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Morbidity of harvesting of retromolar bone grafts: a prospective study

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Key words: membranous bone; radiological markers; retromolar bone graft; single tooth reconstruction; trephine bur.

Abstract: 20 retromolar bone grafts were harvested in outpatients for augmentation of the implant site from January to June 2000 (10 female, 10 male, 40.9 ± 12.8 years, minimum 17 years, maximum 66 years). The aim of the study was to assess typical complications of this procedure in a prospective manner. For the determination of the superficial sensory function of the inferior alveolar and the lingual nerve, an objective method was used. The bone grafts were harvested for single tooth reconstruction. In 14 cases a ridge augmentation and in 6 cases an endoscopically controlled crestal sinus floor elevation was performed. Preoperatively, the height of bone above the cranial aspect of the inferior alveolar nerve in the retromolar region was assessed radiologically with known markers. The maximum mouth opening was determined. The superficial sensory function of the inferior alveolar and the lingual nerve was assessed with the Pointed-Blunt Test, the Two-Point-Discrimination Test and the objective method of the 'Pain and Thermal Sensitivity' Test (PATH Test). Moreover, the pulp sensitivity of the teeth of the donor site was determined by cold vitality testing. All tests were repeated 1 week postoperatively. Intraoperatively, the width of the retromolar region was measured with a caliper. The patients rated the operative strain on a visual analogue scale. The height of bone above the inferior alveolar nerve in the retromolar region was 11.0 ± 2.2 mm. The width of the retromolar area was 14.2 ± 1.9 mm. Postoperatively, the maximal mouth opening changed significantly (40.8 ± 3.5 mm preoperatively, 38.9 ± 3.7 mm postoperatively, $P = 0.006$). However, the reduction was not relevant clinically. A direct injury of the inferior alveolar or lingual nerve did not occur. A sensitivity impairment could not be detected for either of the nerves by the different test methods 1 week postoperatively. The operative strain related to the donor site was significantly less than the strain generated by the implant placement (rating on a visual analogue scale 2.8 ± 1.0 and 4.1 ± 2.0, respectively, $P = 0.027$). Retromolar bone grafts are a viable method for augmentation of the implant site in conjunction with single tooth reconstruction with low strain on the patient and minimal risk of complications.

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The use of autogenous bone grafts for the augmentation of the resorbed alveolar ridge is still considered the gold standard in implantology. Various extraoral donor sites like calvarium, tibia, rib and iliac crest have been used. The iliac crest is the most common site to harvest large amounts of autogenous bone (Tolman 1995). Obtaining grafts from these areas usually involves general anaesthesia. However, localized bone defects of the alveolar ridge require only a confined amount of bone. Donor sites for these grafts can be found within the oral cavity. A major advantage of an

intraoral donor site is that harvesting of bone can be performed under local anaesthesia. The use of the mandible as a donor site is said to be less invasive, to save surgical and anaesthetic time and can be accomplished in the outpatient operatory (Misch 1997).

Harvesting of bone grafts from the retromolar region has been reported several times before (Laskin & Edwards 1977; Girdler & Hosseini 1992; Khoury et al. 1993; Raghoebar et al. 1996; Von Arx et al. 1996; Misch 1997; Schlegel et al. 1998; Von Arx & Kurt 1998; Khoury 1999; Misch 1999; Pikos 1999). However, the outcome of these trials concerning complications are discordant. They range from absence of complications over impairment of the sensory function of the inferior alveolar nerve to mandibular fractures (Hönig 1996; Von Arx & Kurt 1998; Khoury 1999). Prospective trials are not available in the current literature.

The aim of the present prospective study was to assess the rate of complications that arise from harvesting of retromolar bone grafts. A special emphasis was put on the objective measurement of changes in the sensory function of the inferior alveolar and the lingual nerve.

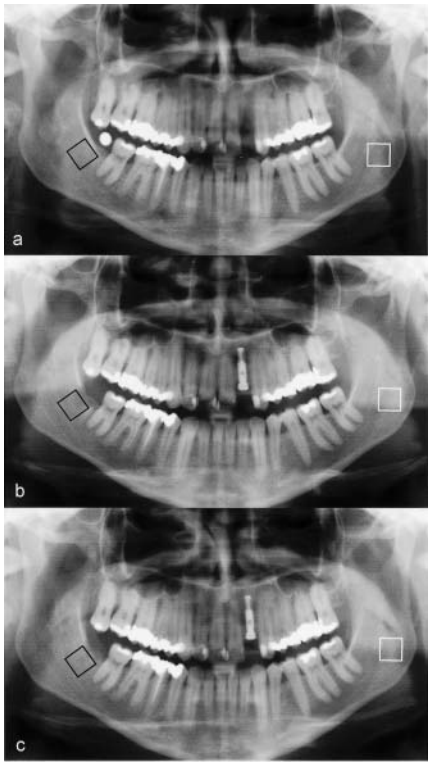

Fig. 1. Pre- and postoperative X-rays. a) Preoperative panoramic radiograph with radiological marker *in situ* retromolar left, black rectangle region of interest for densitometric evaluation, white rectangle reference region of interest. b) Panoramic radiograph directly postoperatively. c) Panoramic radiograph 6 months postoperatively.

