# Morbidity after Chin Bone Harvesting – A Retrospective Long-Term Follow-Up Study

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## ABSTRACT

*Background:* Resorption of the alveolar bone after tooth extraction may result in insufficient bone volume for implant placement. Augmentation of the resorbed site using autogenous bone grafts harvested from the maxillofacial region, for example, the chin, is a common method; however, it also involves donor site morbidity. Chin graft morbidity involves impaired sensibility in the frontal teeth, the gingival, and skin postoperatively.

*Materials and Methods:* A group of 60 patients with partial edentulism in the maxilla and insufficient bone volume for implant therapy were augmented with bone grafts from the mandibular symphysis. The grafting procedure was performed between 1991 and 2001 with a follow-up period of 1 year after surgery. Postoperative sensibility of the lip, teeth, and gingiva was registered. Forty-six patients (18 women and 28 men) also participated in a long-term follow-up study. The mean age was 49 years (range 23–81 years) and the mean follow-up time was 7.5 years (range 4–14 years). The donor site was evaluated in four parts: a standardized clinical examination, radiographic examination and measurements, a mail-in questionnaire, and a survey of the medical records regarding complications and graft size. In the donor site, both hard tissue (mandibular symphysis and teeth) and soft tissue (ie, lower lip, infralabial area, and chin) were evaluated. A questionnaire was also answered by 38 of 46 patients.

*Results:* In the long-term follow-up, impaired tactility and sensitivity of the soft tissues were registered in 7.6%. Adjacent teeth (incisors, canines, first and second premolar) (n = 418), showed increased lamina dura in seven cases (1.7%) and four teeth had apical pathology (1.0%). The donor site (n = 45) showed good remineralization in 42 patients (93.3%), and 28 patients (62.2%) had a noticeable concavity radiologically. The questionnaires from 38 patients (answer frequency 82.3%) rated high satisfaction with the grafting and implant treatment.

*Conclusions:* This study indicates that long-term follow-up of the chin graft donor site shows some postoperative morbidity. The most frequent disturbance was impaired sensibility in the soft tissues of the chin. The lower lip and teeth showed fewer disturbances. The rate of subjective symptoms was higher than the clinical findings but did, in general, not affect the patient in daily life. At radiographic examination, bone healing after chin graft harvesting did not regenerate to the preoperative level. The donor site showed good remineralization but left a radiologic concavity in the majority of cases.

KEY WORDS: autogenous bone, chin graft, morbidity

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# INTRODUCTION

Bone augmentation procedures are often used in oral and maxillofacial surgery in case of insufficient bone volume prior to implant placement. Several bone grafting techniques and regimens have been described to create adequate volume at the implantation site.<sup>1–3</sup> Autogenous bone is commonly used in such procedures and provides a predictable treatment outcome.<sup>4–6</sup> A well-known drawback with autogenous bone is, besides resorption of the graft, donor site morbidity, which may vary depending on where the bone is harvested and the

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technique used.<sup>7</sup> Extraoral donor sites are, for example, the iliac crest, calvarium, tibia, and rib. Intraoral donor sites are preferably used when a smaller amount of bone is needed. Common sites are mandibular symphysis<sup>8-10</sup> and ramus region,<sup>10,11</sup> and also posterior maxilla or zygomatic bone can be used.<sup>12</sup> The mandibular symphysis region is providing good access and bone quality. The amount of bone that can be harvested is usually enough for minor bone grafting such as buccal onlay or sinus inlay.<sup>3,5,13</sup>

Several studies describe sensory disturbances following chin graft.<sup>14–16</sup> However, the follow-up time is, to our present knowledge, in no study exceeding 3 years, and the patients' mean age was relatively low. As nerve fibers has a slow regeneration, healing takes a long time, and improvement may occur after a considerate time period postoperatively. More important than clinical success rates are patients' own evaluation of persisting deficiencies.

The aim of this retrospective study was to evaluate the long-term morbidity of donor sites following harvesting of chin bone grafts. Additionally, patients' own experience of the procedure and of the donor sites were assessed.

