Tibial Cancellous Bone Grafting in Jaw Reconstruction: 10 Years of Experience in Taiwan

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ABSTRACT

Background: Use of proximal tibia as a donor site has been applied in jawbone reconstruction since the 1990s. Catone and colleagues described a U-shaped incision made on the iliotibial tract during tibial cancellous bone procurement for maxillofacial reconstruction in 1992. We used a curvilinear incision on the iliotibial tract in lateral approach in our tibial cancellous bone harvesting procedure.

Objectives: The objectives of this retrospective study are to describe our modified lateral approach for procuring cancellous graft from the proximal tibia and to assess the bone volume, donor site morbidity, and associated complications.

Material and Methods: Eighty consecutive jawbone reconstructions utilizing autogenous tibial cancellous bone grafts in 78 patients from March 1998 through March 2008 were reviewed. The patient group consisted of 45 males and 33 females, ages 18 to 76 (average age 36.1 ± 12.3). Minimal postoperative follow-up period was 3 months. Unlike the traditional U-shaped trapdoor incision on the iliotibial tract, our curvilinear incision was made almost parallel to the fibers of that tract.

Result: Only mild complications were observed at donor sites, including temporary paresthesia, gait disturbance, and an unpleasant scar. The average procured graft volume was 17.8 mL. We also present the first case of reconstruction of mandibular continuity defects of up to 6 to 7 cm lengthwise by tibial cancellous bone grafting, which has not previously been reported in the English literature.

Conclusion: The modified incision on the iliotibial tract allowed access to obtain an equally good bone volume from the lateral aspect of the proximal tibia, and it rendered wound closure much easier than the procuring techniques described in the earlier literature.

KEY WORDS: bone graft, Gerdy's tubercle, iliotibial tract, jaw reconstruction, tibia

INTRODUCTION

Cancellous bone grafting in the maxillofacial region has long been an accepted procedure in oral and maxillofacial surgery. Common donor sites have included the anterior and posterior iliac crests, the ribs, and more recently the calvarial diploic bone. The iliac crest has been heralded as the "gold standard"[1] for functional jawbone reconstruction for many years despite the concerns of postoperative discomfort and morbidity.

Use of proximal tibia as a donor site has been applied in jawbone reconstruction since 1990, although Breine and Johanson[2] had described the technique of harvesting bone from the tibia for primary bone grafting as early as 1966. Orthopedic surgeon O'Keeffe and colleagues[3] in 1991 reported excellent results of 203 tibial

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bone grafts used in cases of lower extremity fractures or nonunions requiring cancellous bone grafting. Catone and colleagues[4] described a U-shaped incision made on the iliotibial tract during tibial cancellous bone procurement for maxillofacial reconstruction in 1992.

Gerdy's tubercle, a practical landmark for tibial bone procurement, was named after the French surgeon Pierre Nicholas Gerdy and is the insertion site of the iliotibial tract on the anterolateral aspect of the proximal tibia plateau. Only minimal dissection through the thin subcutaneous layer is necessary to gain easy access to Gerdy's tubercle. Nevertheless, van Damme and Merkx[5] first harvested the tibia cancellous bone graft through the medial approach with the Wagner instrument. Subsequently, Herford and colleagues[6] and Jakse and colleagues[7] also advocated the medial approach.

This retrospective study is to describe our 10 years of experience of jawbone reconstruction by using a modified technique of tibial cancellous bone grafting via lateral approach.

Sufficient graft volume for continuity defects of the lower jaw with our technique was demonstrated. The advantage of the lateral approach, depicted by axial CT images, is also discussed in this article.

METHOD AND MATERIALS

A retrospective review was carried out in 78 patients with 80 consecutive tibial cancellous bone graft procurements for jaw reconstructive procedures in our department from March 1998 through March 2008. The patient group comprised 45 males and 33 females, aged 18 to 76 (average age 36.1 ± 12.3) (Figure 1). All patients with postoperative follow-up of less than 3 months were excluded. All medical records were carefully reviewed. All patients agreed to participate in this retrospective study involving clinical and radiograph examinations. We were granted an exemption issued from the committee of ethics of our hospital. Ethical approval was not required.

Preoperative check-ups include detailed review of history, physical examination, and lateral and posteroanterior view of knee joint. Patients with history of knee joint trauma or disease were excluded and contraindicated for tibial bone grafting.[8] Early and late complications were recorded. Preoperative radiograph was also used to monitor the development of tibia in young patients. The growth plate of the tibia usually matures between ages 18 and 20.

Tibial Bone Harvesting Procedures (Figure 2)

Patients were placed in supine position with a soft roll under the ipsilateral thigh to elevate it and keep the knee joint flexed. The chosen leg was restrained toward the contralateral side of the body for better access to the anterior lateral tibial plateau. Meticulous marking of all palpable surface landmarks, including the proximal fibular head, patella, proximal tibial head, distal femoral head, and Gerdy's tubercle, was made following routine aseptic skin preparation.

