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Clinical results of alveolar ridge augmentation with mandibular block bone grafts in partially edentulous patients prior to implant placement

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Abstract: A group of 15 partially edentulous patients who needed alveolar ridge augmentation for implant placement, were consecutively treated using a two-stage technique in an outpatient environment. A total of 18 alveolar segments were grafted. During the first operation bone blocks harvested from the mandibular ramus or symphysis were placed as lateral or vertical onlay grafts and fixed with titanium osteosynthesis screws after exposure of the deficient alveolar ridge. After 6 months of healing the flap was re-opened, the screws were removed and the implants placed. Twelve months after the first operation implant-supported fixed bridges could be provided to the patients. Mean lateral augmentation obtained at the time of bone grafting was 6.5±0.33 mm, that reduced during healing because of graft resorption to a mean of 5.0±0.23 mm. Mean vertical augmentation obtained in the 9 sites where it was needed was 3.4±0.66 mm at bone grafting and 2.2±0.66 mm at implant placement. Mean lateral and vertical augmentation decreased by 23.5% and 42%, respectively, during bone graft healing (before implant insertion). Mandibular sites showed a larger amount of bone graft resorption than maxillary sites. All the 40 implants placed were integrated at the abutment connection and after prosthetic loading (mean follow-up was 12 months). No major complications were recorded at donor or recipient sites. Soft tissue healing was uneventful, and pain and swelling were comparable to usual dentoalveolar procedures. A visible ecchymosis was present for 4 to 7 days when the bone was harvested from the mandibular symphysis. From a clinical point of view this procedure appears to be simple, safe and effective for treating localised alveolar ridge defects in partially edentulous patients.

Alveolar ridge resorption in partially edentulous patients may interfere with the safe and correct insertion of oral implants. In some cases the amount of bone available is not enough to place the implants securely. Since an adequate bone volume is needed to guarantee long-term implant stability (Dietrich et al. 1993), alveolar reconstruction is mandatory in such cases. In other cases implant placement, without augmentation procedures, leads to an aesthetically compromised rehabilitation on account of increased inter-arch distance or unfavourable position and direction of implants.

Several reconstruction procedures have been proposed to increase alveolar volume both vertically and laterally to prepare the ridge for a correct placement of oral implants.

The use of particulate autogenous bone in combination with barrier membranes has been extensively reported to be effective when small edentulous segments such as single tooth deficiencies are to be treated (Fugazzotto 1997). Results with the former technique seem to

be more controversial when larger ridge reconstructions are needed (Lang et al. 1994; Chiapasco et al. 1999).

The use of autogenous bone blocks has been reported as effective both in edentulous and partially edentulous patients. Most previous reports, however, describe the results of alveolar augmentation using autogenous bone blocks harvested from extra-oral donor sites (Collins 1991; Keller et al. 1987; Raghoebar et al. 1996; Lekholm et al. 1999; McGrath et al. 1996; ten Bruggenkate et al. 1992).

It must be pointed out that patients affected by partial edentulism do not easily accept major surgical procedures that may imply hospitalisation or general anaesthesia. They rarely accept procedures that may involve major complications during the healing phase. The use of iliac or calvarial bone grafting is a cause of major patient discomfort during the immediate postoperative phase (Isaksson & Alberius 1992; Keller et al. 1987) and may be considered too invasive for ridge augmentation in partially edentulous patients.

The purpose of this study was to evaluate the results of alveolar ridge augmentation with onlay block bone grafts harvested from the mandible in a group of partially edentulous patients with a broad edentulous area that needed a major bone reconstruction. The use of mandibular bone allowed us to treat all patients as outpatients under local anaesthesia. Other authors (Chiapasco et al. 1999) have used bone blocks harvested mainly from extra-oral sites, or treated half of their partially edentulous patients under general anaesthesia (Jensen & Sindet-Pedersen 1991).

We used a two-stage technique. In the first surgical stage, one or more corticocancellous bone blocks harvested from the mandibular symphysis or ramus were fixed with osteosynthesis titanium screws to the recipient site as onlay grafts, to achieve a horizontal and/or vertical augmentation of the ridge volume. In the second procedure, 6 months later, the screws were removed and implants were placed in a routine fashion. The results regarding bone augmentation obtained, implant stability, donor and recipient site morbidity, and bone graft resorption prior to implant placement were recorded as well as patient discomfort during the immediate postoperative period and during the healing phase.

Material and methods

Fifteen patients affected by partial edentulism were consecutively treated with the following technique. A total of 18 alveolar segments were treated: 10 procedures involved the upper jaw and 8 the mandible. Three patients included in the study were treated in separate procedures for augmentation of different alveolar sites. Each augmented site was studied. All partially edentulous patients needing onlay alveolar ridge augmentation were included in this study.