## MATERIALS AND METHODS

# **Clinical Procedures**

Sixty consecutive patients, with deficient sagittal and/or vertical dimension of the alveolar crest and scheduled for rehabilitation with endosseous implants, were included in the study. All patients were clinically examined with regard to general and oral health. The patients were generally healthy, with no deficiency in the inferior alveolar nerve. Panoramic radiographs and lateral cephalometric projection were used to assess the amount of available bone in the chin.

The bone augmentation was performed by two experienced surgeons between 1991 and 2001 at the Department of Oral and Maxillofacial Surgery, Mölndal Hospital, Mölndal, Sweden. The patients were treated under local anesthesia and oral sedation in 49 cases and under general anesthesia in 11 cases. Antibiotic prophylaxis, either amoxicillin 3 g (Amoxicillin®, Scand Pharm Generics AB, Stockholm, Sweden) or clindamycin 600 mg (Dalacin®, Pfizer AB, Sollentuna, Sweden), was given 1 hour preoperatively. On the recipient sites, a crestal incision was used with vertical releasing incisions in order to raise a buccal and a palatal mucoperiosteal flap. In the mandibular intercanine region, a vestibular incision was made 3 to 4 mm below the mucogingival border, a mucoperiostal flap was elevated, and the chin bone was exposed. The dimension of the graft was determined by the size of the bone defect in the maxilla. The osseous cuts were made with a fissure burr or a bone saw with a safety margin of  $\geq$ 5 mm to the tooth apices and the mental foramen. A monocorticocancellous graft was then removed with a chisel. Graft size was registered with two-dimensional measurements, width and height.

Prior to soft tissue closure of the donor site, sharp edges were removed and the area was generously irrigated with saline. As a hemostatic dressing, a sponge of bovine collagen was applied into the remaining defect. The wounds were closed in layers with resorbable sutures (Ethicon Vicryl® 4-0, Johnson & Johnson AB, Sollentuna, Sweden). To minimize postoperative swelling and hematoma, an extraoral pressure dressing was applied to the donor sites and maintained for 5 days. All patients were prescribed antibiotics and analgetics for 10 days. They were instructed in oral hygiene and to use 0.2% chlorhexidine mouth rinse twice a day for 10 days.

The patients were followed up clinically at 10 days, 1 month, 4 to 6 months, 1 year, and thereafter annually. The patients' subjective postoperative sensory deficiencies were evaluated with sharp/blunt and light touch by finger strikes. Radiographs including panoramic and lateral cephalometric projection radiographs were taken after 10 days, 4 to 6 months, and thereafter individually.

## Long-Term Follow-Up and Assessment

The donor sites were evaluated in four parts: a standardized clinical examination, radiographic examination and measurements, a mail-in questionnaire, and a survey of the patients' records regarding complications and graft size.

*Clinical Examination.* The clinical examination was restricted to the donor site, including contour of the chin where scar formation and invaginations were registered. To assess tissue tactile sensibility, the donor site area was divided into six fields (Figure 1): right and left side of the lower lip (A, B), the infralabial area (C, D), and the chin (E, F).

The area was examined with a sharp probe and a blunt burnisher (ø 2 mm). For discrimination between



Figure 1 Clinically investigated fields.

hot and cold, a can was filled with ice and a second can was filled with 42°C hot water. To obtain the right temperature, the water was monitored with a thermometer. Spatulas were then chilled or heated by insertion in the ice or the hot water before being applied to the soft tissue. The mandibular teeth from the second premolar region to the contralateral premolar were examined for sensibility by percussion, ice, and electric pulp tester (Pulp Tester Mod. 2001, Analytic Technology, Redmond, WA, USA). The sensibility results for all assessment modalities were registered as normal, anesthesia, hypoesthesia, or hyperesthesia.