Fig. 2. Retromolar donor site.

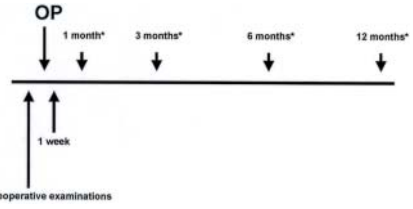

Fig. 3. Follow-up examinations (*examinations were only carried out when there was a sensitivity impairment in the previous follow-up).

Material and methods

At the Department of Oral and Maxillofacial Surgery, University of Erlangen-Nuremberg, 20 retromolar bone grafts were harvested by three experienced surgeons from January until June 2000 for the preparation of implant sites in an outpatient procedure (10 female, 10 male, 40.9 ± 12.8 years, minimum 17 years, maximum 66 years). Preoperatively, all patients showed a regular sensory function of the inferior alveolar nerve and the lingual nerve.

The cutting depth selection in the retromolar area was based on panoramic radiographs using known markers to correct for distortion (Fig. 1). The maximum interincisal distance between the right maxillary and mandibular central incisors was determined with a Zielinsky caliper.

The bone harvesting procedure was performed using a standardised surgical technique. The treatment was carried out under local anaesthesia with 2 mL Ultracain™ D-S (Hoechst Marion Roussel Deutschland, Frankfurt, Germany). No premedication or sedation was used. The approach to the retromolar region was made by an incision in the retromolar region extending from the midpoint of the ascending ramus to the posterior aspect of the second molar. The incision was accomplished in a curvilinear fashion anteriorly beneath the attached gingiva to the region of the first molar. A mucoperiosteal flap was reflected from the mandibular body exposing the third molar area and the lateral aspect of the ramus. The width of the retromolar area was measured with a Zielinsky caliper. Subsequently, the osteotomy was performed with a trephine bur in a straight surgical handpiece under copious saline irrigation (Fig. 2). As modification to previously described techniques, the external oblique ridge and the lingual aspect of the ramus were preserved. Except for one case, a trephine bur 10 mm in diameter was chosen. To preserve lingual nerve and artery from injury in case of perforation, a raspatory was placed between these structures and the lingual aspect of the ramus. A thin chisel was used to elevate the bone block out of the retromolar region. To keep an adequate margin of safety, the harvesting of the grafts was performed at least 2 mm above the superior aspect of the neurovascular bundle (Bartling et al. 1999).

To determine sensitivity impairment after harvesting of retromolar bone grafts, different examination methods were applied, assessing the different qualities of the superficial sensitivity of chin and tongue. In a preoperative test the function of the inferior alveolar nerve and the lingual nerve was determined on the ipsilateral side by the Pointed-Blunt Test and the Two-Point-Discrimination Test. Moreover, the 'Pain and Thermal Sensitivity'-Test (PATH Test) was applied (Schultze-Mos-

gau & Reich 1993; Schultze-Mosgau et al. 1994, 1999). The pulp sensitivity of the teeth of the ipsilateral side was examined by cold vitality testing with carbon dioxide snow (Rowe & Pitt Ford 1990). The different examination methods have been described in detail by Nkenke et al. (2001).

The repetition of the examinations was planned for 1 week, 1 month, 3, 6 and 12 months after surgery according to the follow-up regimen of Nkenke et al. (2001) (Fig. 3). The examinations were stopped when a sensitivity impairment could no longer be detected. The follow-up was confined to a maximum of 1 year, because after this time a further improvement of the superficial sensory function of the inferior alveolar nerve cannot be expected (Robinson 1988). The patients were asked to rate the operative strain of harvesting of the retromolar grafts in comparison with the implant insertion on a visual analogue scale. The value 10 was defined as maximum, and 0 as minimum operative strain. At the postoperative examinations visible oedemas and haematomas were recorded.

