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RESEARCH ARTICLE

ASSESSMENT OF SECONDARY ALVEOLAR BONE GRAFTUSING TWO-DIMENSIONAL RADIOGRAPHIC SCALES: A LITERATURE REVIEW

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ABSTRACT

Secondary alveolar bone grafting (SABG) is an essential component of treating cleft lip and alveolus and cleft lip and palate. Alveolar cleft repair involves creating a bony bridge to restore maxillary continuity.One of the main success factors for this bony bridge is its dimensions, which are assessed radiographically using specific scales. The results of SABG treatment influence where teeth should be placed in the cleft; in cases where a tooth is lost, they assist specialists in determining whether to close the gap or restore the missing tooth. X-ray images are used to assess the results of the treatment. This literature review aims to assess the various radiographic scales for evaluating alveolar cleft repair and analyse their key properties.The most well-known is the Bergland scale. The literature also suggests the Enemark, Long, Kindelan, Chelsea, and SWAG scales.All of them use periapical or occlusal x-rays to determine the height of the bony bridge or the degree of bone fill in the cleft area.

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INTRODUCTION

The most prevalent congenital disorders affecting the craniofacial region are cleft lips and palates (CLP). Tissue hypoplasia in the affected area and a partial or total lack of anatomical tissue continuity are traits common to clefts. Cleft patient treatment is an intricate process that requires many years of care. When a patient has mixed dentition(pre-adolescence), secondary alveolar bone grafts, or SABG, are done. Boyne and Sands originally published a description of this technique in 1972. (1)There are two types of secondary grafting, depending on when the procedure is done: early secondary grafting, which is done before the permanent lateral incisors erupt, and late secondary grafting, which is done after the canine roots have grown to half to one-third of their length. The best results from SABG are obtained when the bone has been functionally loaded and the lateral incisors or canines have erupted through the transplant. (2)–(4). The goal of autogenous bone grafting is to stabilize the dental arch by closing the oronasal fistula and achieving anatomical tissue continuity in the maxillary alveolar process (especially in bilateral clefts). In addition, the transplanted bone gives the nasal alae bony support, which enhances the symmetry of the nose. (1). The results of SABG treatment influence where teeth should be placed in the cleft; in cases where a tooth is lost, they assist specialists in determining whether to close the gap or restore the missing tooth. X-ray images are used to assess the results of the treatment. Two-dimensional pictures were used in the past. Abyholm et al. (1981) (1) created the first scale for evaluating SABG treatment outcomes, which served as the foundation for all later techniques utilizing 2D images.

New techniques for the qualitative and quantitative evaluation of bone grafting have been made possible by the development of 3D X-ray diagnostics. The purpose of this literature review is to present the radiographic success scales that have been proposed for the assessment of alveolar cleft repair and to analyze the qualities that these scales should have.

Scales based on plain radiographs

The 1980s saw the introduction of the first radiographic scales, which were based on measurements made on simple intraoral x-rays. (5)–(7). They became widely used in the scientific community over time. They are now regarded as the primary method of assessing the outcome of the repair of an alveolar cleft (8)–(10). Below is a review of the plain radiograph-based success scales:

Radioghraphic assessment by Abyholm et al The first grading system for assessing the success of bone grafting procedures on 2D radiographs (periapical radiograph) was proposed by Abyholm(5). A four-point scale was developed, with grade I

denoting approximately normal septum height, grade II denoting at least ¾ of normal height, grade III denoting less than ¾ of normal height, and failure denoting the absence of a continuous bone bridge.

Bergland scale: The easy clinical application has kept it the most well-known scale to this day. It was initially reported in Abyholm, Bergland, and Semb's (1981) preliminary study from the University of Oslo(5). However, this grading system was popularizedby Bergland et al (11)as Oslo grading system.Theydemonstrated the benefits the of the scale in numerous instances in 1986 (12). The scale was named after Professor Bergland by researchers as a result of this significant publication. This scale measures the height of the bone interdental septum in the repaired cleft area based on the necks of the surrounding teeth (canine and lateral or central incisor). It is based on periapical or occlusal x-rays. Following the assessment, each case is categorized into a single category (semiquantitative estimation), as shown in Table 1.

