Case Report

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Alveolar cleft reconstruction using iliac bone graft: a clinical case report

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Introduction and importance: Alveolar clefts are frequently occurring congenital anomalies that can significantly impact both the functional and aesthetic aspects of an individual's life. Thus, reducing the quality of life. These clefts can give rise to difficulties in feeding, speech, and dental development. Furthermore, the presence of a gap in the alveolar ridge can disrupt the proper alignment and eruption of permanent teeth. Various techniques have been developed to effectively repair these defects and restore oral function and rehabilitation.

Case presentation: An 18-year-old girl is presented with unilateral alveolar cleft which was successfully repaired by utilizing iliac bone grafting and augmenting the defect to restore proper bone architecture and gain suitable support for dental prostheses. Therefore, enhancing oral health by closing the oronasal fistula and improving aesthetics and functional abilities including speech.

Clinical discussion: Having an alveolar cleft can lead to challenges which may require a multidisciplinary approach, including surgical intervention, orthodontic treatment, and dental rehabilitation. The primary goal is to close the cleft, restore normal speech and feeding functions, and promote proper dental development.

Conclusion: Patients who suffer from alveolar clefts need appropriate treatment. This case report suggests a surgical technique of utilizing the combination of hard and soft tissue management to fix the problem for such individuals and achieve improved oral health, speech, and overall enhancement in quality of life.

Keywords: alveolar bone cleft, alveolar bone grafting, case report, iliac bone graft, oronasal fistula

Introduction

Cleft lip and palate are a prevalent craniofacial deformity, being the most common congenital anomaly of this nature. The prevalence of this condition varies among populations, with the highest occurrence observed in Indians and Native Americans, affecting 3–4 children per 1000 births. In contrast, Caucasians experience a lower incidence, with cleft defects affecting 1–2 newborns per 1000 births[1,2].

The incomplete fusion of facial prominences between the fourth and tenth week of gestation is the underlying cause of clefts. The specific prominence affected determines the type of cleft, which can manifest as either a primary or secondary palate cleft. A primary palate cleft involves a cleft in the lip, alveolus, and a small portion of the hard palate. In contrast, a secondary palate cleft encompasses the remaining sections of the hard and soft palate, extending from the incisal foramen[3].

HIGHLIGHTS

- Iliac bone is a great source of bony graft to be used in augmenting alveolar bone cleft.
- The osteogenesis advantage of this graft is very important in generating sufficient bone for later placement of dental implant.
- The advantage of grafting such cleft makes a huge difference upon restoring the contour of alveolar bone and the support for soft tissues.
- The combination of hard and soft tissue management in such cases improves the quality of clinical results.

The utilization of bone graft for alveolar cleft reconstruction was initially documented by von Eiselsberg[4] in 1901.

Later, in 1914, Drachter[5] introduced a similar technique using grafts from the tibial bone.

Between 4 and 12 weeks of gestation, the palate forms from the frontonasal and maxillary prominences. From gestational weeks 4–7, the median palatine process, derived from the frontonasal prominence, gives rise to the primary palate. This developmental process also involves the formation of the lip, alveolus, and the hard palate in front of the incisive foramen. If there are disruptions during this period, it can lead to the development of clefts in the primary palate. Between 7 and 12 weeks of gestation, the secondary palate forms from the lateral palatine processes, which arise from the maxillary prominences. This developmental process gives rise to the posterior portion of the hard palate, as well as the soft palate. Disruptions occurring during this period can lead to the development of clefts in the secondary palate. The alveolus, which is part of the primary palate, can develop with a cleft when there is a failure of normal formation of the frontonasal

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prominence. This condition is closely associated with both cleft lip and cleft palate. Typically, alveolar clefts are found between the lateral incisor and the canine teeth[6].

The introduction of alveolar bone grafting by Boyne and Sand in 1972[7] has made it a standard procedure for most clinical cases. The primary objectives of this procedure are:

(1) to create an environment where the canine or lateral incisor can naturally erupt or be guided orthodontically into the cleft area[8].
(2) to maintain the necessary bony support for the teeth adjacent to the cleft and prevent the collapse of the alveolar segments[9].
(3) facilitating the closure of oronasal fistulas[9].
(4) providing support for the alar base and nose[9].
(5) enhancing speech, articulation, and reducing nasality[10].

Currently, the iliac crest bone is highly regarded as the top choice because of its ability to provide abundant amounts of cancellous bone with endochondral potential. This makes it an excellent option for reconstructing large alveolar defects[11].