A curvilinear incision[9] about 2 cm long and deep to the subdermal fat was made along the natural skin crease just across from Gerdy's tubercle. The loose subcutaneous fat and areolar tissues could be easily torn apart through blunt dissection to discover the white, shiny iliotibial tract (ITT), which was then cut in a curvilinear

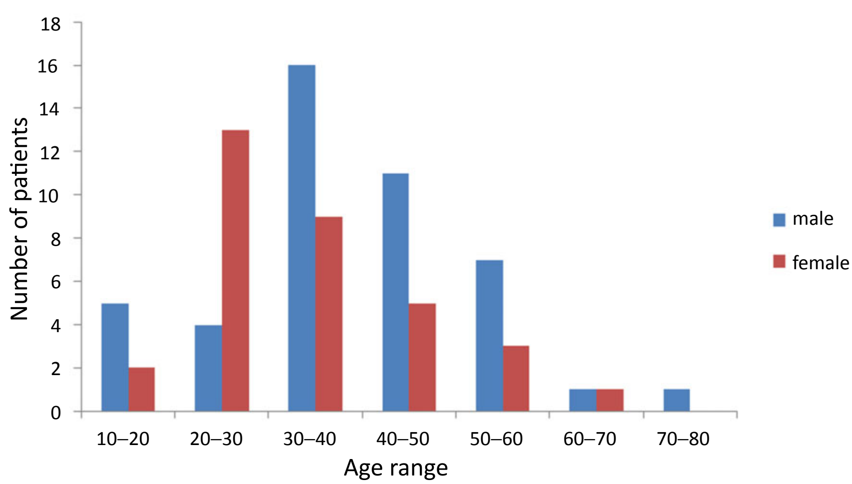

Figure 1 Age and gender distribution of patients.

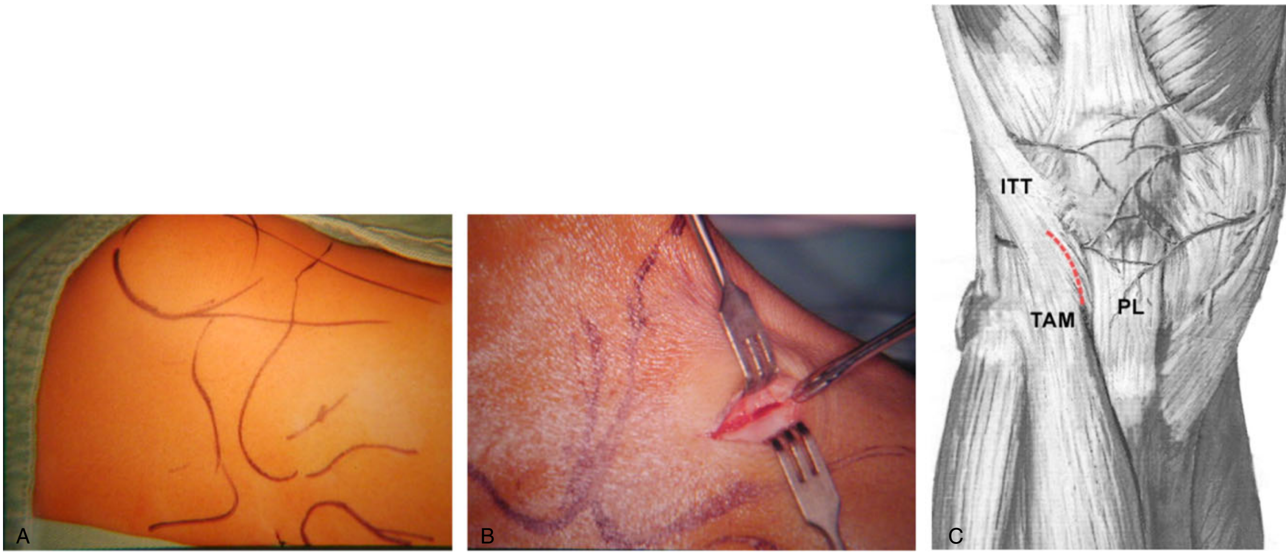

Figure 2 (A) The right knee joint area was marked with methylene blue to indicate the skin incision along the natural skin crease just across from Gerdy's tubercle and all the other relevant surface landmarks such as the tibial plateau, fibular head, and patella and patellar ligament. (B) On the white dense connective tissue layer, a curvilinear incision was made through the periosteum anteromedial to Gerdy's tubercle and approximately parallel to the contracting vector of the iliotibial tract (ITT). (C) Be sure to preserve the integrity of the tibialis anterior muscle (TAM) and patellar ligament (PL).