Table I. Bergland Scale

Types I and II being satisfactory outcomes and Types III and IV being unsatisfactory.
Type I: Interdental septum height is almost normal (<25% of bone resorption).
Type II: Interdental septum height is equal to or greater than ¾ of the normal height (bone resorption 25%–50%).
Type III: Interdental septum height is less than ¾ of the normal height (bone resorption 50%–75%).
Type IV: Bone graft failure; no continuous bony bridge is visible across the cleft (bone resorption ≥75%)

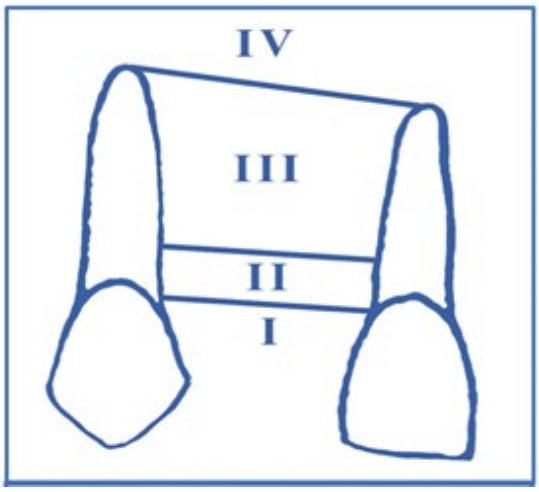

Figure 1. schematic representation of the Bergland Scale

A threshold of 75% of normal bone height (types I and II) is thought to be necessary for a clinically satisfactory outcome. It is believed that this bone level is required to support the neighbouring teeth's roots during their orthodontic movements(12). Although widely used, the Bergland scale has two main deficiencies. Firstly, the scale is assumed to be used following the eruption or guidance of a tooth in the cleft region; as a result, it cannot be used to evaluate the success or failure of a graft in a mixed dentition or in situations where a tooth is missing in the cleft region(13). Secondly, this also does not assess the amount of bone at the most apical region of the cleft. Even in cases where there is no bony bridge in the middle or apical part of the roots, resulting in the expansion of the nasal cavity, an operated case with a relatively normal cervical bone level is considered successful(13).To overcome the above deficiency, modifications of the Bergland scale have been proposed to assess the apical part as well by Hynes and Earley in 2003(14) and Semb et al., 2011(15)but are not well accepted still.(Table I) (Figure 1)

Enemark Scale: It was put forth by Enemark et al. (1987)(6), and it is very similar to the Bergland scale. Before the evaluation, both scales demand that all tooth movements be completed. Moreover, the bone level in the cleft that was surgically repaired is comparable to the adjacent teeth's necks only. The Enemark scale divides the bone height equally among the categories, in contrast to the Bergland scale. Table 2 displays the categories.Although the Enemark scale is easily recognized in the literature, some authors (16)–(18)refer to it under different names or see it as a modification of the Abyholm and Bergland scale. Furthermore, a number of researchers (16)–(18) have arbitrarily set the 50% of normal height (scores 1 and 2) as the threshold for a successful outcome. (Table II) (Figure 2)

Table II. Enemark scale

Scores 1 and 2 correspond to successful results.
Score 1: Bone level at 75-100% of normal height
Score 2: Bone level at 50-75% of normal height
Score 3: Bone level at 25-50% of normal height
Score 4: Bone level at 0-25% of normal height