The work has been reported in line with the SCARE criteria[12].

This study is registered with the Research Registry by the identifying number: researchregistry9493 and the reference hyperlink is: https://www.researchregistry.com/browse-the-registry#home/

Case presentation

An 18-year-old girl presented to The University Hospital. The chief complaint was food and liquid leakage to the nose, which negatively affected the quality of life. The girl underwent an unsuccessful surgical procedure to fix the alveolar cleft when she was 10 years old. The previous surgical procedure included the use of β- tricalcium phosphate graft material to repair the alveolar cleft. Unfortunately, augmentation failed and the oronasal fistula continued to permit leakage of food and liquid to the nasal cavity. The patient did not have any drug history. No allergies and/or adverse reactions were detected. Laboratory testing showed normal values. Intraoral examination revealed a clear oronasal fistula at the site of the lateral incisor accompanying a very bad smell. Figure 1.

Extraoral examination showed residual scars on the upper lip and asymmetry of the vermilion border on both sides. Figure 2.

No history of a similar case was recorded in her family.

According to cone-beam computed tomography scan, the absence of the lateral incisor with a huge discontinuity of the maxillary alveolar ridge was observed. Figure 3.

The surgical procedure was done by the author under general anaesthesia. The recipient site was infiltrated by 2% lidocaine with 1:200 000 epinephrine. The incision was made along the cleft side at the labial and palatal aspects. Labial sulcular incision was extended to include four teeth on each side of the cleft. Two releasing incisions were made to ensure sufficient release of the flaps.

The palatal sulcular incision was extended to three teeth on each side of the cleft.

Full thickness flaps were raised buccally and palatally. Thus, the oronasal fistula was clearly isolated from the flaps and bone of adjacent teeth. Figure 4.

An incision was made to split the fistula into buccal and palatal parts. Subsequently, allowing of rotation of the fistula liner towards the nasal cavity for reconstruction of the nasal floor. Thus, preparing the graft recipient site. Evaluation of nasal cavity closure was checked by saline through the nostril of the noncleft side.

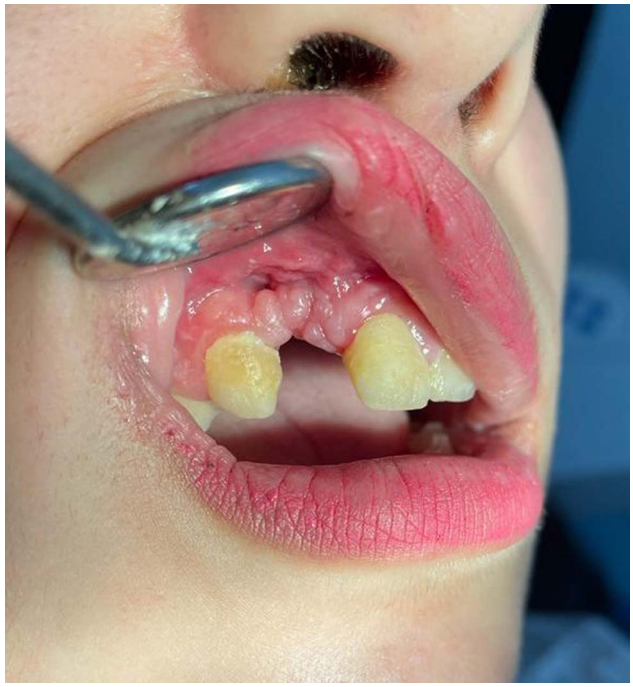

Figure 1. Intraoral examination showing oronasal fistula at the site of upper right lateral incisor.

Next, iliac bone harvesting began by making an incision on the skin 2 cm posterior to the anterosuperior iliac spine. The incision was 3–4 cm parallel to the iliac crest, aiming to avoid damage of the lateral femoral cutaneous nerve. Exposing of the iliac crest continued by removal of the periosteum allowing to remove the graft using a disk under copious irrigation and a chisel. Figure 5.

Therefore, the cancellous bone was harvested using a curette.

Figure 2. Extraoral examination showing scars of previous surgical procedure and the unregular vermilion border.

Figure 3. Coronal cone-beam computed tomography scan showing absence of lateral incisor with a big defect.

Closure of the wound was done after placing a haemostatic sponge (Gelfoam-Pfizer). Interrupted sutures were placed to close the wound in two layers. (Periosteal layer was closed using vicryl 4/0 SURGIReal and skin was closed using 5/0 nylon SURGIReal).