The preoperative case study consisted of: a conventional panoramic radiograph of the jaws (Siemens Orthophos) and periapical exposures, plaster models and photographs. In only 4 lower jaw cases were CT scans reformatted with Dentascan software available as requested by the referring dentist. In agreement with other authors, we believe that in critical cases reformatted CT images do not always provide a precise treatment guide when the decision to graft or not to graft has to be made (Jacobs et al. 1999).

All the patients were informed in advance that bone reconstruction might be necessary prior to implant placement, since the need to augment the alveolar ridge can be correctly evaluated using panoramic radiographs only when there is vertical resorption of the ridge. Conventional radiographic examination provides little or no information about ridge thickness.

In one case, 2 onlay block grafts were placed in the anterior part of the maxilla during the reconstruction procedure and a maxillary sinus lift was performed on the side. In this particular case, bone harvested from the symphysis was used for both procedures.

At the time of surgery, linear measurements were taken with a periodontal probe at stage 1 (bone grafting) and stage 2 (implant insertion) (Buser et al. 1996). Baseline, stage 1 and stage 2 measurements were recorded. The reference points for measurements related to crestal height were the vestibular cusp or the incisal edge of the teeth adjacent to the site to be augmented. Increases in width and height at the crestal level were easily calculated. When a vertical augmentation was accomplished, the horizontal increase was measured at the crestal level. The number of bone blocks, donor sites and number of implants inserted in each augmented site were also recorded.

All sites were treated in a similar fashion and all procedures were carried out under local anaesthesia. Patients were sent home 2 hours after completion of the operation. Complications related to the donor and the recipient site were recorded.

Stage 1 surgery

Mucoperiosteal flaps were raised for easy access to the alveolar ridge. A crestal incision was made and continued in the gingival sulcus of the teeth adjacent to the edentulous space. Medial and distal releasing incisions were performed when needed to achieve easy movement of the buccal flap. Subperiosteal exposure of the planned implant site permitted direct measurement of the available bone and confirmation of the need for bone augmentation (Fig. 2) At this stage bone harvesting was initiated.

When the mandibular symphysis was selected as the donor site, easy access to the mandible was gained through a horizontal incision deep in the vestibule, extending from canine to canine, similar to that used in genioplasty. Depending on the amount of bone needed, 2 to 5 cylindrical bone blocks were harvested with a round trephine bur 9 or 11 mm in width (see Fig. 7, which shows the harvesting of 4 bone cylinders 11 mm in diameter). Great care was taken not to interfere with lower incisors or canine roots. The height of the bone blocks harvested depends on the sagittal length of the mandibular basal bone in the anterior region. In these cases, however, bone blocks higher than 9 mm were not necessary. In none of the cases was the lingual cortex involved. In most cases the height of the block had to be reduced and the residual bone was then reduced into chips and packed into the recipient site together with the blocks.

When the mandibular ramus was chosen as the donor site, bone was harvested by splitting the outer cortical plate. Through a mucosal incision in the

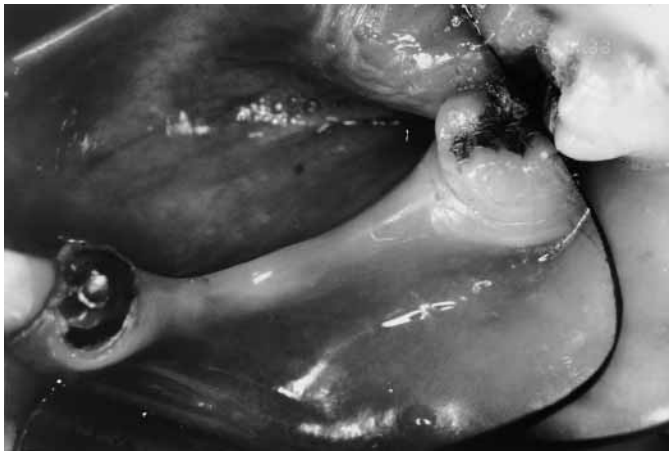

Fig. 1. An example of horizontal augmentation. Note knife edge ridge in this mandibular posterior quadrant (case no. 3).

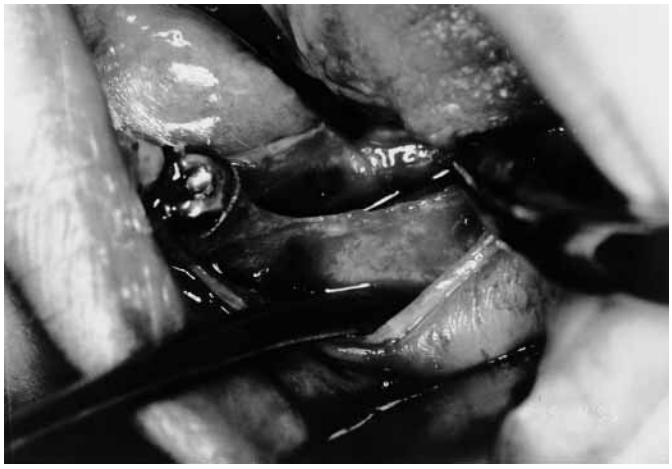

Fig. 2. Notice the very thin alveolar bone when the flap is opened.