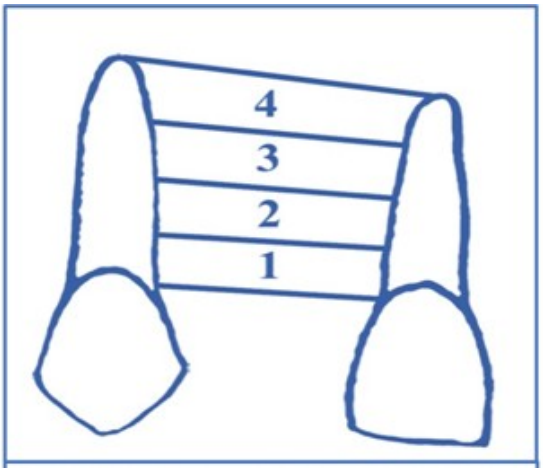

Figure 2. Schematic representation of the Enemark Scale

Long Scale: It was suggested by Long et al. (1995) (19)as a revision to Helms et al.'s (7)evaluation methodology. The scale assesses the architecture of the bones in the operated cleft and is based on periapical or occlusal x-rays. As shown in Table 3, this is achieved by computing several ratios between the height of the bony bridge and the root length of the neighbouring teeth. Despite the lack of category classification, the Long scale offers success criteria for the cases. The existence of a bony bridge indicates success, and the extension of the bone notching to the apices or the lack of bone support on the root next to the cleft indicates failure, according to Long et al. (1995)(19). Subsequently, Aurouze et al. (2000) (20)proposed that a case should only be deemed successful if all ratios were normal, thereby enforcing the success criteria. Both the coronal and apical portions of the bony bridge's morphology are thoroughly described by the Long scale. In addition, an effort is made to rectify the intraoral x-ray image elongation using a variety of computations, the root lengths of the adjacent teeth serving as the denominator of each ratio. The measurements

can be taken at any tooth that is distal to the cleft, and the authors state that the evaluation does not require the canine to erupt(19), (20). Conversely, an excessively complex approach to evaluation leads to a challenging clinical implementation of the criterion (13), (21). (Table III) (Figure 3)

Table III: Long scale

Lengths measured	**A: proximal segment root**
	B: bone attachment along the distal surface
	of the proximal segment root
	C: distance from the alveolar crest bone on the distal surface
	of the proximal segment root to the cementoenamel junction
	D: notching of the alveolar bone
	E: distal segment root
	F: bone attachment along the mesial surfaceof the distal segment root
	G: distance from the alveolar crest bone on the mesial surfaceof the distal segment root to the cementoenamel junction
Ratios evaluated	B/A (normal value 1)
	C/A (normal value 0)
	D/A (normal value 0)
	F/E (normal value 1)
	G/E (normal value 0)
The presence of a bony bridge between the adjacent teeth (B>0, F>0 and D<A) correspond to a successful result.	