pattern, a bit longer than the skin incision and parallel to the fibers just 2 to 3 mm medial to Gerdy's tubercle. Caution should be taken to preserve the integrity of the origin of the tibialis anterior muscle, situated posterolaterally, and the patellar ligament, situated anteromedially, while cutting and elevating the dense tissue attachment to expose Gerdy's tubercle and the adjacent cortex. With proper protection of the soft tissue, rotary drilling instruments were used to create a bone window of up to 1.0 to 1.5 cm in diameter through which procurement of cancellous marrow bone grafts could be easily achieved with a set of hand instruments (regular orthopedic bone curettes). To avoid accidental knee joint entry, curettage toward the cephalic direction should be carried out with very gentle wrist exercise. A set of specially designed suction tips with a filtering reservoir for collection of tiny cancellous marrow bone chips was routinely used to maximize the procured bone volume, which was then stored in a sterile stainless steel bowl covered by saline-soaked gauze or packed in hypodermic plastic syringes under operating room temperature. The precondensed volume of bone grafts, which would be generally equal to or slightly more than the amount necessary for reconstruction of the recipient defect, could be estimated by injecting sterile saline into the bony cavity with the operated tibia raised parallel to the operating table.

To ensure reliable hemostasis, the bony defect at donor site was packed with absorbable gelatin sponge (Gelfoam®, Pharmacia and UpJohn, Bridgewater, NJ, USA) before layer-by-layer soft tissue closure. A pressure bandage was applied around the knee joint during the first 48 to 72 hours post-operation to prevent excessive tissue swelling. Patients were made aware of the adverse effects associated with early excessive load-bearing activities. Although ambulation was permitted and recommended for all our patients, vigorous exercises such as bike riding, jogging, hiking, dancing, and walking on high heels were all prohibited during the first month postoperatively.

The severity of donor wound pain was measured by the visual analogue scale (VAS; 0–100) and recorded beginning on the first day post-operation until the day of discharge.

Statistical Analysis

Data are expressed as means ± standard deviation. Statistical significance was evaluated using the *t*-test. A *p*-value < .05 was interpreted to be statistically significant. The influence of gender on the results was examined by an unpaired *t*-test. Pearson's correlation analysis was done for the influences of age, body height, and body weight on VAS score.

RESULTS

Seventy-eight patients underwent 80 cancellous tibial graft procurements as part of their maxillofacial procedures. The follow-up period was an average of 13.6 months, ranging from 3 months to 6 years. Age showed the normal Gaussian distribution with right skew (Table 1 and Figure 1). The peak of this curve stands for patients aged 30 to 40, demonstrating higher motivation of younger patients to receive grafting for jawbone reconstruction.

Bone was harvested from bilateral tibias in 2 cases (2.6%), from unilateral right tibia in 74 cases 94.8%), and from unilateral left tibia in 2 cases (2.6%). Harvesting the cancellous bone graft from the right tibia is preferred by the right-handed surgeon.

The average amount of procured bone graft was 17.8 ± 5.3 mL (range 8–32 mL). The harvestable amount of cancellous bone from the tibial plateau actually exceeded this volume, as we only had to harvest the amount of graft required for the recipient site. Bone grafts were placed onto continuity defects of the mandible in 7 patients. For a large defect resulting from osteoradionecrosis in a 34-year-old male patient (Figure 3), cancellous bone graft was harvested from bilateral tibias. Bone grafts from unilateral tibia were sufficient for the reconstruction of the other 6 patients, who were diagnosed with continuity defect due to osteoradionecrosis (3 patients), ameloblastoma (2 patients), or severe osteomyelitis (1 patient), and also for ridge augmentation of both jaws in 2 patients. All 7 cases of continuity defect were classified as L according to Jewer and colleagues' HCL method[10] for classifying mandibular defects. L implies a lateral segment that does not include the condyle. L defects can be of variable length but do not significantly cross the midline.

The mandible was the major recipient site (56/80, 70%) while the maxillary sinus constituted the major maxillary recipient site. Bilateral sinus augmentation using tibial graft was performed on 6 patients.

Platelet-rich plasma was used in 13 patients (16.7%) for various reasons or in irradiated recipient sites. Only on rare occasions ($n = 6$) was addition of bone substitutes (Triosite®, Zimmer Ltd, Swindon, UK) necessary to expand the graft volume.

Complications of Donor Site

Tibial fracture is the major complication of tibial cancellous bone grafting.[11] Other, minor complications are listed in Table 2. There were no major complications during the follow-up period (Table 2). Temporary paresthesia was noted in 5 patients and disappeared within 20 days. Ecchymosis was found in 6 patients; all resolved in 10 days. A late minor complication, gait disturbance persisting for 2 months, was noted in 1 patient. Another long-term minor complication, an unpleasant scar, was found in only 1 patient.

The VAS[12] score of the donor site, indicating subjective discomfort and pain, shows a significant drop from post-op day 5 to post-op day 1 (Figure 4). No gender difference exists with regard to pain and discomfort of donor site. There were no significant differences regarding either body weight or height. VAS scores demonstrated rapid recovery of the donor site in all our patients undergoing the modified incision technique.

