that underwent bone grafting from the lateral mandible rated discomfort significantly lower and satisfaction significantly higher than patients who underwent chin grafting. More discomfort was reported in patients where wide bone grafts had been taken from the chin. A high degree of patient satisfaction with treatment and outcome can be expected after intra-oral bone grafting. However, surgeons should be cognizant of and patients informed about the risks of morbidity, especially when harvesting wide bone grafts from the chin. If possible, a first-hand choice for the surgeon should be grafting from the lateral mandible before considering chin graft.

Bone deficiency in the maxillary region is experienced in trauma areas either as a direct result of the trauma or as bone atrophy in which teeth have been lost for a longer period. Before implants can be installed in areas with bone deficiency, bone augmentation must first be performed at the defect site (1, 2). This procedure is usually accomplished by increasing the bone volume with bone block grafts to the defect areas (1, 2). After a sufficient bone-healing period, implants can be installed at the augmented site. Depending on the bone volume required, bone can be harvested from the iliac crest or intra-oral sites. Several studies have reported that some patients complain of symptoms at the donor site of the bone graft, especially after grafting from the iliac crest (3–5). When smaller bone volumes of bone are required, intra-oral sites may be preferred as an alternative to grafts from the iliac crest (6–9). Intra-oral bone grafts are usually taken from the chin region or posterior regions of the mandible. Studies have reported clinically successful implant treatment that was preceded by intra-oral bone grafts for augmentation (6–9). Chin bone harvesting in cleft children showed minimal morbidity (10). However, studies describing changed sensibility in the chin area following chin grafting (11–13), pain and sensitivity impairment have been reported (13–15). Harvesting grafts from the lateral mandible may be a better alternative than from the chin region. The purpose of the present study was to interview patients who underwent bone graft treatment with bone grafts taken from the chin or lateral mandible and to assess the patients' experience of such treatment, especially regarding morbidity at the donor site and their overall evaluation of treatment and care.

Material and methods

Patients who underwent intra-oral bone grafting for implant treatment in the anterior region of the maxilla were selected from the files. The maxillary anterior region was defined as the region of maxillary incisors and canines. The grafts were all mono-cortical bone grafts taken from the anterior surface of the chin region or the lateral side of the mandible in the molar region. Bone grafts from the chin region were taken after exposure of the bone using a horizontal incision in the oral mucosa in the vestibule anterior to the mental foramina (Fig. 1). In the lateral mandible the bone grafts were harvested by exposure of the bone, either by a mucoperiosteal flap

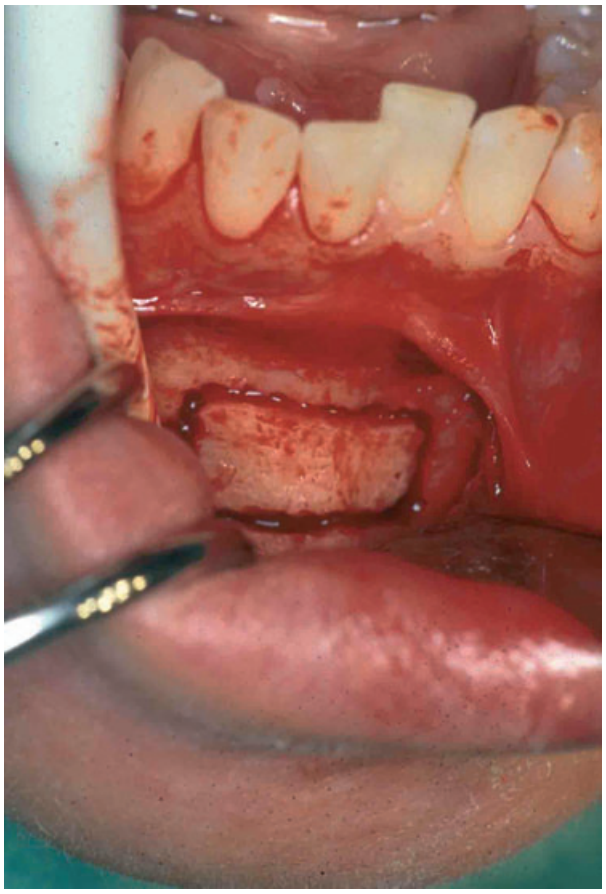

Fig. 1. Bone harvesting from the chin region. A cortical bone block graft is taken by cutting through the cortical bone in the mental region.

using a marginal incision or by an incision in the oral mucosa of the vestibule in the molar region close to the mandibular ramus (Fig. 2). The bone grafts were harvested after penetrating the cortex around the graft with a saw or a small round bur 1 mm in diameter. Special care was taken not to penetrate deeper than necessary in order to be able to fracture and release the cortical bone graft by the use of osteotomes. The cortical bone grafts were used as onlay grafts for increasing the horizontal width of the alveolar process in the anterior region of the maxilla before implant treatment. Implants were installed in the bone grafts at the recipient sites 5–8 months after bone grafting.

