

# Comparison of iliac crest versus mandible for alveolar bone grafting

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## Abstract

**Introduction:** Alveolar bone grafting in patients of cleft lip or palate has become a well established procedure. This procedure has a number of advantages namely, stabilization of the maxillary arch, facilitation of the eruption of maxillary canine and sometimes lateral incisor, providing bony support to the teeth adjacent to the cleft, facilitation of closure of oro-nasal fistula and helping raise the alar base of nose. The objective of this study was to compare the iliac crest bone with that of the mandibular symphysis for the reconstruction of alveolar clefts.

**Material and Methods:** 102 patients were selected ranging in age between 8 to 13 years. Iliac crest was selected as donor site in 58 cases and mandible in 44 cases. Post operative observation period was 12 months. An independent t-test was used to compare the treatment abilities of the two groups.

**Results:** The independent t-test showed a statistically insignificant difference ( $p$ -value  $> 0.05$ ) in the treatment abilities of the two groups. Results of both groups were comparable in most respects regarding pain and paraesthesia. Mandibular reconstruction was superior in regard to reduced morbidity, no gait disturbance, reduced hospitalization time and intraoral scar. On the other hand, reduced operating time, as two operating teams working at a same time, was observed in iliac crest graft cases.

**Conclusions:** The choice of ileac crest versus mandible for alveolar bone grafting depends on the choice of the operator. Reduced hospitization along with early healing are amongst the benefits of mandibular reconstruction.

**Keywords:** Alveolar bone grafting; cleft lip and palate; mandibular reconstruction

## Introduction

**T** Cleft lip and palate, also known as Oro-facial cleft, is a group of conditions that includes cleft lip, cleft palate or both of these conditions together. Cleft lip is an opening or discontinuity in the upper lip that may extend to the nose. While, cleft palate is an open communication between the roof of the oral cavity and the nose. Cleft lip and palate are a result of the tissues of the face not joining properly during development. The risk factors of such conditions include smoking during pregnancy, obesity, late pregnancy, diabetes or medications such as those used to treat seizures.<sup>1,3,4</sup>

Cleft of the palate and lip is the commonest congenital anomaly to affect the oro-facial region.<sup>1</sup> An important part in the treatment of children with clefts in the primary palate is the reconstruction of the alveolar process with bone, which nowadays is a well known and a commonly used surgical procedure. Alveolar bone grafting is an important part of the reconstructive journey for many cleft lip and palate patients.<sup>2</sup>

Alveolar bone grafting has been a popular procedure that has been performed since years to regain the bony support that has been lost due to the presence of the cleft. Early alveolar bone grafting is referred to as bone grafting after the eruption of maxillary lateral incisor but prior to the eruption of maxillary canine. When this procedure is delayed and performed after the eruption of maxillary canine, it is called as late alveolar bone grafting. The ideal time of alveolar bone grafting is determined by the development of

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the root of the maxillary canine (about one quarter to one half the final root length) as indicated by the radiographic evaluation. Survival of the donor tissue is an important aspect or probably the main aim of bone grafting. Under optimal conditions, the osteogenic cells survive the surgical procedure. In prior research it was suggested in histological and micro-radiographical clinical and experimental studies, that cancellous autogenous bone grafts, harvested from either tibia or iliac crest, were transformed to the same structure as the surrounding palate without any discontinuity defect in between. After six months it was not possible to distinguish between the two samples, one from the palate and the other from the transplanted tissue. Furthermore, the architecture of the graft appears to adapt well to the functional requirements of the site. This treatment provides bone growth in the cleft area as well as other benefits, including the eruption of permanent teeth, posterior dental prosthetic rehabilitation, support and stability to the wing of the nose, oronasal communication occlusion (improving nasal emission and phonetics), orthodontic movement, and the insertion of dental implants.<sup>3,4,5,6</sup> Various donor sites for secondary alveolar bone grafting have been described. Iliac crest, Calvarium, mandibular symphysis and tibia are amongst them.<sup>7-11</sup>