Case Presentations

Reconstruction of Mandibular Continuity Defect (Figure 3). Here we present a case of left tongue cancer[13] (pT3N2bM0, stage IV) in a 34-year-old man who had undergone ablative cancer surgery, immediate pectoralis major myocutaneous flap reconstruction, and postoperative adjuvant radiation dose of more than 8,000 cGy. Severe osteoradionecrosis developed and progressed along the poorly immobilized osteotomy site at the left mandibular body. After segmental resection of the necrotic jaw with immediate extraskeletal pin fixation for space maintenance, adjuvant hyperbaric oxygen therapy and delayed reconstruction by a mixture of autogenous tibial cancellous bone grafts and platelet-rich plasma, the continuity defect of the left mandibular body, more than 6 cm lengthwise, was successfully regenerated and turned out to be a well-consolidated viable bone mass where four regular-sized dental implants were installed subsequently to achieve a reasonable oral functional rehabilitation.

Preprosthetic Reconstruction (Figure 5). A 20-year-old man sustained a motor vehicle accident leading to jawbone fractures and dentoalveolar avulsion of both maxilla and mandible. A long-span craterlike ridge defect involving seven missing teeth was observed at mandibular arch with vertical bone loss of up to 9 mm (Figure 5A). To optimize the biomechanics of the implant-supported fixed prosthesis, simultaneous implantation and vertical ridge augmentation using the "tentpole" and "soft tissue matrix expansion" concepts

TABLE 1 Situations for Which Our Patients Underwent Procurement of Tibial Cancellous Bone Graft

			Maxilla					Mandible										
Age Range	Sex	Total	Sinus	Cyst	Ridge	Sinus and Ridge	Trauma	Cyst	AB	Trauma	Ridge	ORN	OM	FD	CCD	SCC	COF	COD
10–20	Male	5	0	0	0	1†	2	0	1	1	0	0	0	0	0	0	0	0
	Female	2	0	1	0	0	0	0	0	1*	0	0	0	0	0	0	0	0
20–30	Male	4	0	0	0	0	0	2	1	1	0	0	0	0	0	0	0	0
	Female	15	0	1‡	2	1*‡	0	4 (1*, 1‡)	2¶	0	1*‡	0	1	0	1	0	1	1
30–40	Male	16	1	2	1	0	0	5	0	0	2	1*¶	2 (1¶)	1	0	0	0	0
	Female	9	2§ (1*)	0	1	0	0	2	3 (1*)	0	0	0	0	1	0	0	0	0
40–50	Male	11	0	0	0	0	0	4	1	3	2	1¶	0	0	0	0	0	0
	Female	5	2	0	0	0	1	1	1*†	0	0	0	0	0	0	0	0	0
50–60	Male	7	1*§	1	0	0	0	3	1*†	0	0	0	0	0	0	1	0	0
	Female	3	2§ (1*)	0	0	1*	0	0	0	0	0	0	0	0	0	0	0	0
60–70	Male	1	0	0	0	0	0	0	0	0	0	1*¶	0	0	0	0	0	0
	Female	1	1§	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
70–80	Male	1	0	0	0	0	0	0	0	0	0	1*¶	0	0	0	0	0	0
	Female	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total		80	9	5	4	3	3	21	10	6	5	4	3	2	1	1	1	1

*Graft with platelet-rich plasma.
†Graft with the additive Triosite.
‡Bimaxillary recipient sites.
§Bilateral sinus augmentation.
¶Continuity defect.
AB, ameloblastoma; ORN, osteoradionecrosis; OM, osteomyelitis; FD, fibrous dysplasia; CCD, cleidocranial dysplasia; SCC, squamous cell carcinoma; COF, cemento-ossifying fibroma; COD, cemento-osseous dysplasia.

