

Complications of Intraoral Donor Site for Bone Grafting Prior to Implant Placement

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Edentulism, severe periodontitis, trauma, malformation, or neoplasias can lead to atrophy of the alveolar ridge, which may complicate rehabilitation of the masticatory function with dental implants. Therefore, preparation of the implant site may require ridge augmentation.¹

Despite some recent advances in bone-substitute technology, autogenous bone grafts remain the "gold standard" in reconstructive surgeries because of their osteoinductive, osteoconductive, and nonimmunogenic properties. Different extra and intraoral donor sites are available.^{1,2} Because of that, several factors must be taken into consideration when choosing the donor site, including the location of the recipient bed, the quality and quantity of bone graft required, and the potential surgical complications.³

Although the iliac crest is used most often in major jaw reconstructions for implants,⁴⁻⁷ various other donor sites have been investigated. Local bone grafts from the maxilla and mandible have also been described.⁸⁻¹⁷ The obvious advantage of intraoral grafts is their convenient surgical access.^{12,18,19} Since they are in close proximity to the recipient site, reducing operative and anesthesia time, they are ideal for outpatient implant surgery. In addition, patients report min-

Purpose: The purpose of this prospective study was to evaluate the morbidity and the major complications of intraoral donor sites for bone grafting prior to implant placement.

Materials: The records of 104 consecutive patients with indication for bone grafting prior to implant installation treated at Piracicaba Dental School by the Department of Oral and Maxillofacial Surgery, from June 2001 until June 2003, were reviewed.

Results: One hundred three surgical procedures were realized, in which 40% were harvested from mandibular symphysis, 28.8% from mandibular ramus, and 31.2% from maxillary tuberosity. Prevalence of complications among intraoral donor sites was more significant after harvesting

vesting the mandibular symphysis. The major complication and discomfort reported by the patients was sensory deficit in lower lip and mental area. It was noted that 16% harvesting procedures involving symphysis and 8.3% involving the mandibular ramus area reported some sensory deficit. No complications were found involving the maxillary tuberosity.

Conclusion: Complications and morbidity were smaller in the ramus than in symphysis, and temporary sensory disturbances were the most common complications, noted in both symphysis and ramus areas. (Implant Dent 2006;15:420-426)

Key Words: alveolar ridge augmentation, autogenous bone grafts, dental implants

imal discomfort, and these areas may offer decreased morbidity from graft harvesting.^{10,12,16,17,19}

Mandibular bone grafts have been used for alveolar repair to allow implant placement with extremely favorable results. Block-type grafts may be harvested from the mandibular symphysis or ramus area. However, the different anatomies of these regions result in different graft morphologies and a different postoperative course.¹

The purpose of the study was to evaluate the morbidity and major complications of intraoral donor sites for bone grafting prior to implant placement.

MATERIALS AND METHODS

The records of 104 consecutive patients with indication for bone graft-

ing prior to implant installation treated at Piracicaba Dental School by the Department of Oral and Maxillofacial Surgery, from June 2001 until June 2003, were reviewed. All patients underwent clinical and radiographic examinations, and were diagnosed as having an inadequate quantity of bone for implant placement. Only patients that had been harvested with intraoral grafts were included in the study.

Access to the symphysis was obtained via a labial incision. The incision was made between the canines, and the tissues were dissected toward the coronal aspect of the ridge, resulting in a split-thickness flap. Then a periosteal incision was made at the insertion of the muscles, and a full-thickness flap was reflected. Access to the symphysis was obtained by reflect-