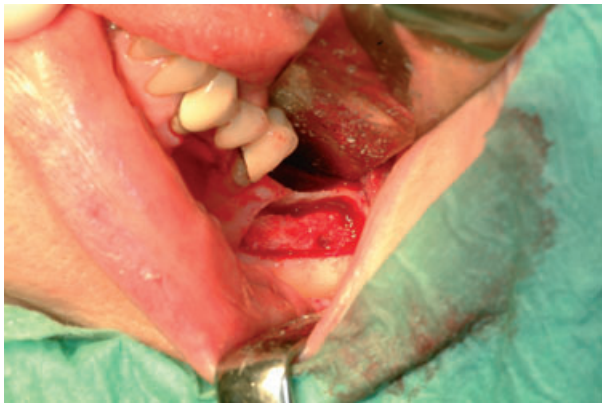

Fig. 2. Bone harvesting from the lateral mandible. A cortical bone block graft has been taken from the cortical bone in the lateral posterior mandibular region.

The following patients data were registered from records: age at time of grafting, gender, reason for missing/losing teeth, donor site for bone grafting, recipient site for bone grafting, anaesthesia procedure and size of graft. Patients were contacted for an interview 3–5 years after surgery in which questions about morbidity and patient satisfaction regarding the donor site were evaluated. Twenty-six patients agreed to being interviewed. The patients were interviewed using a standardized interview form. The following variables were registered: self-assessment of the surgical procedure, self-assessment of long-term morbidity and verbal evaluation of long-term morbidity.

Self-assessment of the surgical procedure

The *quality of the presurgical information* regarding the surgical procedure, discomfort and complications and care during treatment was assessed retrospectively on a scale from 0 to 10, where 0 was defined as 'no information' and 10 was 'best possible' information.

The *quality of the care given* was assessed using a scale from 0 (no care) to 10 (best possible care). *Postoperative discomfort and postoperative pain* the first week after surgery were ranked retrospectively on a scale from 0 (no) to 10 (worst possible).

Self-assessment of long-term morbidity

Long-term discomfort was evaluated by having the patients rank their discomfort on a scale from 0 (no discomfort) to 10 (worst possible discomfort).

To assess *long-term overall satisfaction* patients were asked if they were satisfied with the final results regarding the donor area by rating their satisfaction on a scale from 0 (very dissatisfied) to 10 (very satisfied).

Verbal evaluation of long-term morbidity

Long-term morbidity was assessed by asking the patients if numbness or changed sensation still was present at the donor site, if they experienced any changes in sensitivity to cold temperatures, if there were any aesthetic problems at the donor site and if there were any difficulties in chewing. These questions were answered on a dichotomous scale with 'yes' or 'no'.

Patients were finally asked if it was *worth the effort to undergo the treatment* and if they *would recommend a friend* to undergo the same treatment regarding the morbidity of the donor site. Patients could choose between the answers 'yes', 'yes, with doubt' or 'no'.

Statistics

Descriptive statistics were used for the analysis and presentation of data. The Mann–Whitney *U*-test was

used to test for significant differences between donor graft sites. A statistically significant difference was considered when $P < 0.05$.

Results

General findings

Twenty-six (16 males and 10 females) patients were interviewed. The age of the patients ranged from 18 to 49 years with a mean age of 30.4 years. Trauma (53.8%) was the most frequent cause of tooth loss followed by aplasia (30.8%).

Fourteen of the patients had received their bone graft under local anaesthesia (Xylocaine adrenaline 2%; AstraZeneca, Södertälje, Sweden) and midazolam sedation (Dormicum, Roche, Basel, Switzerland) 0.2 mg per kg body weight in oral administration. One patient was treated under local anaesthesia without sedation and 11 patients had surgery performed under general anaesthesia.

The donor regions are presented in Table 1. In 14 patients grafts were taken from the chin region; in 10 patients grafts were taken from the lateral side of the mandible; and in two patients grafts were taken from both the chin and lateral side of the mandible. Altogether, 28 donor sites were evaluated in the 26 patients.

The recipient regions are listed in Table 2. The size of the bone grafts corresponded to the width of one lost tooth in 19 patients. In five patients the grafted area comprised the width of two lost teeth, and in one patient the graft comprised the width of three lost teeth.

Evaluation of the surgical procedure

The mean scores on the *quality of the presurgical information* and the *quality of care* were close to 9.