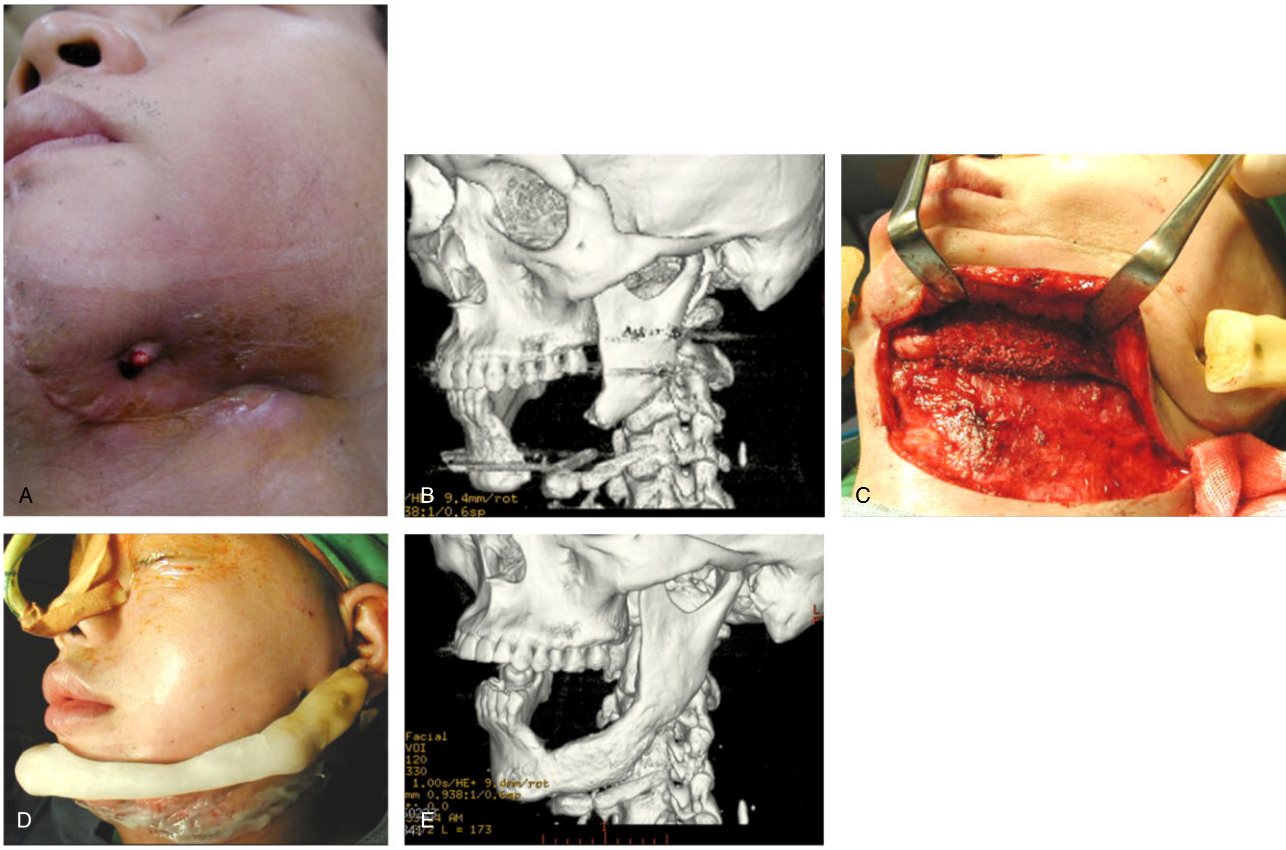

Figure 3 Cases of mandibular continuity defects. (A) Orocutaneous fistula due to osteoradionecrosis. (B) A continuity defect at left mandibular body, 6 cm in anteroposterior dimension. (C) Reconstruction with autogenous tibial cancellous bone, Triosite®, and platelet-rich plasma through extraoral submandibular incision. (D) Resin bar of external pin fixation was reconnected following primary closure of the wound. (E) Continuity defect was replaced with well-consolidated bone.

advocated by Dr. R. E. Marx and colleagues[14] were performed under general anesthesia (Figure 5B). The amount of procured cancellous bone graft from one tibial plateau was more than enough to provide vertical augmentation of mandibular arch and lateral ridge augmentation at upper right quadrant as well as subantral augmentation at upper left quadrant. All the bone augmentation areas healed uneventfully, with adequate osseointegration of all fixtures 5 months postoperatively (Figure 5C); all fixtures were able to support a set of stable and well-maintained fixed restorations (Figure 5D).

Recipient Site. All cases were found to show good bone healing without any complications, except for one case of continuity defect. The etiology of poor healing in this case was noted as wound dehiscence owing to inadequate management of tension-free closure by an inexperienced maxillofacial surgeon performing his first surgery for continuity defect.

TABLE 2 Morbidity and Complication Rates at Donor Sites (*N* = 80)

	n (%)
Early complications	
Bleeding	0 (0)
Tibia fracture	0 (0)
Large hematoma	0 (0)
Ecchymosis	6 (7.6)
Severe pain	0 (0)
Deep infection	0 (0)
Temporary sensory loss	5 (6.3)
Late complications	
Chronic pain	0 (0)
Chronic infection	0 (0)
Paresthesia	0 (0)
Gait disturbance	1 (1.3)
Long-term complications	
Unpleasant scar	1 (1.3)

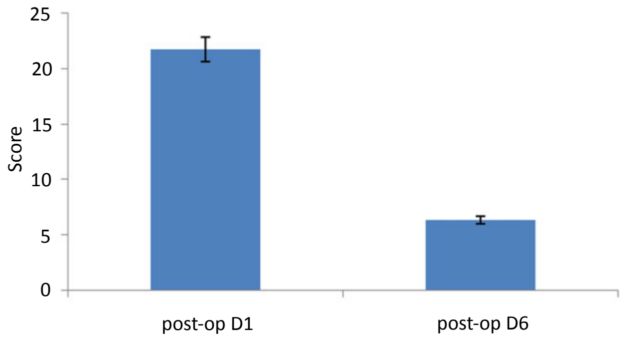

Figure 4 Visual analogue scale (VAS) score at the donor site. On post-op day 6 (D6), VAS score was significantly reduced, compared with that on post-op day 1 (D1) ($p < .01$).