To assess the course of bony regeneration of the area of bone harvest a radiological analysis was performed. On digital panoramic radiographs (Orthophos DS, Siemens, Erlangen, Germany) assessed directly after the operation rectangular regions of interest (ROIs) were defined that covered the areas of bone harvest (Fig. 1). Subsequently, these ROIs were transferred to the panoramic radiographs that were acquired preoperatively and 6 months postoperatively. For each ROI the mean grey value (MGV) was calculated (Osiris imaging software, Hopitaux Universitaires de Geneve, Geneva, Switzerland). To correct for grey level changes in the radiographs assessed directly postoperatively and 6 months postoperatively due to altered scanning parameters at the different points of time of the acquisition of the X-rays, reference regions were marked on the contralateral side of the mandible, where no changes of the bony structures due to the operation had to be expected. The reference mean grey values determined from

Fig. 4. a) Exposed retromolar area. b) Osteotomy for block graft removal. c) Defect of the donor site. d) Bone block with a perforation for implant placement. e) Bone resorption after single tooth loss. f) Onlay graft. g) Increased transversal width. h) Control 6 months postoperatively. I) Prosthodontic supply.

the preoperative panoramic radiographs ($RMGV_{preoperative}$) were divided by the mean grey values assessed from the X-rays taken directly postoperatively and 6 months postoperatively ($RMGV_{directly\ postoperative}$ $RMGV_{6\ months\ postoperative}$, respectively) to calculate the correction factors ($CF_{directly\ postoperative}$ $RMGV_{6\ months\ postoperative}$, respectively) (Formula 1). These factors were multiplied by the mean grey values of the side of bone harvest determined directly postoperatively and 6 months postoperatively ($MGV_{directly\ postoperative}$ $RMGV_{6\ months\ postoperative}$, respectively) to receive the mean grey values independent of the scanning parameters ($IMGV_{directly\ postoperative}$ $RMGV_{6\ months\ postoperative}$, respectively) (Formula 2).

Statistics

To analyse whether there were statistically significant changes of the nerve function, mouth opening and the pulp sensitivity, a comparison of the preoperative examinations with the postoperative examinations after 1 week was done. Multiple measurements per patient at identical time points were aggregated prior to analysis using the mean as aggregation measure. For description of approximately normally distributed variables, mean values are given with standard deviation. The paired Wilcoxon test was used for comparison of pre- and postoperative measurements. *P*-values equal to or smaller than 0.05 were considered significant. All calculations were done using SPSS for Windows (SPSS Inc., Chicago, IL, USA).

Results

For single tooth reconstruction in 14 cases a ridge augmentation was carried out (Fig. 4). In six cases an endoscopically controlled crestal sinus floor elevation was performed.

The bone height over the superior aspect of the mandibular canal calculated from the preoperative panoramic radiographs was 11.0 ± 2.2 mm (minimum 7, maximum 15 mm) (Fig. 1). A margin of safety of 2 mm above the inferior alveolar nerve was taken into account in every case. Extensive bleeding after the removal of the bone graft could not be encountered. An exposure of the inferior alveolar nerve did not occur. The retromolar width ranged from 10 to 17 mm with a mean value of 14.2 ± 1.9 mm. In 19 cases a trephine bur of 10 mm in diameter was used. One patient showed a retromolar width of 10 mm. Therefore, a trephine bur of 8 mm in diameter was chosen to preserve at least 1 mm of the buccal and lingual aspects of the retromolar area (patient no. 13, Table 1).

Table 1. **Anatomical examination of the donor site and rating of operative strain (bg = block graft, pg = particulated graft, VAS = visual analogue scale)**

Patient No.	Age (years)	Sex	Donor site	Host region	Width of retromolar region (mm)	Bone height above inferior alveolar nerve (mm)	VAS rating donor site	VAS rating implant placement
1	44	male	left	16 (pg)	15	7	1	7
2	32	female	left	22 (bg)	13	10	2	2
3	57	male	left	14 (bg)	16	12	2	3
4	58	male	left	16 (pg)	17	10	3	8
5	17	female	left	36 (bg)	13	9	3	3
6	41	female	left	14 (bg)	14	7	2	5
7	36	female	left	21 (bg)	15	13	2	4
8	35	female	left	36 (bg)	12	11	4	3
9	38	male	left	25 (bg)	16	10	3	5
10	44	female	left	25 (pg)	12	14	3	6
11	17	male	left	15 (pg)	14	11	2	2
12	41	male	left	21 (bg)	16	11	4	1
13	30	female	left	11 (bg)	10	13	3	6
14	41	female	right	11 (bg)	13	12	4	4
15	58	male	left	16 (pg)	15	15	1	4
16	38	male	left	46 (bg)	16	12	3	3
17	34	female	right	21 (bg)	13	8	2	2
18	66	female	right	24 (bg)	12	13	3	5
19	38	male	left	21 (bg)	17	11	5	2
20	53	male	left	16 (pg)	15	10	4	7
Mean	40.9 ± 12.8	/	/	/	14.2 ± 1.9	11.0 ± 2.2	2.8 ± 1.0 (*P* = 0.027)	4.1 ± 2.0