Radiographic Examination. In the lower jaw, teeth 45 to 35 were examined with periapical radiographs after grafting (Kodak Insight, Eastman Kodak Co., Rochester, NY, USA; Oralix DC, Gendex, Des Plaines, IL, USA). The bone remineralization was assessed by tracing lateral cephalograms taken before and after chin grafting and at follow-ups 4 months after the fixture installation. Radiographs were thereafter taken on an individual basis (Kodak TML/RA, Eastman Kodak Co.; Agfa Ortho Medium Curix Screens, Agfa Healthcare, Mortsel, Belgium; Planmeca PM 2002 CC/Ceph., Planmeca Oy, Helsinki, Finland). The difference between the bone widths in the sagittal plane in the chin was measured before and after grafting and thereafter at follow-up. The healing of the bone was classified as complete (no difference in contour), slight concavity (<25% loss of contour), or having a persisting concavity (>25% loss of contour) in comparison to the surrounding bone. The bone density in the donor area was evaluated as good (mineralization >75%) or bad (<75%) in comparison to the surrounding bone. The tracing and evaluation were all made by a specialist in oral and maxillofacial radiology.



**Figure 2** The follow-up period for the 46 patients included in the study.

*Questionnaire*. All patients were asked to anonymously fill in a mail-in questionnaire containing an analogous visual analogue scale (0-100) about aesthetics of chin contour, sensation, chin function, and experience of surgical procedure. There was also space available for personal comments. The patients were also asked if they, with the present knowledge, could consider being reoperated with the same method.

*Patients' Records.* A survey of the patient records was made regarding pre- and postoperative complications and the size of the bone graft.

#### RESULTS

Forty-six (18 women and 28 men) of the 60 chin graft patients agreed to participate in the follow-up study. The remaining 14 patients did not participate because of the following reasons: four patients had died of unrelated reasons; four had moved abroad; five had no interest in participating; and one patient was excluded because of a severe stroke. The mean age in this group was 49 years (range 23–81 years), and the mean follow-up time was 7.5 years (range 3–14 years) (Figure 2).

#### Sensibility Evaluation at Long-Term Follow-Up

Altered sensation was clinically found in 10 patients (4.6%). The areas of the lower lip and chin were investigated for sensitivity and tactility (n = 276). The chin area was most affected for the three assessment modalities (Table 1).

Teeth, second premolar to second premolar (n = 342), without root fillings or prosthetic crowns were tested for sensibility with a pulp tester.

TABLE 1 Nu	mber of Patie	ents with Differen	t Reactions to the	Chin Harvesting P	rocedure				
	Right Lower Lip	Left Lower Lip	Right Infralabial Area	Left Infralabial Area	Right Chin	Left Chin	Affection Lip	Affection Infralabial Area	Affection Chin
Sharp/blunt	46 normal	44 normal	45 normal	45 normal	43 normal	41 normal	4.3%	4.3%	17.4%
		Two hypoesthetic	One hypoesthetic	One hyperesthetic	Three hypoesthetic	Four hypoesthetic			
						One hyperesthetic			
Cold	46 normal	46 normal	46 normal	45 normal	45 normal	45 normal	0%0	2.2%	4.3%
				One hypoesthetic	One hypoesthetic	One hypoesthetic			
Hot	46 normal	45 normal	46 normal	46 normal	42 normal	43 normal	2.2%	%0	15.2%
		One hypoesthetic			Four hypoesthetic	Three hypoesthetic			

TABLE 2 Sensibility of Teeth 35 to 45 (FDI Two-DigitNotation)				
Teeth 35–45 Sensibility				
	Pulp Tester ( <i>n</i> = 342)	lce ( <i>n</i> = 372)		
Anesthesia	5	24		
Hypoesthesia	24	16		
Normal	301	315		
Hyperesthesia	12	17		

Additionally, teeth without root fillings and with crowns not covering the root surface were also tested with ice (n = 372). Five teeth were found anesthetic for pulp tester (1.5%) and 24 teeth (6.5%) did not respond to ice stimulus. In total, 41 teeth (12.0%) were found having altered sensitivity or anesthesia when evaluated with a pulp tester. Corresponding figure for the ice test was 57 teeth (15.3%) (Table 2). None of these teeth were hyperesthetic at percussion.