The harvested thick block was shaped to fit in the recipient site. The cortex was facing the buccal aspect and cancellous bone towards the palatal aspect. Fixation was done by screws and harvested cancellous bone chips were adapted into the residual spaces.

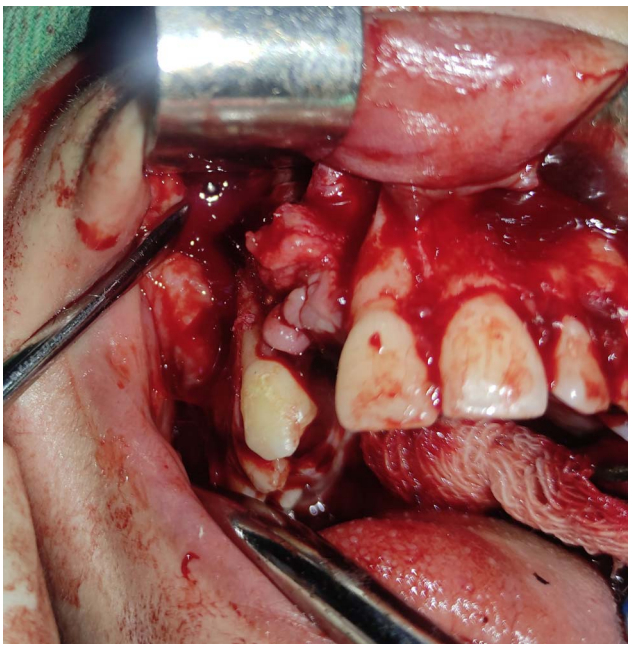

Figure 4. Isolated oronasal fistula after raising full thickness flaps.

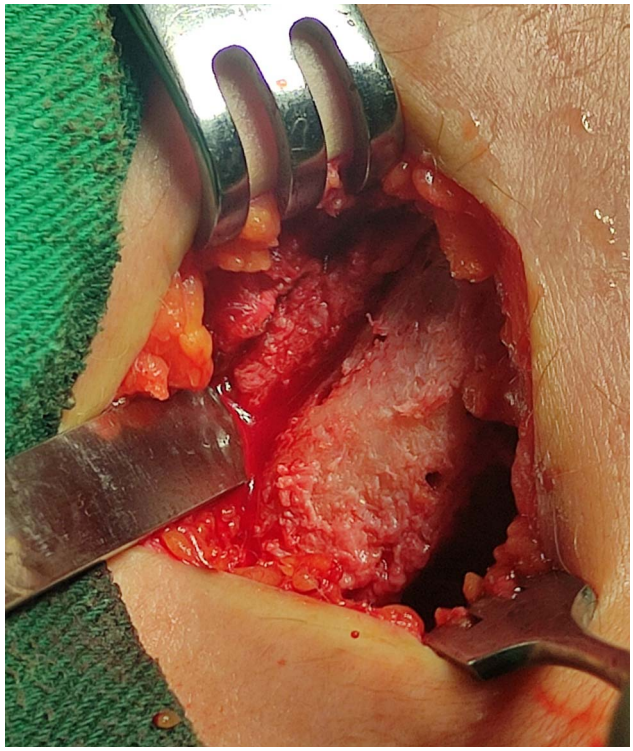

Figure 5. Iliac crest exposure and bone block harvesting.

Advanced-platelet-rich fibrin was prepared to be used as a membrane coating the grafting area before suturing the wound by placing interrupted sutures using 3/0 silk SURGIReal. Figure 6.

Follow-up

The patient was admitted to the hospital for one night. Regular observation was done every 3 days until sutures removal after 14 days of surgical procedure. She was kept on systemic antibiotics for 7 days. Oral feeding included full liquids for the first week and soft foods for the second week. The patient presented very good oral health care, leading to ideal healing.

All complaints regarding liquid and food leakage to the nasal cavity disappeared after surgery, as well as the mouth's bad smell on the 14th day. A cone-beam computed tomography scan was done 3 months postoperatively to check on the status of the graft. Figure 7.

Discussion

The repair of alveolar cleft defects has been a topic of significant interest and research in the field of oral and maxillofacial surgery. Cleft lip and palate are recognized as the most common congenital craniofacial birth malformation, ranking second in terms of prevalence among all congenital malformations of the human body after clubfoot[13].