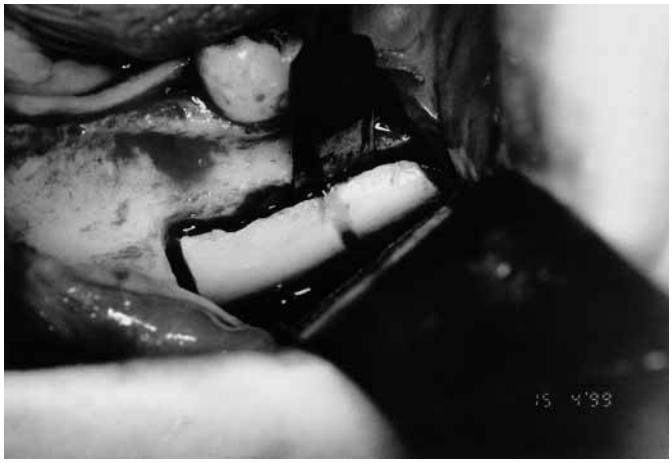

Fig. 3. The bone graft is harvested from the lateral aspect of the mandible.

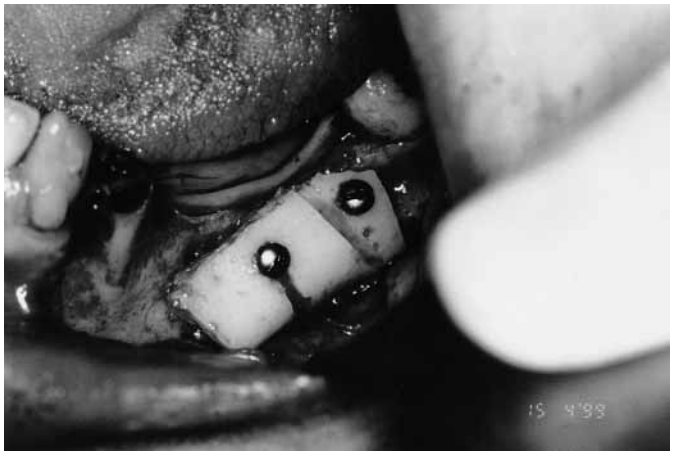

Fig. 4. The bone graft is secured with titanium osteosynthesis screws.

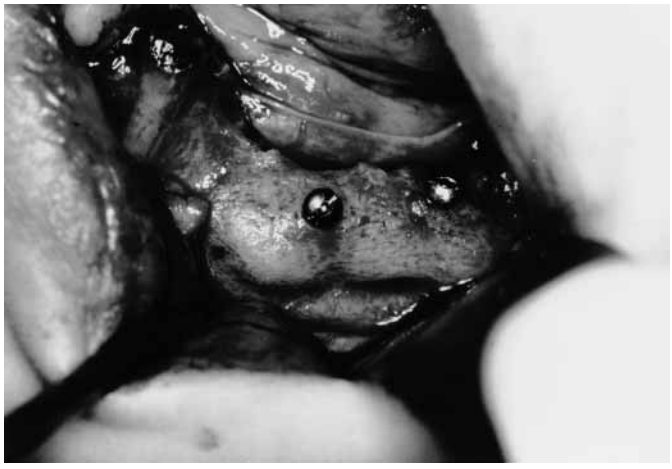

Fig. 5. After 6 months the flap is re-opened. Note the partial resorption of the bone block that is perfectly integrated with the recipient alveolar bone.

Fig. 6. Occlusal view of the same alveolar segment immediately after osteosynthesis screw removal and simultaneous placement of 2 ITI implants. Note the increased width by comparing the original alveolar crest immediately distal to the bicuspid, and the reconstructed segment where the implants were placed.

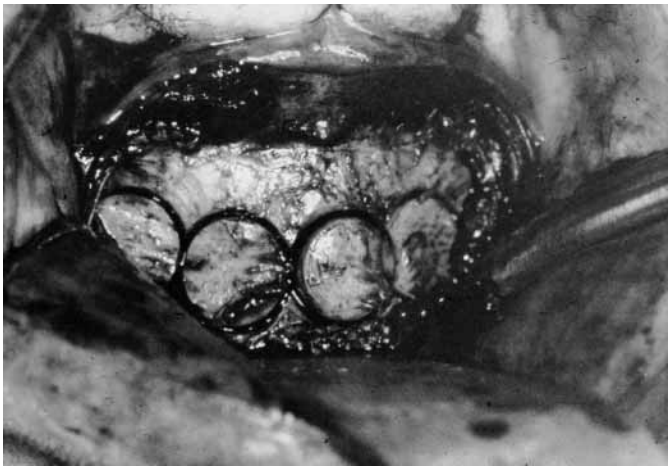

Fig. 7. Mandibular symphysis as donor site. Intraoperative view of the bone blocks ready for harvesting. In this case 4 blocks 10 mm in diameter.

retro-molar area, two bone cuts were made with a Lindemann bur in the lateral aspect of the ramus, obliquely towards the mandibular angle. The cuts were 2 mm in depth and involved only the buccal cortical plate. A third cut was made with the bur in the anterior aspect of the ramus to connect the other two. The cortical plate was then out-fractured using a straight chisel (Fig. 3). A flat bone block of approximately 20 mm in length, 15 mm in height and 2 to 4 mm in width could easily be harvested.