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ing the periosteum with the muscle attachments toward the inferior border of the mandible and extended distally toward the mental foramen. The size and shape of the graft required was marked with fissure burs and abundant irrigation. The superior horizontal osteotomy was made with a minimum distance of 5 mm from the apices of the mandibular incisors and canines. To avoid damage to the nerve and vascular supply to the teeth, the osteotomy was beveled away from the apices. The vertical components of the osteotomy were performed through the cortical bone only. The inferior horizontal osteotomy was made parallel to the inferior border of the mandible and was not extended beyond its maximum convexity (Fig. 1). The graft required was then elevated from the symphysis with bone chisels. Deep periosteal sutures with absorbable polyglactin 910 were used to approximate the periosteal edges. The mucosa was closed using continuous sutures. Access to the ramus donor site was obtained *via* incision to expose the external oblique ridge approximately 1 cm distal to the second molar, over the ridge, and extended mesially toward the buccal aspect of the second molar. Care was taken to ensure that the incision was not extended too far lingually, preventing damage to structures on the lingual aspect of the mandible. Reflecting the periosteum exposed the external oblique ridge, retromolar region, and the lateral aspect of the ramus. The extension of bone graft was selected using the measurements obtained from the defect in the recipient site. Fissure and round burs were used to mark and section the cortical bone to obtain the 3-dimensional shape required to restore the defect (Fig. 2). Care was taken not to extend the osseous incisions too far lingually. A large round bur (No. 8) was used to create a longitudinal groove to connect the vertical cuts made on the lateral wall of the ramus. This was done to create a fracture line so the graft can be removed. The groove did not extend through the cortical plate and was located above the level of the inferior alveolar canal. The graft was removed, and closure of the wound was done with absorbable continuous sutures.

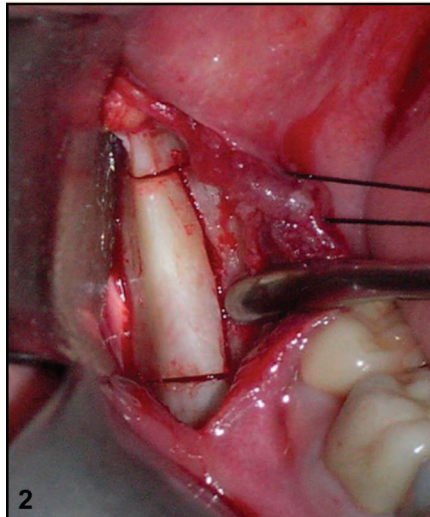
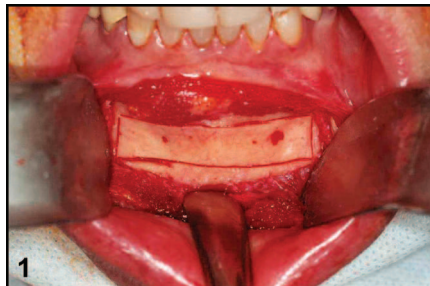


Fig. 1. Mandibular symphysis donor site.

Fig. 2. Mandibular ramus donor site.

Fig. 3. Maxillary tuberosity donor site.

Access to the maxillary tuberosity was made with an incision that exposed the retromolar region distal to the second upper molar (Fig. 3). The graft required was then harvested with bone chisels. Closure of the wound was done with interrupted absorbable sutures.

Clinical appointments at 7, 14, 30, 60, and 120 days after surgery were performed to evaluate any complication at the donor site, such as dehiscence, infection, swelling, sensory disturbances, or hemorrhage. The residents of the department operated and followed up on all patients, and the results were analyzed in percentage and presented in tables.

Table 1. Distribution of Intraoral Donor Sites Used for Augmentation of Alveolar Ridge Volume Prior to Implant Placement

Intraoral Donor Sites	No. Grafting Procedures (%)
Symphysis	50 (40)
Ramus	36 (28.8)
Tuberosity	39 (31.2)
Total	125 (100)

Table 2. Incidence of Complications (sensory deficit in the lower lip and mental foramen area) Noticed in Intraoral Donor Sites

Intraoral Donor Sites	No. Complications (sensory deficits)	%
Symphysis	8	16
Ramus	3	8.3
Tuberosity	0	0

RESULTS

In the 2-year period of this study, there were 125 intraoral harvesting procedures realized. Among the 104 patients, the incidence of female gender was superior to male. The overall age distribution was not arranged according to donor site. In the distribution of intraoral donor sites, the symphysis (40%) was the most incident area to alveolar ridge reconstructions, followed by the maxillary tuberosity (31.2%) and the mandibular ramus (28.8%) (Table 1). Incidence of complications among the intraoral donor sites was more significant for the mandibular symphysis (16%), followed by the ramus area (8.3%) (Table 2). The maxillary tuberosity did not have complications. The major complication and discomfort reported by patients was sensory deficit in the lower lip and mental foramen area. There was no case of infection, dehiscence, or hemorrhage at the harvested area. All patients recovered from the sensory deficit successfully.