Table 1. Distribution of bone grafts from different donor regions

Donor region	Number of grafts
Lateral mandible	12
Chin	16
Total bone grafts	28

Table 2. Distribution of bone grafts to recipient regions

Recipient region	Number
13	2
12	2
11	5
21	5
22	4
23	1
11/21	2
12/11	1
21/22	2
22/23	2
11,21,22	2
Total	28

Table 3. Mean ratings as a function of donor sites from the chin and lateral mandible

	Chin	Lateral mandible	*P*-value
Patient rating of the surgical procedure			
Presurgical information	8.4	8.8	NS
Quality of care	9.0	9.1	NS
Postoperative discomfort during first week	3.9	3.2	NS
Postoperative pain during the 1st week	3.8	1.8	0.002*
Patient rating of long-term morbidity			
Present discomfort	2.1	0.7	0.006*
Satisfied with the final results of donor site	7.8	9.0	0.027*

NS, non-significant difference.
*Significant difference ($P < 0.05$).

Postoperative discomfort the first week after surgery was 3.7. There was no significant difference between patients with grafts taken from the chin as compared with grafts taken from the lateral mandible. The mean score on *postoperative pain the first week after surgery* was 3. When sites were compared postoperative pain during the first week was rated significantly higher in the chin group (3.8) than in the lateral mandible group (1.8), (Table 3).

Long-term evaluation

The patients' rating of morbidity 3–5 years after surgery indicated that their *present discomfort* was very low (mean = 1.4, SD = 1.2). The mean satisfaction score on *the final results of the donor site* was 8.2. Patients who underwent bone grafting from the lateral mandible significantly scored lower and satisfaction with the final results significantly higher than patients whose grafts were taken from the chin region (Table 3).

Table 4 shows the results of the verbal evaluation. In the lateral mandible regions long-term morbidity was not observed in any of the patients. In the chin group four patients (33%) reported mild neurosensory disturbances in the chin region, which the patients described as occasionally occurring mild pain. In addition, two of these patients described a heightened sensitivity to cold temperatures. All four patients reporting neurosensory disturbances had undergone grafts wider than one tooth width from the chin region (Table 2). Aesthetic problems

Table 4. Long-term morbidity of 16 chin and 12 lateral mandibular donor bone graft sites as assessed by patients' verbal rating

	Chin		Lateral mandible	
Verbal evaluation of long-term morbidity	Yes	No	Yes	No
Anaesthesia/paraesthesia at donor site	4	12	0	12
Increased sensitivity to cold temperature at donor site	2	14	0	12
Aesthetic problems at donor site	0	16	0	12
Chewing difficulties	0	16	0	12

or difficulties in chewing were not noted in any of the patients, regardless of group.

All patients reported that the treatment was worth the feelings of discomfort from the donor site (73.1% without doubt and 26.9% with some doubt). Sixteen (61.5%) of the patients would recommend a friend to go through the bone grafting procedure without any doubt, and nine would recommend it with some doubt. Patients expressing doubts were found in both groups and thus were not related to any of the graft site groups, but rather to how the patient experienced the surgical procedure. Patients reporting doubts had more often undergone a surgical procedure with local anaesthesia. One patient with a bone graft taken from the chin with local anaesthesia reported that he would not recommend a friend to go through the same procedure but instead would recommend general anaesthesia.

Discussion

The results of this study show that autogenous bone grafted from intra-oral sites is a method with a good patient satisfaction. Our findings also indicated that bone grafts taken from the chin region may result in greater morbidity at the donor site than grafts taken from the lateral molar region.

In this study we evaluated intra-oral bone grafting in general and the donor site in particular as based on patient self-assessment. The authors have not found any other study evaluating intra-oral bone grafting from the patients point of view. The study was designed as an interview study. Interview studies are advantageous in that they can be performed in a relaxed environment away from the dental chair which otherwise can raise fear and discomfort. Therefore, we decided not to perform a simultaneous clinical examination but restrict our domain of interest to the patient interview. This design of the study has advantages but also disadvantages in that it only evaluates the patients subjective opinion of the treatment. In addition, one should be aware that interviews performed a long time after treatment may be biased by the patients' memory and rationalization. In spite of this the results clearly demonstrate satisfied patients in general and differences in favour of lateral bone grafts to chin grafts for some patients. The final outcome from the patient's point of view is a very, and perhaps the most, important factor, but is seldom seen in the literature when results of various implant treatment methods are reported.

Trauma was the dominating cause of tooth loss in the anterior region. It is noteworthy that the patients in our material were younger than patients from other materials with grafting to edentulous or partially edentulous areas and sinus lift procedures (12–14). It is well documented that dental trauma is more often found in younger individuals, where the anterior region of the maxilla is the most frequently affected site (16). Many of our patients sustained trauma at a young age when they were still growing and implant treatment is contraindicated. In growing patients with tooth loss other treatment methods, such as tooth transplantation or orthodontic space closure, can be used to avoid bone grafting; however, these methods may not be suitable in many patients and hence implant treatment has to be postponed until growth is complete. During this waiting period, atrophy of the alveolar process is seen and the atrophy had apparently resulted in such severe resorption that the area required bone grafting at the time our patients were candidates for implant installation.