The recipient site was prepared using a round bur under copious saline irrigation to create multiple penetrations through the cortical bone in order to form communication with the marrow space (Buser et al. 1996). The harvested bone blocks were then trimmed and adjusted so that they could fit in to the recipient site, where they were firmly secured with the aid of titanium osteosynthesis screws (Fig. 4). Bone chips were then packed around the blocks. No barrier membranes were used to protect the grafts.

Periosteal releasing incisions were made when necessary to achieve easy closure of the mucosal flaps on top of the grafts without tension. Immediately after the bone grafting procedure 8 mg of betamethasone were given together with 2 grams of Amoxicillin.

Intramuscular antibiotic therapy was continued for 5 days and 100 mg of nimesulide were prescribed twice daily for two to three days postoperatively. Patients were instructed to use non-steroidal anti-inflammatory drugs only if pain was present. Extra-oral pressure dressing was applied for 4 days to minimise postoperative swelling. Chlorhexidine mouth rinse was prescribed for 3 weeks. Many reports (Gersema & Baker 1992; Troullos et al. 1990; Holland 1987) show that the use of steroids in oral surgery reduces swelling in the postoperative period. Pain is also reduced in the first day after surgery. No adverse effects for single dose use or a negative effect on wound healing have been reported. Since our patients were sent home two hours after the end of the bone grafting procedure, our aim was to reduce swelling as much as possible. Intramuscular antibiotic therapy was given for a long period: no adverse effects were noticed. There is no evidence that prolonging antibiotic therapy after the first day gives additional protection if antibiotic prophylaxis is correctly prescribed (Topazian 1992). Besides these considerations, many surgeons when using bone grafts or membranes describe the use of i.o. antibiotics for a period varying from 3 to 10 days postoperatively (Jensen & Sindet-Pedersen 1991; Fugazzotto 1997; Buser et al. 1996; Misch 1997).

Patients were instructed not to wear removable prostheses for 2 weeks. After this period the sutures were removed and the prostheses relined and adapted. Patients were instructed to wear the removable provisional prostheses only for aesthetic reasons for the whole period of healing, i.e. 6 months.

Stage 2 surgery

After a healing period varying from 5 to 6 months after the grafting procedure, implants were placed in a routine fashion. A crestal incision and subperiosteal dissection of the alveolus were performed, the fixation screws were removed and a periodontal probe was used to measure the amount of bone augmentation obtained. Implant site preparation was performed following the normal bur sequence and the implants were positioned (Figs 5 and 6).

We used screw-type titanium implants. In 15 sites 4.1 mm diameter ITI solid screws were used (Institut Straumann AG, Switzerland), and in 3 sites 3.75 self-tapping screw implants with external hexagonal head (Implant Innovation Inc., USA) were used. All implants were at least 10 mm in length. In total, 40 implants were positioned. Six months later the prosthetic work was started.

At the time of abutment connection, implant integration was checked clinically and by intra-oral radiographs. Patients were recalled every 3 months for bridge removal and clinical and radiological evaluation of implant status. The success criteria used were: the implant was immobile, no signs of pain or suppuration were present, direct implant-to-bone contact was visible on radiographs, and vertical bone resorption was less than 1.0 mm in the first year after prosthetic loading (Albrektsson et al. 1986). The follow-up period varied from 4 to 38 months after loading of implants, with a mean of 12 months.

Results

Analytical data regarding the increase in alveolar bone volume obtained at the time of graft placement are reported in Tables 1 (mandibular sites) and 2 (maxillary sites) together with the increase in bone volume at the time of graft healing and implant placement. Means and standard deviations of the volume augmentation obtained were calculated. The sample has been divided in 2 groups (upper and lower jaw). The mean and s.d. are reported for the two groups and for the whole sample in Table 3. Since the measurements of lateral and vertical augmentation were recorded at bone

Table 1. **Mandibular sites: analytical description of the procedures and amount of bone augmentation obtained**