Table 2. **Assessment of sensitivity disorders**

Examined region	PATH Test (warm) (°C)	PATH Test (cold) (°C)	Two-Point-Discrimination Test (mm)
Chin			
preoperative	32.93 ± 0.37	31.22 ± 0.39	3.9 ± 0.5
postoperative	31.94 ± 0.25	31.19 ± 0.18	3.9 ± 0.6
P	0.586	0.340	0.791
Tongue			
preoperative	32.62 ± 0.14	31.22 ± 0.08	4.0 ± 0.3
postoperative	32.64 ± 0.14	31.50 ± 0.10	3.9 ± 0.3
P	0.507	0.410	0.567

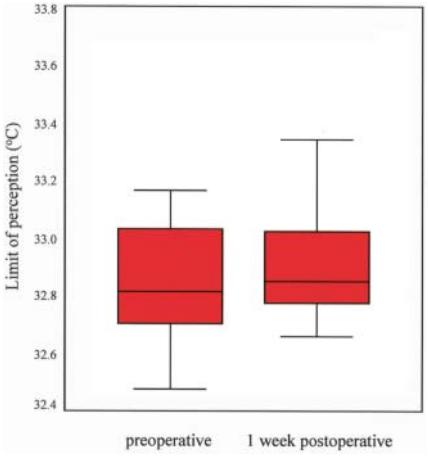

Fig. 5. Box plot analysis of the limit of perception preoperatively and 1 week postoperatively in the innervation area of the inferior alveolar nerve on the ipsilateral side (PATH Test, warm stimuli).

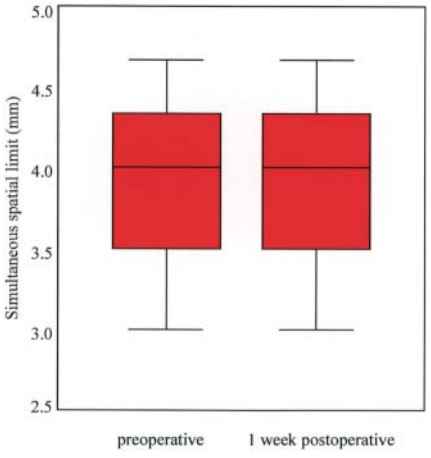

Fig. 6. Box plot analysis of the simultaneous limit of perception preoperatively and 1 week postoperatively in the innervation area of the inferior alveolar nerve on the ipsilateral side. Formula 1: $CF_{directly\ postoperative}$ and $CF_{6\ months\ postoperative}$, respectively = $RMGV_{preoperative}/RMGV_{directly\ postoperative}$ and $RMGV_{6\ months\ postoperative}$, respectively, CF = correction factor, RMGV = reference mean grey value. Formula 2: $IMG_{directly\ postoperative}$ and $IMG_{6\ months\ postoperative}$, respectively = $MGV_{directly\ postoperative}$ and $MGV_{6\ months\ postoperative}$, respectively × $CF_{directly\ postoperative}$ and $CF_{6\ months\ postoperative}$, respectively, IMGV = mean grey value independent of the scanning parameters, MGV = mean grey value.

In all cases a primary wound closure was performed without the use of a surgical drain. The patients rated the operative strain of harvesting of retromolar grafts compared with the implant insertion on a visual analogue scale. While the mean value for the implant placement was 4.1 ± 2.0 (range 1–8), for the harvesting of the retromolar grafts it decreased to 2.8 ± 1.0 (range 1–5)(Table 1). The harvest of the bone grafts was estimated to be significantly more convenient than the implant insertion ($P = 0.027$).

All patients attended the first postoperative follow-up examination. With the Pointed-Blunt Test, Two-Point-Discrimination Test and the PATH Test, changes in the superficial sensory function of the inferior alveolar nerve and the lingual nerve could not be detected. The statistical evaluation revealed that the function of the inferior alveolar nerve and the lingual nerve had not been disturbed by the operation (Table 2). Box plots were used to describe the assessed data (Figs 5 and 6). The postoperative pulp sensitivity of the ipsilateral teeth did not change compared with the preoperative situation.