DISCUSSION

Indication

Generally speaking, tibial cancellous bone grafting is indicated for "space-providing defects" such as maxillary sinus defects and three- and four-wall jawbone cavities. Other corticocancellous bone blocks from iliac crest or mandibular symphysis are indicated for severe transverse and/or vertical alveolar ridge deficiencies, categorized as "non-space providing defects." However, using the "tentpole" concept and "soft tissue matrix expansion" technique described by Dr. R. E. Marx and colleagues, we were still able to build up a complicated crater alveolar defect using only tibial cancellous bone grafts, as demonstrated in Figure 5.

The Anatomy and Role of the ITT

In 1543, the anatomist Vesalius described the tensor fascia lata as one of the tibial muscles. Gerdy described the insertion of the tensor fascia lata at the tibia. Kaplan[15] made a comparative study of the ITT and described it as a unique structure found only in humans.

Recently, the ITT has been found to have multiple periarticular insertions, including insertions at the linea aspera and at the epicondyle, the patellar insertion, Gerdy's insertion, and the capsular-osseous insertion (also known as lateral femorotibial ligament). A horseshoe structure formed by the capsular-osseous layer of the ITT and the anterior cruciate ligament functions to stabilize the knee.

Since the ITT is considered a true anterolateral ligament and also a stabilizer of the knee, incision along the direction of its fibers would hence decrease the postoperative morbidity and allow earlier full-range ambulatory recovery of the donor leg.

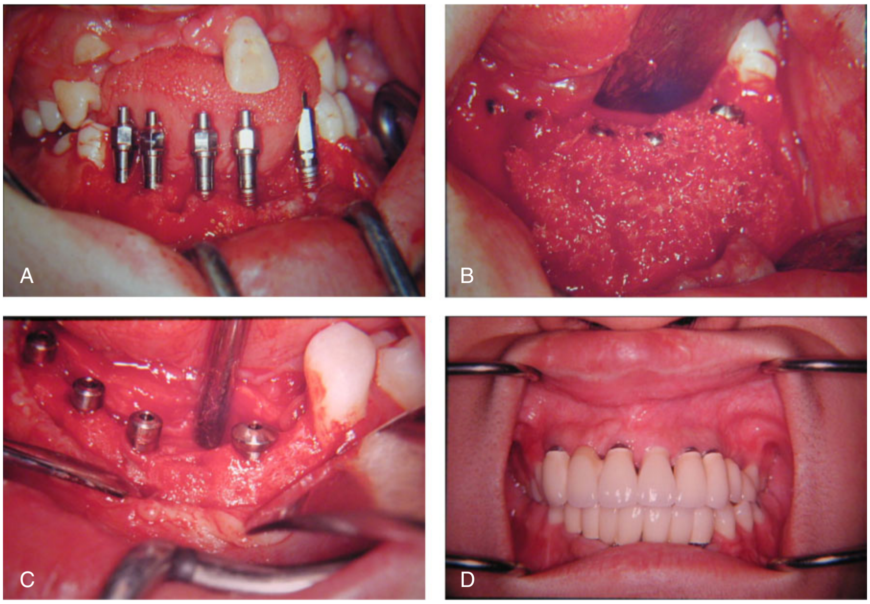

Figure 5 Abundant bone volume for reconstruction of complicated alveolar defects of both jaws in a 20-year-old young man, sustained from a motor vehicle accident. (A) Tentpole concept for simultaneous fixture placement and three-dimensional ridge augmentation at a seven-tooth mandibular alveolar defect of up to 9 mm in vertical dimension, indicated by a periodontal probe. (B) Cancellous marrow bone chips from proximal tibia packed densely around dental implants sticking out above the mandibular alveolar crest. (C) Five months after bone augmentation, good consolidation of bone graft was observed at right and left maxilla as well as anterior mandible. (D) Stable superstructures and healthy peri-implant soft tissue observed at 5 years following delivery of implant-supported fixed restorations.

Incision of the Fascia Layer in Lateral Approach

Catone and colleagues[4] cut the fascia of the ITT in a U-shaped trapdoor fashion, with the base of the U located caudally, which would no doubt lead to disruption of the fibers and increase the risk of suture dehiscence. Our incision follows the direction of the fibers, making suturing at this firm layer much easier. Less pain and discomfort and fewer complications may be expected during post-op ambulation. The finite-element model of Birnbaum and colleagues[16] shows the ITT to have influence on centralizing the hip. Hence, our modified incision technique may be helpful to achieve early ambulation and recovery of the function of both hip and knee.

Age

With regard to age , the growth plate of the tibia matures at about 18 to 20 years old. All our patients were above the age of 18. Kalaaji and colleagues,[17] Walker and colleagues,[18] and Besly and Ward Booth[19] found no evidence of long-term complications at the donor site in 10-year-old children who had proximal tibial bone procurement at a level below the growth plate for secondary repair of residual alveolar clefts. Fusion of the proximal tibial epiphysis usually occurs between the ages of 16 and 17 in females and between 18 and 19 in males. Hence, the upper portion of the proximal tibial head must be avoided when harvesting cancellous bone from teenagers.