Bone grafting before implant treatment will enable the placing of implants in areas with bone deficiency where implants cannot be immediately installed. The graft will also contribute to improved aesthetics by augmenting the tissues to their original size and volume. The reconstruction of the anterior region of the maxilla is aesthetically delicate, especially when replacing single teeth in young patients where the neighbouring teeth are intact. This means that we were dealing with a group of patients with very high demands not only for functional reasons but also for aesthetic considerations. This must always be looked at when interpreting the results. Despite this fact, the results of our study showed that the patients were very satisfied with the treatment given and with the final results of the treatment. All patients were satisfied with the aesthetic aspects of the treatment and not one patient reported any difficulties in chewing. A few patients reported some discomfort. However, given the final results, all patients reported that the benefits of the treatment were worth the discomfort. Consequently, patients are generally positive toward intra-oral bone grafting before implant treatment as well as at the outcome of the treatment.

We have adopted a policy for only using autogenous bone grafts in our clinic. Although there are attempts to use synthetic, alloplastic or xenoplastic materials for grafting, autogenous bone is still the golden standard having both osteoinductive and osteoconductive properties. We take iliac crest grafts when larger volumes are required, such as in reconstruction of the totally edentulous maxilla or with bilateral sinus lift procedures. Such surgery, however, always requires extensive hospital resources because the iliac grafting is performed under general anaesthesia. In situations when smaller bone volumes are required, we take bone grafts from intra-oral sites, usually mandibular sites from the chin and/or the lateral posterior mandible. In some of these patients general anaesthesia is still required though our study showed that half of the patients had their treatment carried out under local anaesthesia combined with benzodiazepine sedation. For this reason, hospital resources can be reduced when grafting from intra-oral sites under local anaesthesia. Nevertheless, the selection of patients for general anaesthesia or local anaesthesia is very important. In our study the patients were selected based on which anaesthetic method they preferred. Despite this careful selection, after treatment a few patients did not appreciate their choice of being treated under local anaesthesia and sedation, but instead would have preferred treatment under general anaesthesia. This finding emphasizes the importance of a thorough preoperative dialogue with the patient. Furthermore, the finding suggests that we need to be more generous in offering general anaesthesia to patients.

Bone grafts can be harvested easily from the chin region and lateral mandible. There are several studies on surgical techniques in intra-oral bone grafting (11, 17–21). Incisions in the vestibular mucosa were used in our study where special care was taken to keep away from the gingival area to avoid later retraction. In our study saw, fissure drills or small round burs were used to penetrate the cortical layers. Trephines have been used in other studies (6, 14) and may be an easier way to harvest bone though wider blocks of bone are possible to harvest with the saw and bur technique. Larger cortical blocks may be advantageous to use, especially when grafting to areas where more than one tooth has been lost.

The finding that a few patients reported anaesthesia or paresthesia in the chin donor area is in accordance with other studies (11–14). The patients described this neural complication as numbness of the lower teeth and vestibular area. Two of our patients also reported increased sensitivity to cold temperature and mild pain at the donor site. Furthermore, patients in the chin group reported a greater degree of pain and discomfort than patients in the lateral mandible group. Discomfort 3–5 years after surgery was significantly higher in the chin group than in the lateral mandible group. This was observed in patients with bone grafts wider than 1 cm, where more than one tooth was replaced by implants. However, this was not noted in any of the patients in which the width of the bone graft was < 1 cm and single tooth implants were installed. Patients with complications were all grafted from the chin region where the width of the graft exceeded one tooth. In contrast, the patients in whom the lateral mandible grafts were taken did not report any anaesthesia, pain or other sensitivity changes. If we can choose from where we take the bone graft, we should first consider the lateral mandible molar area. This site can be used bilaterally when larger bone volumes are needed (20). When still larger bone volumes are required, we can also consider taking bone from the chin area but wide grafts from this region should be avoided. It is also important to consider new, less invasive methods of bone cutting which has recently been reported using ultrasonic (piezoelectric) surgery (22, 23). Piezosurgery is reported only to cut bone and not causing injury to the underlying soft tissue structures such as nerves and vessels (22, 23).

We conclude that patients are generally satisfied with the treatment and outcome after being treated by autogenous bone grafting from intra-oral sites before implant treatment. Surgeons should be aware and patients informed of the risks of morbidity, especially when harvesting bone from the chin. A first-hand choice should be grafting from the lateral mandible, if possible.

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