#### **Radiographic Examination**

Radiographic findings (in 45 patients, one patient declined because of pregnancy) of 418 teeth showed seven teeth with increased lamina dura (1.7%) and five teeth with apical pathology (1.2%) (Table 3).

Regarding bone formation in the donor site (Figures 3–5), three cases showed healing with poor mineralization, and 42 cases showed donor site healing with good mineralization. The site defect after chin graft harvesting was in four cases completely healed (8.9%). In 13 cases, donor site had a minor concavity (28.8%), and in 28 cases, the donor site had a noticeable concavity (62.2%). In one case, the chin concavity was verified clinically.

## Questionnaire

The mail-in questionnaire was obtained from 38 patients (answer frequency 82.6%). Twelve of the patients (26.1%) stated having persisting symptoms from the donor site area; four patients with numbness in the lower incisors and 11 patients with numbness or paresthesia in the lower lip or chin (Figure 6 and Table 4). Five patients had symptoms everyday, two a couple of times a week, and four patients rarely. Two patients had symptoms at weather change.

The difficulty of these symptoms in daily life was classified on a VAS scale (0-100) and the rated mean was 10.5 (range 0-85) (Figure 7).

TABLE 3 Teeth with Apical Pathology					
	Gender and Age	Tooth	Restoration	Symptoms	Response to Pulp Tester/Ice
Patient 1	M, 52 years	45	Crown, insufficient root	No	n.a./n.a.
			filling		
Patient 2	M, 53 years	43	Crown	No	n.a./positive
Patient 3	W, 51 years	43	Crown	No	n.a./n.a.
Patient 4	M, 26 years	41, 31	No restorations	No	Negative/negative

n.a. = not applicable.

The overall satisfaction of the treatment was 5.18 (range 6 "very satisfied" to 1 "very disappointed"). On questioning how satisfied are you with the healing of the



**Figure 3** *A*, Patient at 1 week postoperatively with bone graft fixed in the upper jaw. *B*, Same patient as A at long-term follow-up. Healing of the chin considered as good remineralization with a minor remaining concavity.

chin, patient mean was 1.92 (range 1 "very satisfied" to 6 "very disappointed"). With the present knowledge and experience, the question if they could recommend the treatment, the patients valuated the treatment 2.82 (grading 1 "no," 2 "doubtfully," and 3 "yes"). In addition, 34 patients (71.0%) would undergo chin grafting again.

# Screening of Patient Records

Graft size was registered in 38 patient records with two-dimensional measurements, width and height. Mean size was  $17 \times 10$  mm (range width  $10-20 \times$  height 7–11 mm). Only one preoperative complication of the donor site was found when a fissure in the mandible toward the base was clinically noticed after bone harvesting.



**Figure 4** Patient with healing classified as good mineralization with a noticeable concavity.



**Figure 5** Patient with healing classified as poor mineralization with no remaining concavity.

One week postoperatively, 18 out of the 60 patients (30.0%) had subjective symptoms (Table 5). The dominating symptoms were anesthesia of lower incisors (15 cases) and anesthesia of the chin (10 cases). Forty-two patients (70.0%) reported no complaints from the lower jaw.

One month postoperatively, the number of patients with symptoms (Table 6) had decreased to eight (13.3%) with four cases of anesthesia in the mandibular incisors and three cases of paresthesia in the chin. At this time, 52 patients (86.6%) reported no symptoms from the lower jaw.

#### DISCUSSION

An intraoral donor site has the advantages not to leave extraoral scars and is to be performed as an outpatient procedure. The patient is not hospitalized, which optimizes the cost-benefit ratio. The autogenous bone is



Figure 7 Daily life discomfort (visual analogue scale 0-100).

attractive because of the high biocompatibility and for being both osteoinductive and osteoconductive. The mandibular symphysis provides good grafting volume for minor defects.<sup>17</sup> The donor site can be operated on with good access and control during bone harvesting, which could be a problem in the ramus area as well as risk of damage to the inferior alveolar nerve.<sup>3</sup> Although the chin as a donor site has been used over a long period of time, morbidity reports have also been present.<sup>3,8,14,15,18–20</sup> To our knowledge, no long-term follow-up study has been made. Previous reports rarely exceed a follow-up time over 3 years and only one study investigate patients' own experience and satisfaction.<sup>14</sup>