After one postoperative week visible haematomas were not encountered. In three cases a postoperative oedema still persisted. The maximum interincisal opening changed from 40.8 ± 3.5 mm preoperatively to 38.9 ± 3.7 mm postoperatively ($P = 0.006$). However, the difference was not clinically relevant.

The mean $MGV_{preoperative}$ of the region of bone harvest was 129.74 ± 18.00. The mean $IMGV_{directly\ postoperative}$ decreased significantly to 104.04 ± 18.00 ($P < 0.0005$). However, on the radiographs taken 6 months postoperatively the mean $IMGV_{6\ months\ postoperative}$ increased significantly up to 128.18 ± 26.88 when compared with the mean $IMGV_{directly\ postoperative}$) ($P < 0.0005$). The statistical analysis revealed no significant differences between the mean $MGV_{preoperative}$ and $IMGV_{6\ months\ postoperative}$ ($P = 0.502$).

Discussion

On account of its biocompatibility and osteoinductivity autogenous bone is still superior to all allografts and xenografts. However, shortcomings arising from donor site morbidity cannot be ignored. Several studies have reported on harvesting of grafts from the retromolar region (Khoury et al. 1993; Raghoebar et al. 1993; Von Arx et al. 1996; Misch 1997; Schlegel et al. 1998; Von Arx & Kurt 1998; Khoury 1999; Misch 1999; Pikos 1999). However, the number of complications is discordant when the different trials are compared. This seems to be because none of the studies is prospective and based on objective tests for the function of inferior alveolar and lingual nerves (Table 3).

In the present study the bone grafts were harvested with a trephine bur. With this method a four-wall intrabony defect is produced (Schlegel et al. 2000). The surgical techniques described before have always involved the external oblique ridge and have interrupted its continuity (Table 3). Mandibular fractures have been reported (Hönig 1996). However, when the external oblique ridge and the lingual aspect of the ramus are preserved, decisive weakening of the mandible does not have to be assumed. Therefore, mandibular fractures seem unlikely with the technique used in the present study.

Moreover, using the buccal cortex of the mandible as bone graft, an exposure of the inferior alveolar nerve cannot be avoided safely. The average distance of the inferior alveolar nerve from the buccal aspect of the mandible in the retromolar region is 2.835 mm (Reich 1980). However, a 4-mm

Table 3. **Review of the literature on harvesting of retromolar bone grafts (all authors removed the vestibular cortex except for Girdler & Hosseini (1992), who removed the lingual cortex)**

Authors	No. of patients	Reported complications
Girdler & Hosseini 1992	12	temporary lingual paraesthesia
Hönig 1996	?	mandibular fracture
Khoury 1999	?	none
Khoury et al. 1993	?	none
Misch 1997	19	incision dehiscence
Misch 1999	?	mandibular fracture
Raghoebar et al. 1996	7	none
Schlegel et al. 1998	5	none
Von Arx et al. 1996	4	none
Von Arx & Kurt 1998	13	hypoaesthesia n. V_3, massive postop. bleeding
Wood & Moore (1988)	12	none

thickness of the cortical grafts has been described (Misch 1997). Therefore, the exposure of the inferior alveolar nerve happens frequently. Sometimes, it is accompanied by massive bleeding, because of injury to the inferior alveolar artery (Von Arx & Kurt 1998). It seems that the modification of retromolar bone harvesting with the trephine bur helps to reduce sequelae and complications. Heavy osseous bleeding did not occur after bone harvest. Bone wax or haemostatic dressing did not have to be used. Visible haematomas could not be observed 1 week postoperatively.

During the follow-up, impairment of the superficial sensory function of the inferior alveolar nerve was not observed in the present study, although it has been described previously (Von Arx & Kurt 1998). It is generally accepted that cutting 10 mm deep in a vertical direction in the retromolar region leaves the inferior alveolar nerve untouched (Smith et al. 1991). However, the radiological analysis showed that four cases did not offer this bone height above the nerve canal. In the present study an exposure of the inferior alveolar nerve did not occur. The determination of the bone height above the cranial aspect of the inferior alveolar nerve canal in the retromolar area measured with radiological markers on preoperative panoramic radiographs is a safe procedure to prevent injury of the neurovascular bundle. As a safety limit, a distance of 2 mm above the cranial aspect of the nerve canal was chosen, which seems to be sufficient (Bartling et al. 1999).