The role of alveolar bone grafting is crucial in the treatment of patients with cleft lip and palate who have alveolar clefts. The primary objectives of alveolar bone grafting encompass ensuring a continuous dental arch, closing oronasal fistulae, correcting

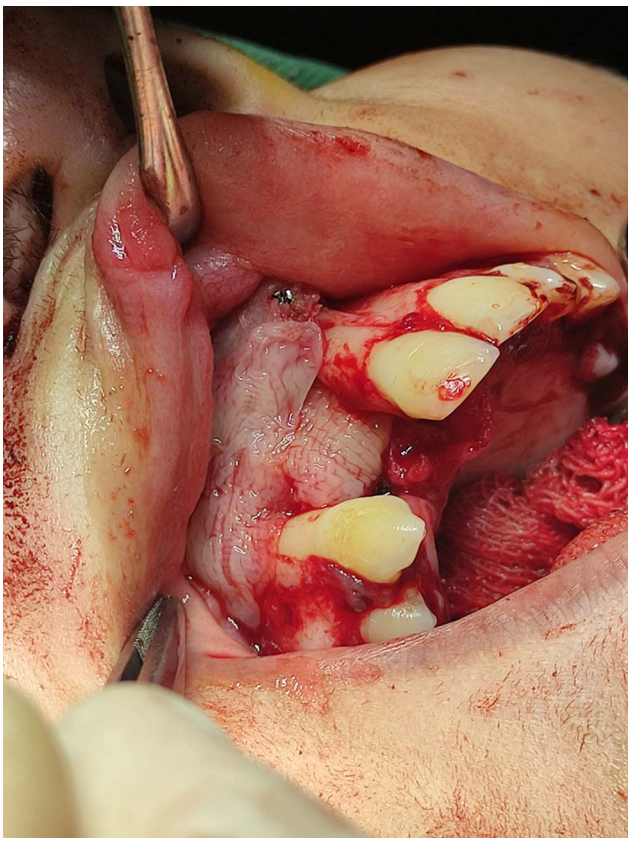

Figure 6. Bone block fixation by screws and adaptation of cancellous bone to the defect site.

nasal alar bases, and facilitating tooth movement and dental implant placement[6].

Considering the numerous donor sites documented in the literature, such as the tibia, rib, calvarium, and mandibular symphysis, our preference for the iliac bone graft was based on its abundant quantity and the presence of osteogenic cells within the cancellous bone. These factors contribute to the prompt vascularization of the graft[14].

A literature review was conducted to assess and compare various biomaterials used in surgeries to close palatal and alveolar clefts as alternatives to using autografts alone. The study found that combining autogenous bone with deproteinized bovine bone or β- tricalcium phosphate significantly reduced the need for harvesting bone from the iliac crest, minimized patient morbidity and hospitalization. On the other hand, the use of bovine hydroxyapatite alone resulted in lower bone density compared to that achieved with autogenous bone[15].

A systematic review was conducted to assess the effectiveness of autologous and alloplastic grafts in children with cleft lip and palate, with a follow-up period of 6 months and/or 1 year. Each randomized controlled trial included in the review utilized iliac bone as the autologous donor site material, and rhBMP-2 was used as the alloplastic material. The analysis of alveolar bone height and volume relied on three-dimensional radiographic evaluation using computed tomography, which was determined to be the only reliable and preferred method. The comparison of bone volume between autologous and alloplastic bone grafts after a 6-month follow-up revealed statistically significant results that favored the autologous approach over the rhBMP-2 graft[16].

Despite significant advancements and enhancements in surgical techniques, the question of the optimal source of bone graft