Several studies also have described the difficulties with clinical tests lacking objective findings to confirm patients' subjective symptoms. Raghoebar and colleagues<sup>14</sup> reported on subjective paresthesia of the chin region after surgery in 9 of 21 patients (43%). This could not be confirmed by clinical tests. The patients had, at 3 years follow-up, clinically no sensibility sensations in the soft tissues, but seven patients had persisting subjective symptoms. Healing of the soft tissues with sensitivity alternations were followed over a period of 12 months in a study by Nkenke and colleagues.<sup>15</sup> Two of the 20



Figure 6 Distribution of subjective symptoms.

TABLE 4 Classification of Subjective Symptoms				
Symptom	Soft Tissue, <i>n</i> = 38	Teeth, <i>n</i> = 38		
Paresthesia	3	0		
Numbness	6	1		
Anesthesia	9	1		
Stiffness	3	0		
Tension	0	0		
Pain	1	0		
Hyperesthesia	1	1		

TABLE 5 Symptoms at 1 Week Postoperatively				
Patients with symptoms 1 week postoperatively				
Teeth	Anesthesia of lower incisors	15		
	Anesthesia of gingiva of lower incisors	2		
	Hyperesthesia of lower incisors	1		
Lip	Anesthesia of lower lip	2		
Chin	Anesthesia	10		
	Stiffness/numbness	5		
	Swollen feeling	2		
	"Feels different"	1		
Patients with no symptoms 1 week postoperatively		<i>n</i> = 42		

patients had remaining hypoesthesia of one chin side. The importance of multiple, complementary tests was also shown when evaluating sensation. In the "Pain and Thermal Sensitivity" Test, hypoesthetic areas were also found with decreased thermal sensitivity. Fifteen out of 29 chin grafted patients in a study by Clavero and Lundgren<sup>19</sup> were considered having subjective altered sensation after 18 months, though only specified as related to the mental nerve branches. The study had no objective clinical evaluation of the sensitivity. This is the highest subjective altered sensation (52%) reported so far but seems only to be related to patients' own complaints. It would be interesting to know if also this high number had decreased over a longer period of time. Compared with our study, 18 patients (30.0%) had subjective symptoms at 1 week postoperatively, to be decreased to eight patients (13.3 %) at 1 month postoperatively. At long-term follow-up, 12 patients stated having subjective symptoms (26.1%).

The number of teeth with altered response to pulp testing also tends to be at its maximum immediately postoperatively. In a comparative study of mandibular grafts by Misch,<sup>3</sup> 29% of the lower incisors had altered sensation 6 months after chin graft harvesting, while no sensory disturbances were found in adjacent teeth after bone graft harvesting from the mandibular ramus. von Arx and colleagues<sup>16</sup> found that 18.6% of the teeth did not respond to pulp testing at suture removal, but decreased to 0.6% at 12 months follow-up. The initial percentage of teeth with negative response postoperatively was 21.6% seen in a study by Nkenke and colleagues.<sup>15</sup> Persisting negative response 12 months postoperatively was registered in 11.4%, predominantly canines. In a prospective study by the same author,<sup>11</sup> no postoperative changes in pulp sensitivity was detected after harvesting retromolar bone grafts. These results are to be compared with 1.5% for pulp tester and 6.5% for ice in this present study. In the prospective study by von Arx and colleagues,<sup>16</sup> the number of teeth with persisting altered pulp sensitivity was 0.6% after 12 months. The mean size of bone harvest defect was  $17.5 \times 8.6$  mm, comparable to the present study.

TABLE 6 Symptoms at 1 Month Postoperatively				
Symptoms 1 month postoperatively		<i>n</i> = 8		
Teeth	Anesthesia of lower incisors	4		
	Anesthesia of gingiva of lower incisors	1		
	Hyperesthesia of lower incisors	0		
Lip	Anesthesia of lower lip	1		
Chin	Anesthesia	2		
	Stiffness/numbness	2		
	Paresthesia	3		
Patients with no symptoms 1 month postoperatively				

However, in this study, graft defect size was measured in difference to the more commonly reported graft size.