The extent of the bone graft cylinder was confined to 10 mm, even when more bone could have been obtained in a vertical direction. The aim was to keep perforations of the lingual cortex as small as possible. However, because of the typical configuration of the alveolar shelves, perforations cannot be avoided reliably. Anatomical trials show that the mandibular base is 5 mm smaller than the alveolar shelf on average (Smith et al. 1991). Therefore, the placement of a raspatory lingual to the alveolar shelf is obligatory. With this procedure, injuries of the lingual nerve and the lingual artery can be avoided in case of lingual perforation. Contrary to other trials, impairment of the sensory function of the lingual nerve due to lingual flap retraction did not occur in the present study (Robinson & Smith 1996).

In only one case was the width of the alveolar shelf insufficient for bone harvesting with a trephine drill of 10 mm in diameter. The average value of 14.2 ± 1.9 mm (minimum 10 mm, maximum 17 mm) was in good accordance with previous trials (Smith et al. 1991). Therefore, when bone blocks were used for ridge augmentation in a single stage procedure, the thickness of the graft around an implant of 4 mm in diameter was still 2 mm. This situation makes it possible to achieve an ideal shape of the newly formed alveolar ridge (Fig. 4).

Performing ridge augmentation and implant placement as two-stage surgery is still said to be more successful than the single-stage procedure (Lundgren et al. 1999). A healing period for mandibular grafts of 4 months has been recommended (Misch et al. 1992; Williamson 1996). Although the block grafts are mostly cortical, delayed implant placement does not have to be carried out later than is usually done in grafts from the iliac crest with a pronounced trabecular portion (Schultze-Mosgau et al. 2001). Because of their embryological origin, retromolar bone grafts have some advantages over extraoral donor sites. The mandible consists of membranous bone. This type of bone shows less resorption than enchondral bone (Phillips & Rahn 1987). In general, cancellous grafts revascularize faster than cortical ones (Kusiak et al. 1985). However, experimental trials have shown that cortical membranous bone revascularizes more rapid than cancellous enchondral bone. The early revascularization seems to explain the good maintenance of volume of the retromolar graft (Zins & Whitaker 1983).

However, a major disadvantage of retromolar grafts remains. Only a confined amount of bone can be harvested from this donor site. It has been described that the volume is half of what can be achieved from the mandibular symphysis (Misch 1997). Therefore, the retromolar grafts were used for single tooth reconstruction in all cases. The ridge augmentations were performed with bone blocks. When a sinus lift was carried out, the endoscopically controlled crestal sinus floor elevation was preferred, because it only demands a small amount of bone for the augmentation. In these cases the grafts had to be particulated in a bone mill, because they consisted predominantly of cortical bone.

In the present study the regeneration of the donor site proceeded uneventfully in all cases. On panoramic radiographs assessed 6 months postoperatively the mean grey values of the regions of bone harvest did not differ from the preoperative ones. This indicates bony regeneration of the retromolar region in all cases. Contrary to other reports, it does not seem to be necessary to fill the bony defects with allogenic bone substitutes (Khoury 1999).

The operative strain of harvesting of retromolar bone grafts is higher than the strain with symphysis bone grafts. While the patients who underwent harvesting of chin grafts rated the operation with a value of 64.4 ± 21.1 (range 11–95) on a visual analogue scale with a maximum value of 100, the retromolar intervention reached a value 2.8 ± 1.0 on a scale with a maximum value of 10 (Nkenke et al. 2001). Moreover, harvesting of retromolar bone grafts was found to be similar or less invasive than the implant placement. Because of the low strain imposed on patients with bilateral retromolar bone harvesting, this seems to be a viable method to increase the graft volume.

In conclusion, retromolar bone grafts have to be especially recommended in conjunction with single tooth reconstruction. The operation area is confined to the oral cavity, which results in reduced costs and anaesthetic time compared to extraoral donor sites. Moreover, autogenous bone is still superior to bone substitutes as regards biocompatibility and osteoconductivity (Buser et al. 1998). Therefore, with retromolar bone an optimum performance of the grafting material can be combined with a minimum patient strain.

Résumé

Vingt greffes osseuses rétromolaires ont été prélevées chez des patients afin d'épaissir le site implantaire de janvier à juin 2000 (dix hommes et dix femmes de 41 ± 13 ans, minimum 17 maximum 66 ans). Le but de cette étude a été d'évaluer les complications typiques de ce processus d'une manière prospective. Pour la détermination de la fonction sensorielle superficielle de l'alvéole inférieure et du nerf lingual une méthode objective a été utilisée. Les greffons osseux ont été prélevés pour une reconstruction dentaire unique. Parmi quatorze cas d'épaississement du rebord alvéolaire, six cas ont subi un épaississement du sinus contrôlé par endoscopie. Préopérativement, la hauteur de l'os au-dessus de l'aspect cranial du nerf alvéolaire inférieur dans la région rétromolaire a été mesurée radiographiquement avec des marqueurs connus. L'ouverture maximum de la bouche a été déter-