Case no.	Type of prosthesis	Lateral augmentation at bone grafting	Lateral augmentation at implant placement	Vertical augmentation at bone grafting	Vertical augmentation at implant placement	Donor site	No. of bone blocks	Implant inserted
2	3 unit bridge 33–34–35	8 mm	5 mm	2 mm	0 mm	Symphysis	2	2
3	3 unit bridge 35–36–37	7 mm	5 mm	–	–	Ramus	1	2
6	3 unit bridge 45–46–47	5 mm	5 mm	–	–	Ramus	2	2
7	3 unit bridge 34–35–36	7 mm	4 mm	3 mm	2 mm	Symphysis	2	2
11	3 unit bridge 35–36–37	6 mm	5 mm	2 mm	2 mm	Ramus	2	2
12	3 unit bridge 44–45–46	7 mm	5 mm	3 mm	1 mm	Ramus	1	2
13	3 unit bridge 44–45–46	7 mm	5 mm	–	–	Symphysis	2	2
15	2 single crowns 33–34	5 mm	4 mm	2 mm	2 mm	Symphysis	2	2

Table 2. **Maxillary sites: analytical description of the procedures and amount of bone augmentation obtained**

Case no.	Type of prosthesis	Lateral augmentation at bone grafting	Lateral augmentation at implant placement	Vertical augmentation at bone grafting	Vertical augmentation at implant placement	Donor site	No. of bone blocks	Implant inserted
1	3 unit bridge 14–15–16	11 mm	7 mm	–	–	Symphysis	2	2
4	3 unit bridge 25–26–27	7 mm	7 mm	–	–	Symphysis	2	2
5	6 unit bridge 13–12–11–21–22–23	5 mm	5 mm	8 mm	6 mm	Symphysis	4	4
8	3 unit bridge 24–25–26	7 mm	5 mm	5 mm	3 mm	Symphysis	1	2
9	3 unit bridge 15–16–17	7 mm	5 mm	–	–	Symphysis	2	3
10	3 unit bridge 13–14–15	7 mm	7 mm	–	–	Symphysis	3	2
14	1 single crown 22	5 mm	4 mm	4 mm	2 mm	Symphysis	1	1
16	3 unit bridge 15–16–17	5 mm	5 mm	–	–	Ramus	1	3
17	2 unit bridge 25–26	6 mm	4 mm	–	–	Symphysis	2	2
18	3 unit bridge 13–14–15	5 mm	3 mm	2 mm	0 mm	Symphysis	2	3

Table 3. **Mean and standard deviations in mm of bone augmentation measured at the time of bone grafting, and at the time of the surgical re-entry for implant placement. Mean percentage reduction in vertical and lateral augmentation during healing of the bone graft**

Groups	No. of augmented sites	Lateral augmentation at bone grafting	Lateral augmentation at implant placement	Percentage reduction of lateral augmentation	Vertical augmentation at bone grafting	Vertical augmentation at implant placement	Percentage reduction of vertical augmentation
Groups 1 and 2	18	6.5±0.33	5.0±0.23	23.5%	3.4±0.66	2.2±0.66	42%
Group 1: maxillary sites	10	6.5±0.6	5.2±0.4	20%	4.75±1.5	2.75±1.5	41.5%
Group 2: mandibular sites	8	6.5±0.37	4.75±0.12	27.5%	2.4±0.2	1.4±0.2	43.5%

grafting and, six months later, at implant placement we calculated the mean amount of bone resorption that occurred during healing.

Considering all the sites together, mean horizontal augmentation at graft placement was 6.5±0.33 mm which reduced to a mean of 5.0±0.23 mm at the time of implant insertion; this is equivalent to a mean reduction in the lateral augmentation of 23.5% during healing. In all the cases where vertical augmentation was needed, horizontal enlargement of the crest was also obtained. In the 9 cases that needed a vertical augmentation, a mean of 3.4±0.66 mm of crestal height was achieved at bone graft placement; at implant placement the mean increase in crestal height was reduced to 2.2±0.66 mm. There was a mean vertical augmentation relapse of 42% during healing. It must be pointed out that the only two cases that needed pure vertical augmentation (cases no. 5 and 8) were clinical successes with 6 and 3 mm increases in crestal height, respectively, at the time of implant placement.

In mandibular sites the average lateral augmentation was 6.5±0.37 mm at bone grafting and 4.7±0.12 mm at implant placement (with 27.5% resorption); vertical augmentation was 2.4±0.2 mm at bone grafting and 1.4±0.2 mm after healing (with a mean of 41.5% resorption).

In maxillary sites average lateral augmentation was 6.5±0.6 mm at bone grafting and 5.2±0.4 mm at implant placement (mean resorption was 20%); vertical augmentation was 4.8±1.5 mm at bone grafting and 2.7±1.5 mm at implant placement (mean resorption was 43.5%).

The mean amount of bone resorption during the first healing phase is fully reported in Table 3. It was greater in the mandible than in the maxilla. Bone resorption was easily visible on removing the osteosynthesis screws since the heads of the screws were always 1 to 2 mm above the grafted bone. On re-opening, the shape of the grafted block was rarely visible in the mandible (Figs 5 and 6), especially when the blocks were harvested from the symphysis. Extensive remodelling of the bone graft produced a more or less ''natural'' crestal shape. In the maxillary sites, bone blocks were still clearly visible in most cases at the time of implant placement.