Changes of the chin contour could be a patient concern preoperatively. Other studies have evaluated the chin status<sup>1,20</sup> but postoperative concavities have not been found. Clavero and Lundgren<sup>19</sup> found 10 of 29 patients reporting changes in chin contour 18 months postoperatively but this could not be clinically verified. Raghoebar and colleagues14 had two patients complaining of contour changes; both of them had weatherdependent symptoms. In the present study, a postoperative concavity ("scarry pit") was a clinical finding in one patient, although the patient had not noticed it himself. Furthermore, three patients complained of the feeling of having a postoperative pit or scar in the chin after the grafting procedure. This could not be confirmed clinically, and all three patients had normal sensation in all the tests performed.

A persisting concavity in the chin was noticed on radiographs in a majority of cases but the remineralization of the new bone seemed good. It seems that bone healing after chin graft harvesting usually does not regenerate to the same level as preoperative. As an extraoral concavity was not a problem, the healing of the bone defect could be explained by the ingrowth of fibrous or connective tissue in the defect, supporting the soft tissue. This provides a good aesthetic result, although sometimes with a sensory deficiency, indicating a subjective remaining defect.

Periapical pathology was found in five teeth (1.2%), three of which were prostethically restored. Therefore, it is possible that the crown preparation itself caused trauma to the tooth leading to pulpal necrosis rather than the grafting procedure. One of these patients also had a severe car accident some years before the grafting, including trauma to his teeth. The number of teeth registered as having clinically altered sensibility was much higher than the number rated subjectively by the patients. In one patient, three teeth did not respond to either the pulp tester or to ice; thus, two of the teeth showed periapical pathology. Usually, teeth that do not respond to clinical stimuli are diagnosed with a necrosis of the pulp. It is an interesting point that none of the clinically anesthetic teeth showed any periapical pathology.

Altogether, radiological examination plays an important role preoperatively but has a lower impor-

tance as a routine examination at postoperative followups, where it seems to have a poor correlation to clinical findings and/or subjective symptoms.

In the mail-in questionnaire, a third of the patients stated having doubts undergoing the therapy again. When patients were asked for comments, they had difficulties in separating the graft therapy from the total treatment. Prosthetics were the dominating reasons to patients degrading the treatment, including the surgical procedure. Several patients expressed that the temporary denture had been a major difficulty. Patients also described having daily problems with oral hygiene around the implant-supported bridge or crown. Regarding persisting symptoms, our results are consistent with previous reports<sup>14</sup> and indicate that the subjective level of discomfort was low and is not causing any noteworthy complaints or difficulties in daily life.

The survey of the patients' records showed a high number of symptoms 1 week postoperatively, which is not unusual for a surgical procedure. A distinct decrease of symptoms was seen 1 month later, which indicates that the major healing is within this first month.

Altogether, this study indicates that the postoperative morbidity after bone graft harvesting from the mandibular symphysis is moderate but tolerated well by patients. However, patients must be carefully informed about possible persisting morbidity, mostly affecting the soft tissues of the chin. A preoperative examination should include adequate radiographs and sensibility tests of the soft tissue and teeth, presenting valuable baseline information when discussing postoperative healing. Safety margins to adjacent structures must not be compromised, and instead alternative donor sites should be discussed when larger grafts are required.

# CONCLUSIONS

This study indicates that long-term follow-up of the chin graft donor site shows some postoperative morbidity. The most frequent disturbance was impaired sensibility in the soft tissues of the chin. The lower lip and teeth showed fewer disturbances. The rate of subjective symptoms was higher than the clinical findings but did not, in general, affect the patient in daily life. At radiographic examination, bone healing after chin graft harvesting did not regenerate to the preoperative level. The donor site showed good remineralization but left a radiologic concavity in a majority of cases.

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