minée. La fonction sensorielle superficielle du nerf alvéolaire inférieur et lingual a été déterminée par le test de la pointe émoussée, le test de discrimination de deux points et la méthode objective du test de sensibilité thermique à la douleur (test PATH). De plus, la sensibilité pulpaire des dents dans le site donneur a été déterminée par le test de vitalité au froid. Tous les tests ont été répétés une semaine après l'opération. Durant l'opération la largeur de la région rétromolaire a été mesurée à l'aide d'un compas. Les patients évaluaient la contrainte de l'opération sur une échelle analogue visuelle . La hauteur de l'os audessus du nerf alvéolaire inférieur dans la région rétromolaire était de 11,0±2,2mm. La largeur de la zone rétromolaire était de 14,2±1,9mm. Postopérativement, la variation d'ouverture maximale de la bouche changeait significativement (40,8±3,5 mm avant et 38,9±3,7mm après l'opération; P=0,006). Cependant la réduction n'était pas cliniquement significative. Une blessure directe du nerf inférieur alvéolaire ou lingual ne s'est pas produite. Une perte de sensibilité ne pouvait pas être détectée pour les deux nerfs par les différentes méthodes de test une semaine après l'opération. La contrainte opératoire concernant le site donneur était significativement moins importante que celle engendrée par le placement de l'implant (2,8±1 vs 4,1±2; p=0,027). Les greffons osseux rétromolaires représentent donc une bonne méthode viable pour l'épaississement du site implantaire en association avec une reconstruction dentaire unique avec une contrainte peu importante pour le patient et un risque minimal de complications.

Zusammenfassung

Von Januar bis Juni 2000 wurden bei Ueberweisungspatienten (10 weibliche, 10 männliche, 40.9+/-12.8 Jahre, Minimum 17 Jahre, Maximum 66 Jahre) in der retromolaren Region 20 Knochentransplantate zur Augmentation in der Implantatregion gewonnen. Es war das Ziel dieser Studie, typische Komplikationen dieses Verfahrens in einer prospektiven Art auszuwerten. Für die Bestimmung der oberflächlichen sensorischen Funktion des Unterkiefernerven und des Lingualnerven wurde eine objektive Methode verwendet.

Die Knochentransplantate wurden für Einzelzahnrekonstruktionen gewonnen. Bei 16 Fällen wurden Kammaugmentationen und bei 6 Fällen endoskopisch überwachte Anhebungen des Sinusbodens durchgeführt. Präoperativ wurde die Höhe des Knochens über der kranialen Begrenzung des Unterkiefernerven in der retromolaren Region radiologisch mittels bekannten Markierungen bestimmt. Die maximale Mundöffnung wurde gemessen. Die oberflächliche sensorische Funktion des Unterkiefer- und des Lingualnerven wurde mittels des Spitz-Stumpf-Tests, des Zwei-Punkte-Unterscheidungstests und einer objektiven Methode des äSchmerz- und Themperaturempfindungs"-Tests (PATH Test) ermittelt. Zudem wurde die Empfindlichkeit der Zähne im Spendergebiet mittels Kältevitalitätstest bestimmt. Alle Tests wurden eine Woche postoperativ wiederholt. Die Breite in der retromolaren Region wurde intraoperativ mit einem Tastzirkel gemessen. Die Patienten bewerteten die intraoperative Belastung auf einer sichtbaren analogen Skala.

Die Höhe des Knochens über dem Unterkiefernerven in der retromolaren Region betrug 11.0+/-2.2mm. Die Breite in der retromolaren Gegend betrug 14.2+/-1.9mm. Die maximale Mundöffnung veränderte sich postoperativ signifikant (40.8+/-3.5mm präoperativ, 38.9+/-3.7mm postoperativ, p=0.006). Die Reduktion war jedoch klinisch nicht relevant. Eine direkte Schädigung des Unterkiefernerven oder des Lingualnerven trat nicht auf. Bei beiden Nerven konnte eine Woche postoperativ mittels der verschiedenen Testverfahren keine Beeinträchtigung der sensorischen Funktion festgestellt werden. Die Belastung durch die Operation in der Spenderregion war signifikant geringer als die Belastung durch die Implantatplazierung (Bewertung auf einer sichtbaren analogen Skala 2.8+/-1.0 bzw. 4.1+/-2.0, p=0.027).