We made no statistical comparison of the two groups. Statistical significance could not be tested because we had no control group. The above data were measured by hand during the procedures; our data could not be supported any more precisely by mechanical or X-ray examination.

The amount of bone resorption that occurred during the healing phase was conspicuous. It must be noted that in all our patients the alveolar bone was effectively reconstructed and ready to receive implants, which we were able to place securely and correctly regarding both position and angulation. We decided not to use implants shorter than 10 mm either in the maxilla or the mandible. In all cases we were able to place the planned number of implants.

Local complications regarding donor and recipient site were minimal. In all but one patient, who underwent bone harvesting from the chin, a strange sensation (numbness) was reported in the region of the lower incisors during chewing for a period of 3 to 4 months. None of our patients reported temporary or permanent lower lip anaesthesia. We report no wound dehiscence or infections in donor site areas. In all patients treated with chin graft a postoperative ecchymosis occurred. Pain and swelling were reported by the patients. For pain: 2 cases (11% of sites) needed no anti-inflammatory non-steroidal drugs (NSAIDs); in 12 cases (66% of sites) anti-inflammatory drugs were taken for less than 3 days and no pain was reported after therapy; in 4 sites (22% of sites) anti-inflammatory drugs were taken for more than 3 days still with no or insufficient pain relief.

Regarding postoperative swelling following the bone grafting procedure, the results were: 6 sites (33% of cases) suffered facial deformity lasting for fewer than 3 days; in 12 cases the facial deformity lasted more than 3 days or there was a visible ecchymosis.

All the implants were integrated at the abutment connection. To date (mean of 12 months after prosthetic loading) all the implants are successful, according to the Albrektsson criteria (Albrektsson et al. 1986).

Discussion

The aim of this study was to report clinical results of alveolar ridge augmentation in partially edentulous patients prior to implant placement, using bone blocks harvested from the mandibular ramus or symphysis and firmly secured to the recipient site with osteosynthesis screws without the use of barrier membranes. The clinical indication for the procedure described was the lack of sufficient alveolar bone, a situation that could interfere with the correct placement of implants of the desired length.

Several procedures have been proposed to achieve alveolar ridge augmentation in partially edentulous patients: bone blocks harvested from the mandible and positioned at the same time of implant placement (Jensen & Sindet-Pedersen 1991), bone blocks harvested from intra-oral or extra-oral donor sites and positioned several months before the insertion of the implants (Chiapasco et al. 1999).

Bone chips and barrier membranes have been used to achieve alveolar ridge augmentation in implant surgery in a staged approach (Buser et al. 1996; Nevins & Mellonig 1994) or at the same time as implant placement (Simion et al. 1998). The use of barrier membranes in combination with particulate grafts and implants to augment the alveolar ridge and obtain ideal positioning of implants is reported to be an effective procedure in both humans and experimental animals (Lundgren et al. 1997; Buser et al. 1996; Cortellini et al. 1993). However the use of barrier membranes at the time of implant placement may be followed by soft tissue dehiscence, membrane exposure and plaque colonisation and, in very few cases, by the need to remove the barrier. This complication jeopardises the whole procedure (Fugazzotto 1997). The use of allografts in combination with barrier membranes is useful when small bone defects are present such as fenestrations or dehiscence around oral implants. Major reconstruction procedures are sometimes needed in cases of vertical or lateral augmentation of the crest in partially edentulous patients. In such cases, the use of particulate auto- or allografts covered by barrier

membranes seems to produce controversial results. According to Buser, if a staged approach is used, complications involving membrane exposure, suture dehiscence and loss of the graft are minimal (Buser et al. 1996). Fugazzotto in 1997 described preliminary results using a one-stage membrane technique that included implant placement, DFDBA or TCP graft covered by non-reabsorbable membranes. He reported the need to remove the membranes because of premature exposure and infection in 70 cases from a group of 331 patients (21.5% of patients). Apart from these complications, only 9 out of 626 implants failed in his series (Fugazzotto 1997).

The use of barrier membranes over particulate bone grafts seems to reduce the tendency for bone graft to be reabsorbed during the healing phase. It must be pointed out that the tendency of bone grafts to resorb during the healing phase also occurs if the graft is protected by a membrane and no complications occur (Buser et al. 1990, 1996).

We can assume that autogenous bone grafts are the gold standard for bone reconstruction; the use of autogenous bone is mandatory when we expect the reconstructed segment to be loaded with oral implants. It has been shown that, in the facial skeleton, membranous bone, such as that grafted from the mandible, undergoes less resorption than endochondral bone, such as the iliac crest (Zins & Whittacker 1983; Phillips & Rhan 1990). If the graft volume is sufficient for the planned reconstruction, mandibular bone is thus the ideal choice since only one surgical field is needed (Misch et al. 1992; Misch 1997). We expect an autogenous bone graft to resorb partially and finally to heal as vital bone. Bone graft resorption during the healing phase has been extensively reported (Linn et al. 1990). To reduce the amount of bone resorption when planning an onlay graft to the facial skeleton, it is advisable to use membranous bone and to stabilise the graft firmly in the recipient site (Phillips & Rhan 1990).