## Material and Methods

A total of 102 patients reporting to the department of Oral and Maxillofacial Surgery, Armed Forces Institute of Dentistry (AFID), were included in the study who were treated by secondary alveolar bone grafting using iliac crest and mandibular symphysis as a donor site during the period from March 2012 to 2015. Ethical Committee approval was taken from the institute and after obtaining informed consent from the patients, subjects were included in the study. The post-operative complications, clinical outcomes,

operating time and hospital stay of both the groups was compared. Pain was assessed by eliciting the severity using Visual Analog Scale (VAS) and the duration of pain was recorded. Gait disturbance along with the number of days to revert back to normal gait were noted. Post-operative complications including numbness/sensory loss and dissatisfaction regarding the presence of scar in the hip region were also recorded. All surgeries were performed by a single operating surgeon with assistance taken from colleagues. The medial trap door technique for harvesting bone from anterior iliac region was performed. All procedures were performed under general anesthesia in supine position allowing simultaneous preparation at the recipient site. Pre-operative antibiotics were given to all patients. Under aseptic conditions, orotracheal intubation was done and procedure was performed simultaneously at donor and recipient sites. At the donor site, the iliac crest was palpated and with the non-surgical hand the skin over the crest was displaced medially before the incision was made (for aesthetic reasons and to avoid irritation of scar from tight clothes). The area of the iliac crest was infiltrated using 2% lignocaine containing 1:1,00,000 adrenaline.

Incision was placed 2 cm away from the anterior superior iliac spine, over the displaced skin measuring about 3-5 cm avoiding damage to the lateral femoral cutaneous nerve and the growth centre (anterior iliac spine). Dissection was continued following the axis of the iliac crest through the subcutaneous tissues and fascia lata directly over the crest with minimal undermining. A medially based trap door was outlined with anterior and posterior vertical stop cuts creating a hinge joint medially. Blocks of cancellous bone were harvested using a small osteotome and a bone gouge. After sufficient amount of bone graft was taken (20-30cc), it was transferred to the recipient site simultaneously. Afterwards the

whole area was irrigated, and homeostasis achieved. The trap door was repositioned and if required it was secured using resorbable sutures. The incision was closed in layers using 3-0 Vicryl and 3-0 silk for skin. The incision was covered by a compression plaster under pressure to avoid any dead space. For harvesting symphysis graft, local anesthesia infiltrated in chin region, labial incision made, mucoperiosteal flap raised and leaving bone of anterior symphysis region intact, two blocks of cortico-cancellous bone of pentagonal shape removed. Incision closed with Vicryl 3.0. A water tight repair of the palatal cleft and the nasal lining and a secure closer of the soft tissue across the anterior alveolus are essential.

## Results

Out of the 100 subjects included in the study, 60 were males and 40 females (Table I). 78 subjects had unilateral (48 left side, 30 right side) and 34 had bilateral cleft alveolus. The age at the time of surgery ranged from 8 to 32 years, mostly in the age of 8 to 13 years. Majority of the cases were from low socioeconomic group and were referred from other hospitals. In 30% of the cases, parents had consanguineous marriage. The types of grafts used can be seen in Table II. More pain was seen in patients having iliac crest as the donor site as compared to the oral region. Visual Analogue Scale (VAS) was used to assess the severity of pain. 45% of the patients had post operative pain which gradually subsided within two weeks except two cases of iliac crest donor site. Patients were encouraged to walk after first 24 hours post operatively with the help of assistant or nursing staff. All the patients had mild to moderate gait disturbances. 7 subjects had slightly prolonged and severe gait disturbances while all the other patients improved within two weeks time. None of the patients reported paraesthesia of lateral femoral cutaneous nerve while in patients having chin as donor site 6 reported pain, 8 sensory disturbance in lower incisor region which improved except in one patient. 96% of the patients were satisfied with the post

operative scar which was hidden lateral to the hip.

**Table I: Frequency of gender**

Gender		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Male	60	60.0	60.0	60.0
	Female	40	40.0	40.0	100.0
	Total	100	100.0	100.0	

**Table II: Type of graft used for alveolar bone grafting**

Graft		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Iliac Crest	58	58.0	58.0	58.0
	Chin	24	24.0	24.0	82.0
	Ramus	18	18.0	18.0	100.0
	Total	100	100.0	100.0	

## Discussion

There is no hiding the stigmata of unrepaired clefts. The clefting of the alveolus is a less conspicuous component of the cleft continuum. This and the necessity of bone grafting have resulted in a paucity of ancient historical references to alveolar cleft repair. The first reports of bone grafting to the alveolus were reported in 1901 by Von Eiselsberg.<sup>2</sup> The benefits and goals of alveolar grafting include stabilization of the maxillary arch, elimination of oro-nasal fistulae, creation of bony support for subsequent tooth eruption, soft tissue nasal base support and tooth transplanted in the grafted cleft alveolus.<sup>12,13</sup> Compromised alveolar volume may be augmented by use of several methods for instance alloplastic materials such as hydroxyapatite, tri-calcium phosphate, allografts such as freeze dried or demineralized freeze-dried bone such as deproteinised bovine bone (Biooss-Geistlich), homografts such as demineralized bone from a bone bank, autogenous bone grafts such as from the iliac crest, tibia, rib, mandible or calvarium.<sup>14</sup> The ribs, iliac crest, calvarium, mandibular symphysis and tibia are the most