DISCUSSION

The autogenous bone grafts are the best option when compared to allografts and xenografts because of some proprieties, such as biocompatibility and osteoinductivity. For augmentation of the implant site, several

donor regions of autogenous bone grafts are available. However, shortcomings that can arise from donor site morbidity cannot be ignored.²⁰ In this study, the atrophic alveolar ridges had been reconstructed using autogenous bone blocks harvested from the mandibular ramus and symphysis alone or associated with particulated autogenous bone grafts harvested from the maxillary tuberosity. The volume of the recipient sites was increased vertically and laterally, allowing the ideal placement of oral implants.

This retrospective study evaluated the records of patients that developed bone graft donor site complications. The authors had difficulty analyzing the records, since different residents had treated and followed up the patients in the postoperative period. It was also difficult to compare our results with other similar studies because of the different forms to evaluate the complications. We agree with Tolman²¹ when he concluded in his study that it is difficult to compare the studies and develop valuable clinical guidelines.

The harvesting of autogenous bone from intraoral sites, although potentially lower than extraoral sites, can often be associated with some complications. Misch¹ reported that no soft tissue sensory deficits were noted in ramus grafted patients, and, also, he did not note changes in their molar teeth. The incidence of temporary mental nerve paresthesia in symphysis graft patients was 9.6%. Twenty-nine percent of symphysis graft patients described altered sensation of the incisor teeth. The postoperative neuropraxia was common.¹ In our study, none of the patients noted any kind of sensation alteration from soft tissue related to molar teeth. However, 16% of patients complained of numbness of the lower lip and of the mental area associated with harvesting the symphysis area and 8.3% from ramus area. No specific treatment was required, and all patients recovered completely.

It is important to take care of details from the beginning of the procedure. The distal extent of the anterior vestibular incision should be limited to the intercanine teeth area. Blunt dissection is completed with extreme

caution, improving surgical access without damaging the mental nerve.

Patients were less able to discern neurosensory disturbances in the posterior buccal soft tissues than in the lower lip. Although the incision along the external oblique ridge could possibly damage the buccal nerve, reports of postoperative sensory loss in the buccal mucosa were rare,²² and most of the patients did not notice or report this complication.

A 5-mm border below the apices of the roots of anterior teeth is recommended when harvesting bone from the chin. Even then, the contents of the incisive canal, which innervate the teeth, may still be disturbed. Reports on tooth vitality following genioplasty or subapical osteotomy revealed a substantial percentage (range 20% to 25%) of teeth testing as nonvital.²³ However, unless clinical signs of pulpal necrosis become apparent (discoloration, radiographic changes), endodontic therapy is not indicated.²⁴ Although the risk of damaging the teeth is minimal and endodontic therapy can eventually arise, patients should be aware of these potential pathologic changes.

The risk of damaging the inferior alveolar nerve, as opposed to its peripheral mental branches, is of great concern with the ramus graft technique. The surgery has many features similar to a sagittal split ramus osteotomy.²⁵⁻²⁷ To prevent nerve injury, harvesting of bone from ramus requires knowledge of the anatomy of the mandibular canal.

The position of the canal varies. Anatomical averages are helpful in surgical planning. The mean anteroposterior width of the ramus is 30.5 mm, with the mandibular foramen located about two-thirds the distance from the anterior border. The mean vertical distance between the superior edge of the canal and the cortical surface along the external oblique ridge is approximately 7 mm in the second molar region, 11 mm in the third molar region, and 14 mm at the base of the coronoid process.²⁸ Although the buccolingual position of the mandibular canal varies, the distance from the canal to the medial aspect of the buccal cortical plate (medullary bone

thickness) was found to be greatest at the distal half of the first molar (mean 4.05 mm).²⁹ Therefore, when larger grafts are planned, the anterior vertical bone cut should be made in this area. This cut is progressively deepened carefully until bleeding from the underlying cancellous bone is visible.²⁸

Damage to the neurovascular bundle can also occur during sectioning of the graft. Care must be taken to keep the chisel parallel to the lateral surface of the ramus when doing the external oblique osteotomy. If the inferior ramus cut is below the level of the inferior alveolar canal, graft separation should not be completed until it can be ascertained that the neurovascular bundle is not entrapped within the graft.