The patients included in this study were treated without barrier membranes or allografts, thus eliminating the risk of complications associated with the former. To overcome the problem of physiologic graft resorption we used larger bone grafts than appeared necessary at the time of stage 1 surgery. Intra-oral sites were used for bone harvesting so that general anaesthesia or hospitalisation were not necessary in any of our cases.

Bone graft harvesting was easy and fast and the amount of bone available was always sufficient. In all our patients, the alveolar ridge at stage 2 surgery was capable of receiving the implants needed in the desired position and angulation. When the augmentation was planned in the posterior mandible a single surgical field was needed, thus reducing patient discomfort.

This is a clinical study; the data reported were readily collected by the surgeon at the time of surgery and during the postoperative phase. The sample studied was small and the augmented sites differed in location and type of defect. In the absence of a control group the statistical significance of the means calculated was not tested. The clinical data presented show that onlay block grafts harvested from the mandible are a safe, effective and simple method of treating localised alveolar ridge hypoplasia in partially edentulous patients. It must be considered that the postoperative phase of stage 1 surgery is comparable to the discomfort felt following major dentoalveolar surgery and that the procedure can easily be carried out in an outpatient environment. We believe that implants placed in an alveolus reconstructed with autogenous bone should demonstrate the same success rate as implants placed in normal alveolar bone, provided the bone volume gained is sufficient to place a 10 mm long standard screw implant.

Résumé

Quinze édentés partiellement nécessitant un épaississement du rebord alvéolaire pour le placement d'implants ont été traités par une technique en deux étapes. En tout, 18 segments alvéolaires ont été greffés. Durant la première opération, des blocs osseux ont été prélevés de la branche ou de la symphyse mandibulaire et placés comme greffons onlay en latéral ou vertical et fixés avec des vis d'ostéosynthèse en titane après la mise à nu du rebord alvéolaire déficient. Après six mois de guérison, les lambeaux ont été réouverts, les vis ont été enlevées et les implants placés. Douze mois après la première opération, des bridges sur implants ont pû être fixés. L'augmentation latérale moyenne obtenue au moment du greffage osseux était de 6.5±0.33 mm et se réduisait durant la guérison à cause de la résorption du greffon à une moyenne de 5.0±0.23 mm. L'augmentation verticale moyenne obtenue des neufs sites était de 3.4±0.66 mm au moment du placement du greffon et de 2.2±0.66 mm au moment du placement des implants. Les augmentations moyennes latérales et verticales diminuaient respectivement de 23.5% et 42% durant la guérison de la greffe c.-à-d. avant l'insertion des implants. Les sites mandibulaires accusaient une plus grande quantité de résorption du greffon osseux que les sites maxillaires. Les 40 implants placés étaient ostéointégrés tant à la connexion du pilier qu'après la charge prothétique (moyenne du suivi: 12 mois). Aucune complication majeure n'a été mise en évidence tant au niveau des sites donneurs que receveurs. La guérison du tissu mous était parfaite et la douleur et le gonflement étaient comparables aux procédures dento-alvéolaires usuelles. Une ecchymose a été présente pendant quatre à sept jours lorsque l'os avait été prélevé de la symphyse mandibulaire. D'un point de vue clinique ce processus paraît simple, sûr et efficace pour traiter les déficiences ossueses chez les patients édentés partiels.

Zusammenfassung

Eine Gruppe von 15 teilbezahnten Patienten, die vor der Implantation eine Alveolarkammaugmentation brauchte, wurde nacheinander gemäss definiertem zweiphasigem Protokoll ambulant behandelt. Man transplantierte insgesamt 18 Alveolarknochensegmente. In der ersten Operation entnahm man Knochenblocks aus dem Unterkieferast oder der Symphysenregion und schraubte sie mit Osteosyntheseschrauben aus Titan dort seitlich oder oben auf den freigelegten Alveolarkamm, wo das entsprechende Defizit an Knochenmaterial herrschte. Nach einer Heilphase von 6 Monaten wurde das Operationsgebiet erneut eröffnet, die Schrauben entfernt und die Implantate eingesetzt. 12 Monate nach dem Ersteingriff konnten den Patienten implantatgetragene festsitzende Rekonstruktionen eingesetzt werden. Die durchschnittliche seitliche Augmentation am Tag der Augmentation betrug 6.5±0.33 mm und reduzierte sich während der Heilphase infolge Resorption auf einen Mittelwert von 5.0±0.23 mm. Die durchschnittliche vertikale Augmentation in den 9 Fällen wo sie von Nöten war betrug 3.4±0.66 mm am Tag der Augmentation und 2.2±0.66 mm bei der Implantation. Die durchschnittliche seitliche und vertikale Augmentation nahm demnach während der Ausheilung des Knochentransplantates (vor der Implantation) um 23.5% und 42% ab. Die augmentierten Stellen im Unterkiefer zeigten eine ausgedehntere Resorption des Transplantates als im Oberkiefer. Alle 40 Implantate waren zur Zeit des Aufsetzens der Sekundärteile und nach der prothetischen Belastung (die mittlere Nachuntersuchungszeit betrug 12 Monate) osseointegriert. Man verzeichnete keine grösseren Komplikationen auf der Spender- oder Empfängerseite. Die Weichgewebsheilung verlief ohne grössere Ereignisse, die Schmerzen und die Schwellung waren mit normalen oralchirurgischen Eingriffen vergleichbar. Während den ersten vier bis sieben Tagen verzeichnete man eine sichtbare Ecchymosis, wenn der Knochen aus der Unterkiefersymphyse entnommen worden war. Aus klinischer Sicht scheint dieses Vorgehen in der Behandlung von lokalisierten Alveolarkammknochendefekten bei teilbe-