Gerdy's Safe Zone: Far Away from the Peroneal Nerve

Rubel and colleagues[20] revealed that the course of the common peroneal nerve trunk and its anterior recurrent branch define an arc with an average radius of 45 mm. The circumferential trajectory was seen to be centered at the most prominent aspect of Gerdy's tubercle. The circular nature of the peroneal nerve and its consistent relationship to the most prominent aspect of Gerdy's tubercle prevents damage to nerve during bone harvesting at the proximal tibia. Not one of our patients shows long-term cutaneous paresthesia, which is also consistent with the results of other studies based on lateral approach to the proximal tibia.

Neither Rubel and colleagues' cadaver study nor our clinical experiences[21] concord with the claims made by Lezcano and colleagues[22] and Jakse and colleagues.[7,23]

Quantity and Quality

The procurable volume of cancellous graft from the tibia is always the focus and concern in reconstruction of the jaws. Catone and colleagues[4] took an average volume of 25 mL of cancellous bone intraoperatively from the proximal tibial metaphysis in 21 cases. A cadaver study by Gerressen and colleagues[24] showed that equal amounts of cancellous bone were available from the iliac crest and tibia plateau in the fresh cadaver. This result is dependent on neither age nor gender. Alt and colleagues[25] also found equal amounts of compressed volume of cancellous bone from the iliac crest and tibia in their cadaver study. However, bone porosity of the iliac graft turns out to be proportionately higher with age. Hence, Gerressen and colleagues concluded that tibial cancellous bone grafts could serve as an appropriate alternative to the classic iliac bone graft, especially in the elderly.

The amount of cancellous bone graft from the proximal tibia is so abundant that even continuity defects of the mandible could be restored by using the tibial bone graft alone (Figure 3). The abundance of cancellous graft is also sufficient enough to allow reconstruction of the atrophied ridges of both jaws and even simultaneous augmentation of the maxillary sinuses. In rare occasions of extensive defect, bone substitutes are still needed for graft volume expansion.

Chiodo and colleagues[26] stated that there is more fat in tibial marrow, which is somewhat in contrast with the observation of previously mentioned studies. Nevertheless, we did not notice whether or not tibial bone grafts were fattier than iliac cancellous bone grafts. There might be some individual variation by gender, age, body mass index, and so on.

Tibial bone harvesting can be performed under intravenous sedation.[27] Minimal invasiveness, easier manipulation, and simple instrument setting are the advantages of this donor site procedure. An additional advantage of this donor site is that it allows application of thigh tourniquet and thereby minimizes intraoperative bleeding.[28]

Low Rate of Tibia Fracture

Alt and colleagues' mechanical loading test[25] on cadavers demonstrated no difference in force required to induce a tibial plateau fracture between intact and decancellated proximal tibia. The result of this study is consistent with the low rate of tibial fracture[29] found in studies by

O'Keeffe[3] (0.43%, 1/230) and Hughes and Revington[1] (2.7%, 2/75).

Lateral Approach vs. Medial Approach (Figure 6)

Equal amounts of bone graft material are procurable from the medial and lateral aspects of the proximal tibia.[6] Besly and Ward Booth[19] claimed the superiority of the medial approach over the lateral approach, given that the latter one requires cutting through the anterior tibial muscle.

As branches of recurrent tibial vessels and nerves course through the anterior tibial muscle, some surgeons[22,23] also advocate the medial approach to reduce the risk of injury to the nerves and vessels. The authors cannot agree with this statement, as neither Catone and colleagues[4] nor Brutus and Loftus[30] described stripping or incising the anterior tibial muscle in their techniques while approaching laterally. Some of the advantages of the lateral approach were revealed through our imaging studies. In Figure 6, an axial section at the level of Gerdy's tubercle illustrates the prominent landmark, safe for skin incision. The anterior tibial muscle is located posterolateral to Gerdy's tubercle (Figure 6A). Incision and dissection of the ITT were made to avoid cutting through the anterior tibial muscle (Figure 6B), therefore minimizing the possibility of injury to the recurrent tibial vessels and nerves.