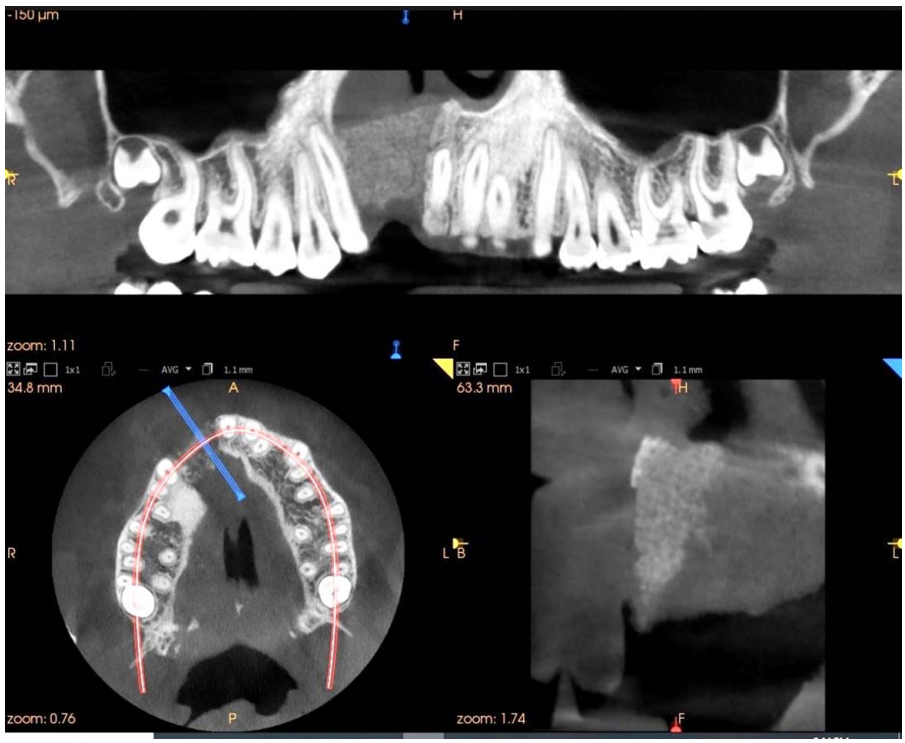

Figure 7. Postoperative cone-beam computed tomography scan.

material continues to be a subject of ongoing debate and controversy[17].

In this clinical case, the chosen grafting technique focuses on the advantages of rigid fixation of the cortical layer, which was oriented buccally to cover the cleft margins. This approach plays a fundamental role in preventing the migration of soft tissue into the graft space[18].

On the other hand, the cancellous part of the harvested graft allowed accelerated vascularization and healing[16].

Platelet-rich fibrin contains beneficial components found in a blood sample, such as a high number of platelets and leucocyte cytokines[19].

These concentrated platelets are rich in various growth factors like platelet- derived growth factor, transforming growth factor-β, insulin-like growth factor, epidermal growth factor, fibroblast growth factor, and bone morphogenic protein. These growth factors are instrumental in angiogenesis, proliferation and differentiation of osteoblasts, and haemostasis, making platelet rich fibrin invaluable. Therefore, the fibrin network created by platelet rich fibrin at the regenerative site aids in cellular migration, promotes the formation of new blood vessels, and enhances the survival of the graft[20].

This case report demonstrates a novel technique for repairing alveolar clefts, incorporating the benefits of previous studies into a single clinical case. While previous studies have highlighted the use of iliac bone graft as a rich source of graft material, this case illustrates a simplified approach using a block graft technique. While graft material selection has been extensively discussed in prior research, proper preparation of the recipient site is crucial. The closure of the nasal cavity is a key aspect for ensuring graft stability, and in this case, the fistula is dissected into buccal and palatal flaps, facilitating a watertight closure of the nasal cavity. Additionally, the use of advanced-platelet-rich fibrin is employed to enhance the grafting outcomes, further supporting the advantages of autogenous grafting.

This clinical case had certain limitations, including the absence of histological examination to provide comprehensive information about the quality of bone in the augmented area. Furthermore, the follow-up period was relatively short, which limited the assessment of bone loss over time.

The treatment protocol suggested in this clinical case resulted in a successful outcome, as demonstrated by the cone-beam computed tomography scan, disappearance of the oronasal fistula, and the continuity of alveolar bone of the maxilla, making it possible to restore the lost lateral incisor in the future by inserting a dental implant.

Conclusion

Alveolar bone grafting is considered an essential cornerstone in oral surgery treatments due to its significant impact on oral rehabilitation and its substantial role in enhancing the quality of patients' life. A plethora of surgical techniques and graft materials were extensively studied and discussed in the field of alveolar cleft repair, and this study proposes a potentially effective solution to reach long-lasting and satisfactory results.

Patient perspective

The patient realized the importance of this surgical intervention to obtain satisfying results for aesthetic and functional aims.

Ethical approval

Board Name: Scientific Research Board Resolution- Tishreen university, latakia, Syria.
Board Status: Approved Approval no. 1488/2022 (6.10.2022).

Consent

Written informed consent was obtained from the patient for publication of this study and accompanying images, a copy of the written consent is available for review by the Editor-in-Chief of Journal of Oral & Maxillofacial Surgery.

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Author contribution

N.S., MSc in oral and maxillofacial surgery. The author of the manuscript including performing the surgical procedure, writing, discussion.

Conflicts of interest disclosure

The author declares that there is no conflict of interest.

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Guarantor

Nadim Sleman.

Data availability statement

All data are available upon request.

Provenance and peer review

Not commissioned, externally peer-reviewed.

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