zahnten Patienten einfach, sicher und effizient zu sein.

Resumen

Se trataron consecutivamente, un grupo de 15 pacientes parcialmente edéntulos que necesitaban aumento de la cresta ósea para colocación de implantes, usando una técnica de dos fases en una situación ambulatoria. Se injertaron un total de 18 segmentos alveolares. Durante la primera operación se colocaron como injertos laterales o verticales bloques de hueso recogidos de la rama mandibular o de la sínfisis fijándose con tornillos de osteosintesis tras la exposición de la cresta alveolar deficiente. Después de 6 meses de cicatrización se levantó el colgajo de nuevo, se retiraron los tornillos y se colocaron los implantes. Doce meses después de la primera operación se pudieron proporcionar los puentes fijos implantosoportados a los pacientes. El aumento lateral medio obtenido en el momento del injerto óseo fue de 6.5 mm (±0.33) que se redujo durante la cicatrización a causa de la reabsorción del injerto a una media de 5.0 mm (±0.23). El aumento vertical medio obtenido en los 9 lugares donde se necesitó fue de 3.4 mm (±0.66) en el momento del injerto óseo y de 2.2 (±0.66) al colocar el implante. El aumento medio lateral y vertical disminuyó en 23.5% y 42% respectivamente durante la cicatrización del injerto óseo (antes de la inserción del implante). Los lugares mandibulares mostraron una mayor cantidad de reabsorción del injerto óseo que los lugares maxilares. Todos los 40 implantes colocados estaban integrados en el momento de la conexión del pilar y tras la carga prostética (media de seguimiento de 12 meses). No se recogieron complicaciones mayores en los lugares donantes o receptores. La cicatrización del tejido blando ocurrió sin incidentes, y el dolor y la inflamación fueron comparables a los procedimientos dento-alveolares usuales. Durante 4 a 7 días existió una equimosis visible donde se recolectó el hueso de la sínfisis mandibular. Desde un punto de vista clínico este procedimiento parece ser simple, seguro y efectivo para el tratamiento de defectos alveolares localizados en pacientes en pacientes parcialmente edéntulosl.

要旨

インプラント埋入のために顎堤増多を必要とする連続１５名の部分無歯顎患者を、外来診療で２回法によって治療した。合計１８箇所の顎堤に移植を行った。最初の手術において、顎堤の欠損部を露出してから、下顎下行枝あるいはオトガイ結節部から採取した移植骨ブロックを外側あるいは垂直オンレー・グラフトとして埋入し、チタン製骨接合スクリューで固定した。治癒６ヵ月後に再度フラップをあけてスクリューを除去し、インプラントを埋入した。初回手術１２ヶ月後にインプラント支持による固定式ブリッジを患者に装着した。平均外側顎堤増多量は骨移植時に６．５ｍｍ（±０．３３）であったが、治癒中に移植骨が吸収したため平均５ｍｍ（±０．２３）に減少した。垂直増多が必要であった９箇所では、平均垂直増多量は、骨移植時に３．４ｍｍ（±０．６６）、インプラント埋入時には２．２ｍｍ(±０．６６)であった。移植後の治癒中（インプラント埋入前）に外側及び垂直の増多量は各々平均２３．５％と４２％減少した。下顎は上顎より移植骨の吸収が有意に多かった。埋入した４０本のインプラントは全て、アバットメント連結時及び補綴物荷重後に統合していた（平均追跡期間１２ヶ月)。主だった合併症は供給側でも受給側でも報告されなかった。軟組織の治癒は問題なく起こり、痛みと腫れは通常の歯牙歯槽の治療に相当する程度であった。移植骨を下顎オトガイ結節部から採取した場合は、４日から７日間は斑状皮下出血が視認された。臨床的観点から、本術式は部分無歯顎患者において局所的な顎堤欠損を治療するための、単純で安全かつ有効な方法であると思われる。

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