Retromolare Knochentransplantate sind wertvoll für die Augementation von Implantatstellen im Zusammenhang mit Einzelzahnersatz. Es entsteht eine geringe Belastung für die Patienten und es besteht eine minimales Risiko für Komplikationen.

Resumen

Se recolectaron 20 injertos retromolares en pacientes externos para aumento del lugar de implante desde enero a junio de 2000 (10 hembras, 10 varones, 40.9±12.8 años, mínimo 17 años, máximo 66 años). La intención de este estudio fue valorar las complicaciones típicas de este procedimiento de una forma prospectiva. Se usó un método objetivo para la determinación de la función sensorial superficial del alveolo inferior y el nervio lingual.

Los injertos óseos se recolectaron para reconstrucción de diente unitario. En 14 casos se llevó a cabo un aumento de la cresta ósea y en 6 casos una elevación del suelo del seno controlada por endoscopia. Se valoró radiologicamente con marcadores conocidos, preoperatoriamente, la altura del hueso sobre la zona craneal del nervio alveolar inferior en la región retromolar. Se determinó la apertura máxima de la boca. Se valoró la función sensorial superficial de los nervios alveolar y dentario inferior con el test Pointed-Blunt, el test de discriminación de dos puntos y el test de método objetivo de "Sensibilidad Dolorosa y Térmica" (test PATH). Incluso se determinó la sensibilidad de la pulpa de los dientes de la zona donante probando la vitalidad al frío. Todos los test se repitieron una semana tras la operación. Se midió la anchura de la región retromolar intaroperatoriamente con un calibre. Los pacientes valoraron la tensión operatoria en una escala visual analógica. La altura del hueso sobre el nervio alveolar inferior en la región retromolar fue de 11.0±2.2 mm. La anchura del área retromolar fue de 14.2±1.9 mm. La apertura máxima oral postoperatoria cambió significativamente (40.8±3.5 mm preoperatoriamente, 38.9±3.7 mm postoperativamente, p=0.006). De todos modos, la reducción no fue clínicamente relevante. No ocurrió una lesión directa del nervio alveolar inferior. No se detectó variación de la sensibilidad para ninguno de los dos nervios por medio de las diferentes pruebas a la semana de la operación. La tensión operatoria relacionada con el lugar donante fue significativamente inferior que la tensión generada por la colocación del implante (valorada en una escala visual analógica 2.8±1.0 resp. 4.1±2.0, p=0.027.

Los injertos óseos retromolares son un método viable para aumento del lugar de implante en combinación con reconstrucción de diente unitario con una baja tensión en los pacientes y un riesgo mínimo de complicaciones.

要旨

２０００年１月から６月までの期間に、外来患者においてインプラント埋入部位を増多するために臼後三角部２０箇所から移植骨を採取した（女性１０名、男性１０名、４０．９±１２．８才、最小１７才、最高６６才）。本前向き研究は、この術式の典型的な合併症について評価することを目的に行った。下歯槽神経及び舌神経の表在性感覚機能を客観的な方法で測定した。

単独歯修復のために移植骨を採取した。１４症例において顎堤増多術を、６症例において内視鏡下で上顎洞挙上術を行った。術前放射線像によって、臼後三角部の下歯槽神経上端から上方の骨高径を、通法のマーカーを用いて評価した。最大開口量を測定した。下歯槽神経及び舌神経の表在性感覚機能は、Pointed-Blunt テスト、二点弁別試験、及び痛覚温感試験（ＰＡＴＨ試験）の客観的な方法によって評価した。さらに供給側歯牙の歯髄感受性を、寒冷歯髄生死試験で測定した。全ての試験を術後１週間後に繰り返した。術中に臼後三角部の幅径をキャリパスで測定した。患者は視覚アナログ・スケールによって術中の緊張を評価した。臼後三角部の下歯槽神経上方の骨高径は１１．０±２．２ｍｍであった。臼後三角部の幅径は１４．２±１．９ｍｍであった。術後に最大開口量は有意に変化した（術前４０．８±３．５ｍｍ、術後３８．９±３．７ｍｍ、ｐ＝０．００６）。但しこの減少は臨床的な意味合いはないと思われる。下歯槽神経あるいは舌神経の直接的な損傷は起こらなかった。これら二つの神経について感受性障害は、術後１週間後の各種試験方法によって検出されなかった。供給側の手術に関する苦痛の度合いは、インプラント埋入よりも有意に低かった（視覚アナログ・スケールの評価は各々２．８±１．０、４．１±２．０、ｐ＝０．０２７）。臼後三角部からの骨移植は、患者の苦痛は低く、合併症のリスクも最小であり、単独歯修復時にインプラント部位を増多する有効な方法である。

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