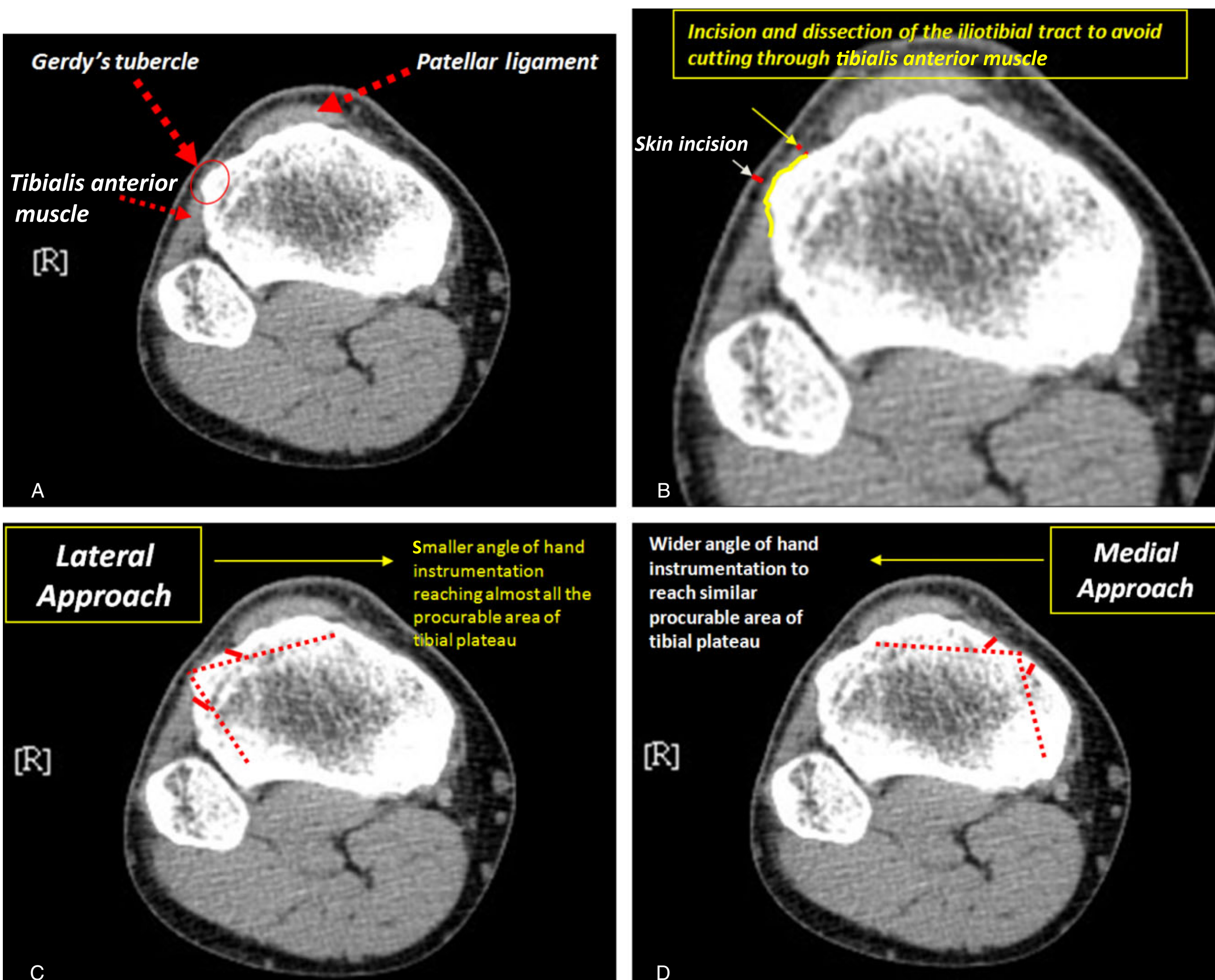

Figure 6 Lateral approach versus medial approach. (A) Axial section of tibia indicating the location of Gerdy's tubercle and anterior tibial muscle. (B) Incision and dissection of the iliotibial tract to avoid cutting through the anterior tibial muscle (white arrow: skin incision, yellow arrow: incision of the iliotibial tract, yellow line: area for periosteal reflection and for bony window). (C) Smaller angle of hand instrumentation reaching almost all the procurable area of the tibial plateau in lateral approach. (D) Wider angle of hand instrumentation needed to reach similar procurable area of tibial plateau in medial approach, indicating the greater effort expended with that approach.

Mazock and colleagues[31] offered a geometric method to locate Gerdy's tubercle, pointing it out as the midpoint of a line from the fibular head to the anterior tibial tuberosity. Geideman and colleagues[28] also advocate the lateral approach to minimize superficial sensory changes.

Easier Manipulation during Procurement

The lateral approach shows a smaller angle of hand instrumentation required to access almost all of the procurable area of the tibial plateau (Figure 6C), while the medial approach (Figure 6D) requires a wider angle of hand instrumentation to reach a similar procurable area of the tibial plateau. Thus, less effort and time will be expended during procurement using orthopedic bone curettes via the lateral approach. However, the Wagner osteotome is recommended as a good instrument for the medial approach according to Luzcano and colleagues,[22] Besly and Ward Booth,[19] van Damme and Merkx,[5] and Hernandez-Alfaro and colleagues.[27]

Schow and colleagues[31] advised caution in the harvesting of proximal tibia from patients with obesity, peripheral vascular diseases, or compromised wound healing due to systemic diseases.

CONCLUSION

Conventional autogenous bone grafts may someday be replaced by products of the novel technology of tissue engineering. Until the advent of these perfect materials becomes reality, autogenous bone grafting still remains the primary solution in jawbone reconstruction. Our modified harvesting technique from the proximal tibia, offering abundant particulate cancellous marrow bone graft with low morbidity and few complications, is a technique worth promoting. Moreover, this is the first report of autogenous tibial cancellous bone grafting for reconstruction of mandibular continuity defect resulting from osteoradionecrosis.

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