

## **Anatomical and technical considerations for planning anterior iliac crest graft cutting guide for mandibular reconstruction: a case report**

### **Considerações anatômicas e técnicas para o planejamento de guia de corte de enxerto de crista ilíaca anterior para reconstrução mandibular: relato de caso**

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**ABSTRACT**

Delayed mandible reconstruction is a challenged situation in Oral and Maxillofacial surgery, due to great quantity of fibrous tissue and quality of covering soft tissue. The virtual surgical planning not only assists in previewing results, it assists in adjust the size and format of bone grafts by means of cutting surgical guides according to the anatomy of regional donor area too. We reported a clinical case a 20-years-old male patient attended to our service presented with segmented mandibular defect. Aiming to perform the procedure with more predictability, accuracy and less morbidity, we planned to remove the anterior portion of the iliac crest bone using a cutting guide computer aided design/computer aided manufacturing which was in accordance with the curvature and the size mandible bone defect.

**Keywords:** computer-assisted surgery, bone grafts, iliac crest, mandibular reconstruction.

**RESUMO**

A reconstrução mandibular tardia é uma situação desafiadora na Cirurgia Bucomaxilofacial, devido a grande quantidade de tecido fibroso e pouca qualidade dos tecidos moles de cobertura. O planejamento cirúrgico virtual não apenas auxilia na previsão dos resultados, como também ajuda a ajustar o tamanho e o formato dos enxertos por meio de guias cirúrgicos de corte de acordo com a anatomia da área doadora. Relatamos caso clínico de paciente do sexo masculino, 20 anos, atendido em nosso serviço com defeito mandibular segmentar. Com o objetivo de realizar o procedimento com mais previsibilidade, precisão e menor morbidade, planejamos remover a porção anterior do osso da crista ilíaca usando um guia de corte auxiliado por planejamento/confecção assistidas por computador, de acordo com a curvatura e o tamanho do defeito ósseo mandibular.

**Palavras-chave:** cirurgia assistida por computador, enxertos ósseos, crista ilíaca, reconstrução mandibular.

**1 INTRODUCTION**

Non-vascularized bone grafts are part of the arsenal of possibilities for mandibular reconstructions, especially in central and lateral defects caused by ablation of pathologies, trauma, gunshot wounds, osteonecrosis, among others.<sup>1</sup> The iliac crest bone is widely used as a graft in the maxillofacial region, due to the good bone availability and high concentration of osteocompetent cells, presenting satisfactory results.<sup>2</sup> Despite this fact, most of the studies related to virtually planned surgical guides for use in Oral and

Maxillofacial Surgery use the fibula as donor site but few studies describes the characteristics of the cutting guides for anterior iliac crest region.<sup>3</sup>

## 2 CASE REPORT

A 20-year-old male patient presented to our service with a previous history of Ameloblastoma resection associated to mandibular reconstruction plate installation treated two years ago in another hospital by Head and Neck Surgery Service. Physical examination showed a moderate swelling localized in the mandibular angle compatible with fracture of reconstruction plate, which was evidenced by Computer Tomography analysis. In this sense, we decided to perform the partial mandibular reconstruction by autogenous bone graft removed from iliac crest using an iliac crest cutting guide.

In order to obtain more predictability and accuracy of the bone graft shape and assisted the orthopedist during the graft removal, a computerized cutting surgical guide (Fig. 01) was made by a specific software (Blender® – Netherlands) and was printed using the 3D printer (Moonray SprintRay - USA). (Fig. 2)

Furthermore, a repositioning mandible guide and a biomodel were printed by the 3D printer too, to facilitate the mandible segments alignment, condylar positioning and aided the bending process of the 2.4 mm plate respectively, due to the high quantity of fibrous tissue. Bone graft was fixed by means of steel wires to the fixation system. Postoperative computed tomography shows adequate positioning of the bone graft and the mandibular conformation similar to the contralateral side (Fig. 03).

## 3 DISCUSSION

Despite being the most common tumor among odontogenic tumors, the management of ameloblastoma still presents a great challenge, due to the high power of aggressiveness and recurrence, so individualized planning is essential.<sup>4</sup>

The measurement of bone defect size plays a key role in the reconstructions planning stage, since it assists in donor area choice. In the reported case, specific software (Blender® - The Netherlands) was applied, not only to determine the bone gap size, but it was also possible to define the best region for graft removal, according to the arch curvature (Fig. 01).