In this study, other major complications different from sensory alterations were not found. Despite the need for 2 surgical procedures (the grafting procedure and posterior implant installation), the patients were compliant with the entire treatment. Not only was the planning a key factor of every successful case, it was also essential to learn exactly what the patient expected from the surgery and to design the surgical procedure to achieve that goal.

CONCLUSIONS

According to the donor site, we found a very small number of postoperative complications when a graft was harvested from the ramus area of the mandible in comparison to mandibular symphysis. Temporary sensory disturbances were the most common complications, noted both in the symphysis and the ramus area.

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Abstract Translations

GERMAN / DEUTSCH

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Vor der Implantateinpflanzung auftretende mögliche Komplikationen bei in der Mundhöhle gelegenen Spenderorten

ZUSAMMENFASSUNG: Zielsetzung: Die vorliegende Prospektivstudie zielte auf eine Bewertung der Anfälligkeit sowie der wesentlichen Komplikationen von zur Knochen-transplantation vorgesehenen intraoralen Spenderbereichen vor Implantatsetzung ab. **Materialien und Methoden:** Es wurden die Patientenakten von insgesamt 104 aufeinander

folgenden Patienten untersucht, die im Zeitraum von Juni 2001 bis Juni 2003 in der Abteilung für Gesichts- und Kieferchirurgie an der Piracicaba zahntechnischen Hochschule aufgrund der Erfordernis einer Knochengewebs transplantation vor Einpflanzung eines Implantats behandelt wurden. **Ergebnisse:** In 103 der Fälle wurden die Operationen tatsächlich durchgeführt. Dabei wurde das Transplantat bei 40% aus der Unterkiefersymphyse, bei 28,8% aus dem Unterkieferzweig und bei 31,2% der Fälle aus der Tuberositas des Oberkiefers entnommen. Bei den in der Mundhöhle gelegenen Spenderorten wurden vermehrt Komplikationen festgestellt, sofern eine Entnahme aus der Symphyse des Unterkiefers vorgenommen wurde. Zu den wesentlichen, von den Patienten geschilderten Komplikationen und Beschwerden gehörte eine verminderte Gefühlswahrnehmung im Raum der unteren Lippe sowie im seelischen Bereich. Bei 16% der Transplantierungsvorgänge aus der Symphyse und 8,3% der Transplantierungen aus dem Unterkieferzweig wurden sensorische Störungen festgestellt und aufgeführt. Keine Komplikationen entstanden dagegen bei Einbeziehung des Oberkiefer-Tuberositas als Spenderort. **Schlussfolgerung:** Es gab weit weniger Komplikationen und Anfälligkeiten im Zweig als in der Symphyse. Dabei traten am häufigsten sensorische Störungen auf, und dies sowohl im Bereich des Zweigs als auch an der Symphyse.

SCHLÜSSELWÖRTER: Anreicherung des Alveolarkamms, autogenes Knochentransplantat, Zahnimplantate

SPANISH / ESPAÑOL

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ABSTRACTO: Propósito: El propósito de este estudio prospectivo fue evaluar la morbilidad y las complicaciones mayores de los sitios donantes intraorales para el injerto de hueso antes de la colocación del implante. **Materiales y métodos:** Se evaluaron los registros de 104 pacientes consecutivos con indicaciones para el injerto de hueso antes de la

colocación del implante tratados en la Escuela Dental de Piracicaba por el Departamento de Cirugía Oral y Maxilofacial, desde junio del 2001 a junio del 2003. **Resultados:** Se realizaron ciento tres procedimientos quirúrgicos, en los cuales un 40% se sacaron de la sínfisis mandibular, un 28,8% de la rama mandibular y un 31,2% de la tuberosidad maxilar. La preponderancia de complicaciones entre los sitios donantes intraorales fue más importante después de la extracción de la sínfisis mandibular. La complicación principal e incomodidad indicada por los pacientes fue el déficit sensorial en el labio inferior y área mental. Se notó que un 16% de los procedimientos de extracción que involucraban la sínfisis y un 8,3% que involucraban la rama mandibular informaron cierto déficit sensorial. No se encontraron complicaciones con la tuberosidad maxilar. **Conclusión:** Las complicaciones y la morbilidad fueron menores en la rama que en la sínfisis y los problemas sensoriales temporarios fueron las complicaciones más comunes, notadas ambas en las áreas de la sínfisis y de la rama.