common donor sites. Cranial bone is the alveolar bone of choice for some. Use of cranial bone can prove to be extremely advantageous. Its scar is hidden and there is limited post operative pain. It is easy to harvest this bone and also has the intrinsic advantages of origin as a membranous bone. Detractors cite longer operative time and the potential for more serious complications, for example cerebrospinal fluid leak, dural tear, hemorrhage, epidural hematoma. Tibia has been used by some as a source of cancellous bone, trephining is commonly used to harvest this graft. This technique results in less post operative pain and shorter hospital stays. Rib has been utilized to close the alveolar cleft; however, it is considered to be of limited use by many due to its donor site morbidities, including visible scarring and pain.<sup>15</sup> Rib grafts have also been criticized for difficulties in orthodontic tooth movement. Another source of membranous bone that has been utilized in alveolar cleft grafting is bone from the mandibular symphysis and favorable outcomes have been reported with this source. Other reported advantages include use of the same operative field, no visible scar and decreased post operative pain.<sup>14,15</sup> The use of autogenous bone graft from the anterior iliac crest was proven to be gold standard for secondary alveolar bone grafting and is well established. There is also evidence that bone grafts derived from the iliac crest require less surgical time and are associated with a shorter hospital stay for the patient.<sup>4</sup> The complications at donor site include acquired bowel herniation, meralgia paresthetica (injury to the lateral femoral cutaneous nerve also called Bernhardt - Roth's syndrome), pelvic instability, fracture (extremely rare and usually with other factors), injury to the clunial nerves (this will cause posterior pelvic pain which is worsened by sitting), injury to the ilioinguinal nerve, infection, minor hematoma (a common occurrence), deep hematoma requiring surgical intervention, seroma, ureteral injury, pseudoaneurysm of iliac artery (rare), tumor transplanted, cosmetic defects (chiefly

caused by not preserving the superior pelvic brim) and chronic pain.<sup>1,2,4,5,7</sup>

The post-operative pain and discomfort are assessed by the visual analogue scale of 0 - 10. Where, '0' indicates no pain and '10' as severe pain. Gait disturbance is the most common complication observed next to pain. Previous studies by Rawashdeh et al <sup>19</sup>, the average duration of limp walking was 6.6 ± 5.4 days and no patient showed gait disturbance four weeks post-operatively. Limping was reported in 19 patients in a study conducted by Zaid et al <sup>20</sup>, the post-operative limp was resolved after 10.4 days and 50% of the patients had gait disturbances even after 14<sup>th</sup> post-operative day.<sup>21</sup> In the present study, average duration of limping was 7 days due to pain and no patient had experienced any gait disturbance two weeks after the surgery.

Studies focusing on scar formation suggest that 92% of patients were pleased with the aesthetic outcome of the scar when the length of incision was between 30 - 50 mm. Rudmann reported a mean of 29 mm,<sup>22</sup> Canady et al., a mean of 42 mm,<sup>23</sup> Cohen et al,<sup>24</sup> reported a scar length of 40 mm and Grossman et al., reported scar length of 23-46mm during follow up of 9-12 months.<sup>25</sup> However in our study 96% of patients were satisfied with the postoperative scar.

In a study conducted by Pollock R et al,<sup>26</sup> on donor site morbidity, cosmesis and overall satisfaction with iliac crest bone graft for anterior cervical discectomy and fusion, they found no major complications in trephine group and open group patients with no statistically significant difference in morbidity. In a similar study conducted by Matsa S et al.,<sup>27</sup> on evaluation of morbidity associated with iliac crest harvest for alveolar cleft bone grafting, they found that young patients have increased tolerance. Temporary sensory loss or post-operative sensory disturbances i.e., parasthesia were reported. None of the patients in the present study complained about any parasthesia in the

donor site or limb region during follow up of three months and further, compared to other studies which reported 22.7% sensory disturbances.<sup>27</sup>

## Conclusions

This comparative study suggests that the iliac crest and mandible both provide adequate correction for alveolar bone grafting, with acceptable complication rate. However, the use of mandible for grafting offers the advantage of reduced hospitalization along with early healing of the donor site.

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