In our report, the donor area of choice was the anterior iliac crest. This region is advantageous, because it can provide up to 50 cc of excellent corticomedullar bone.<sup>5</sup> The

use of the cutting guide allowed the osteotomies design, maintaining the margins of the graft, and the more predictability of the size bone portion removed (Fig. 02).

During the planning, some considerations respecting the position of cutting guides for anterior iliac crest are extremely important, especially in the medial and anterior extensions, in which demands adequate detachment. It is important to remember that the lateral cutaneous branch of the iliohypogastric nerve which is located overlying the ilium tubercle and is most commonly injured during an anterior iliac crest bone graft; as the lateral branch of the subcostal nerve, located overlying the anterior superior iliac spine. The subcostal nerve is located medial to the iliohypogastric nerve and the lateral femoral cutaneous nerve, located between the psoas major and the iliacus muscle, medial to the subcostal nerve.<sup>6</sup> Some authors report that the lateral femoral cutaneous nerve can be found within 1 cm of the anterior superior iliac spine.<sup>6,7,8</sup> In addition, the deep iliac circumflex artery is located in the medial portion of the ilium and traverses the inferior surface of the pelvic curvature 2 - 3 cm posterior to the anterior superior iliac spine and 2-3 cm lower than the inner border of the anteroposterior iliac spine.<sup>9</sup>

It is therefore important that during iliac crest cutting guide planning, ideally, we should preserve the anterior curvature with the guide starting at a minimum distance of approximately 1.5 cm to 2 cm from the anterior edge of the iliac crest, on account of innervation adjacent to this region. With regard to medial depth, we should respect a maximum detachment of approximately 2 to 2.5cm due to the position of the deep circumflex iliac artery.

We observed that virtual planning and the printed cutting guide promoted a shorter surgical time and greater predictability of the result and decreased morbidity, since it was possible to remove the graft from the region of the anterior iliac crest that had a conformation close to the contralateral mandibular curvature, besides a sufficient height for later rehabilitation (Fig. 03). We warn about some characteristics must be respected so that the guide can be used on the iliac crest without risks to noble structures, as previously described.

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## SUBTITLES

Fig. 01: Cutting guide for iliac crest performed through the Blender – Netherlands program.



Fig. 02: Image showing the adaptation of the graft removed, through the guide, in the bone defect.

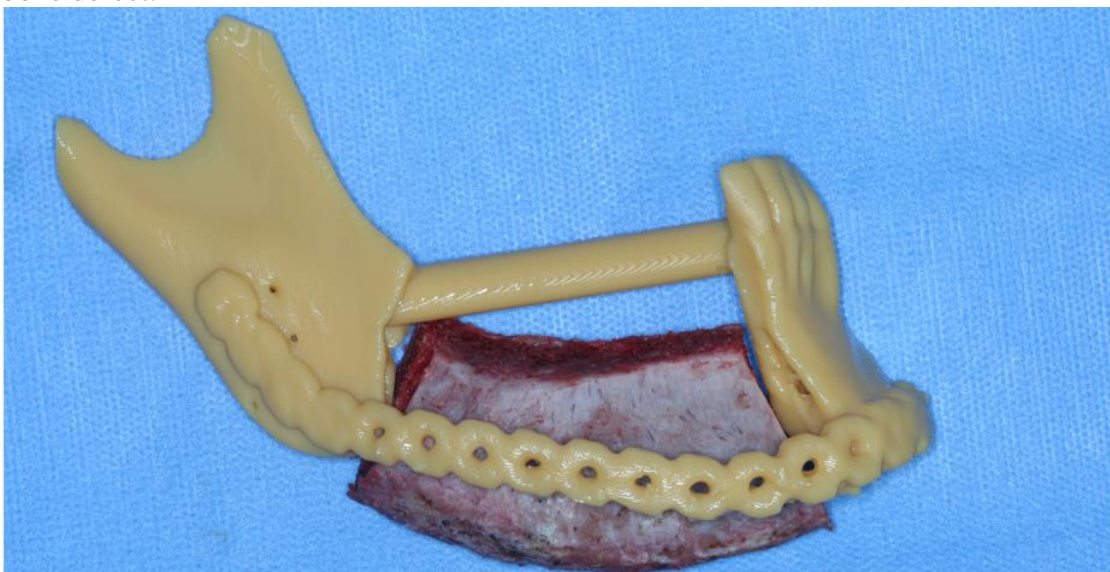


Fig. 03: Postoperative tomographic reconstruction showing good positioning of the graft and mimicking the anatomy of contralateral mandibular body