PALABRAS CLAVES: aumento de la cresta alveolar, injerto de hueso autólogo, implantes dentales

PORTUGUESE / PORTUGUÊS

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Complicações de Local de Doador Intra-oral para Enxerto Ósseo Antes da Colocação do Implante

RESUMO: Objetivo: Objetivo deste estudo em perspectiva era avaliar a morbidade e as principais complicações de locais de doador intra-oral para enxerto ósseo antes da colocação do implante. **Materiais e Métodos:** Os registros de 104 pacientes consecutivos com indicação para enxerto ósseo antes da instalação do implantes tratados na Faculdade de Odontologia de Piracicaba pelo Departamento de Cirurgia Oral e Maxilofacial, de junho de 2001 até junho de 2003, foram revisados. **Resultados:** Cento e três procedimentos cirúrgicos foram realizados, dos quais 40% foram

colhidos de sínfise mandibular, 28.8% de ramo mandibular e 31.2% de tuberosidade maxilar. A prevalência de complicações entre locais de doador intra-oral foi mais significativa após a colheita de sínfise mandibular. As principais complicações e o desconforto relatados pelos pacientes foram déficit sensorial no lábio inferior e área mental. Notou-se que 16% dos procedimentos de colheita envolvendo sínfise e 8,3% envolvendo a área do ramo mandibular relataram algum déficit

sensorial. Nenhuma complicação foi encontrada envolvendo a tuberosidade maxilar. **Conclusão:** Complicações e morbidade foram menores no ramo do que na sínfise, e os distúrbios sensoriais foram as complicações mais comuns, notadas em ambas as áreas, da sínfise e do ramo.

PALAVRAS-CHAVE: aumento do rebordo alveolar, enxertos do osso autógeno, implantes dentários

JAPANESE / 日本語

インプラント装着前の骨移植Intraoralドナーサイトにおける合併症

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概要:

目的: 本前向き調査の目的は、インプラント装着前の骨移植のためのintraoralドナーサイトのmorbidityとそこにおける主要合併症について評価することにある。

素材と方法: ピラチカバ・デンタル・スクールの口腔上顎顔面外科学部において、2001年6月から2003年6月までの期間にインプラント装着前に骨移植が行われた104人の順次来院患者の記録が調査された。

結果: 外科処置は103件行われ、うち下顎結合からの採取は40%、下顎枝からの採取は28.8%、上顎結節からの採取は31.2%あった。Intraoralドナーサイトにおける合併症の多発性は、下顎結合からの採取後により顕著であった。患者報告による主要合併症と不快感には、下唇とmental areaの知覚障害があった。下顎結合からの採取例の16%、下顎枝からの採取例の8.3%にある程度の知覚障害が起こった。上顎結節からの採取例には合併症は見られなかった。

結論: 合併症とmorbidityは下顎枝部からの採取例の方が下顎結合からの採取例より少なかった。一時的知覚障害が¹、下顎枝部、下顎結合どちらのサイトにとともに認められたもつとも普通な合併症であった。

キーワード: 歯槽堤増大、自家骨移植、デンタルインプラント

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植體植入前骨移植的口腔內取骨部位的併發症

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摘要：

目的：本前瞻性研究的目的旨在評估植體植入前骨移植的口腔內取骨部位的發病率和主要併發症。

資料與方法：檢閱2001年6月至2003年6月間，在巴西皮拉西卡巴牙醫學院口腔與頤面外科手術學系進行治療，並於植體安裝前進行骨移植的104個連續患者的紀錄。

結果：合計 103人進行外科手術，其中 40% 摘自下頷聯合、28.8% 摘自下頷支、31.2% 摘自上頷結。口腔內取骨部位併發症的盛行率在摘除下頷聯合後更明顯。患者描述的主要併發症與不適症是下唇和頤部位的感覺喪失。紀錄也顯示，16% 和下頷聯合有關以及8.3% 和下頷支有關的摘除手術，亦有些許感覺喪失現象。和上頷結有關的摘除手術則未發現併發症。

結論：下頷支的併發症與發病率較下頷聯合小，暫時性感覺擾亂則是最常見的併發症，在下頷聯合與下頷支均有紀錄。

關鍵字：齒槽骨牙脊豐隆、自體骨移植、牙科植體

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