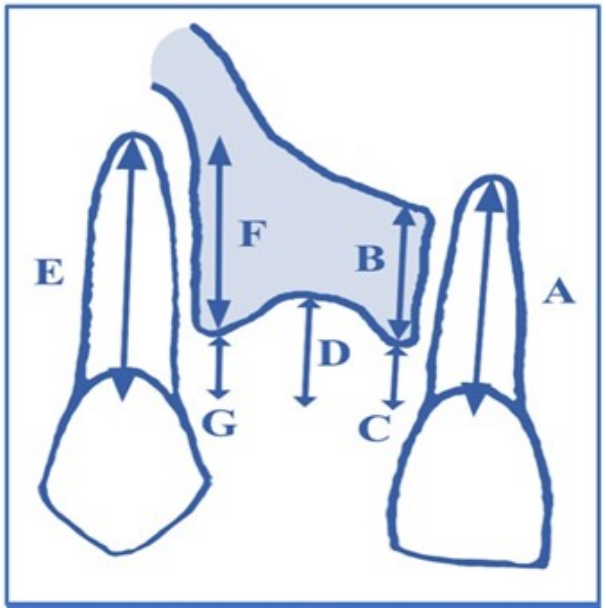

Figure 3. Schematic representation of the long Scale

Kindelan Scale: It was first suggested by Kindelan et al. (1997) (22), and researchers in the UK frequently use it.(23)This scale evaluates the percentage of bone fill by comparing pre- and post-operative occlusal radiographs. The evaluation is independent of and does not consider the adjacent teeth next and it is not necessary for them to erupt. Table 4 displays the categories on the scale.According to several studies (9), (23), (24)the 50% of bone fill (grades 1 and 2) is the arbitrary cut-off point for a successful outcome. A successful case, according to Revington et al. (2010)(24), also necessitates the presence of a bony layer at the apices of the teeth on either side. Among the drawbacks of the Kindelan scale are the requirement for a pre-operative x-ray and the lack of information regarding the bony bridge's location (13). (Table IV) (Figure 4)

Table IV: Kindelan scale

Grade 1: Bone fill in >75% of the alveolar cleft area
Grade 2: Bone fill in 50-75% of the alveolar cleft area
Grade 3: Bone fill in <50% of the alveolar cleft area
Grade 4: No complete bony bridge
Grades 1 and 2 correspond to successful results.

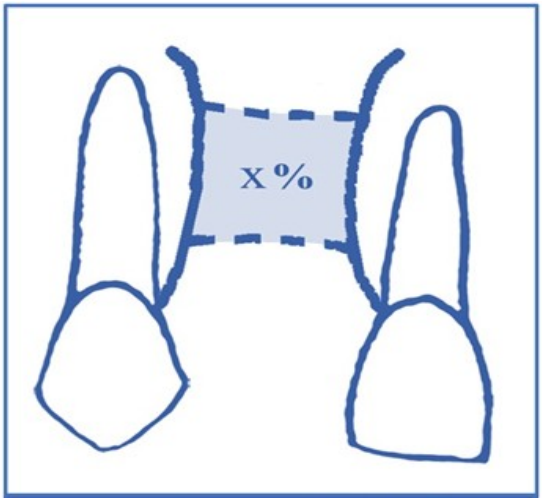

Figure 4. Schematic representation of the kindelan scale

Chelsea Scale: Witherow et al. (2002)(13) from the Chelsea and Westminster Cleft and Craniofacial Unit proposed it. The scale provides comprehensive information on the architecture of the bony bridge in the operated alveolar cleft and is based on periapical or occlusal x-rays.The adjacent teeth's roots are initially split into four quarters, with the region being divided vertically by an imaginary line. Next, the bone is evaluated, and as shown schematically in Figure 5, each quarter of a root is given a score of 0 (no bone), 0.5 (bone present but not reaching the midline), or 1 (bone present but reaching the midline). Based on the six categories shown in Table 5, each case is categorized. Witherow et al. (2002)(13)state that the presence of bone tissue at the cervical quarter of adjacent teeth (groups A and B) or across at least 75% of the cleft roots from an apical direction (group C) determines the success of the procedure. However, it is unlikely that cases (group B) with a bony bridge located directly at the cervical quarter should be regarded as successful or acceptable.(25)–(27)The coronal and apical sections of the bony bridge's morphology are described in detail by the Chelsea scale. According to the authors, measurements can be taken at any tooth distal to the cleft during the mixed dentition, and the evaluation is not dependent on the canine erupting. However, the scale's application is challenging and complex(21). (Table V) (Figure 5)

Table V. Chelsea scale

Group A: Presence of bone tissue at the amelocemental junction and at least 75% of both roots covered with bone
Group B: Presence of bone tissue in the amelocemental junction and in at least 25% of both roots
Group C: Presence of bone tissue across at least 75% of the cleft roots from an apical direction
Group D: Presence of bone tissue across at least 50% of both roots from an apical to coronal direction
Group E: Presence of a bony bridge in any area of the cleft except apically and coronally
Group F: Presence of bone tissue 25% or less across both roots from an apical direction
Groups A, B and C correspond to satisfactory results.

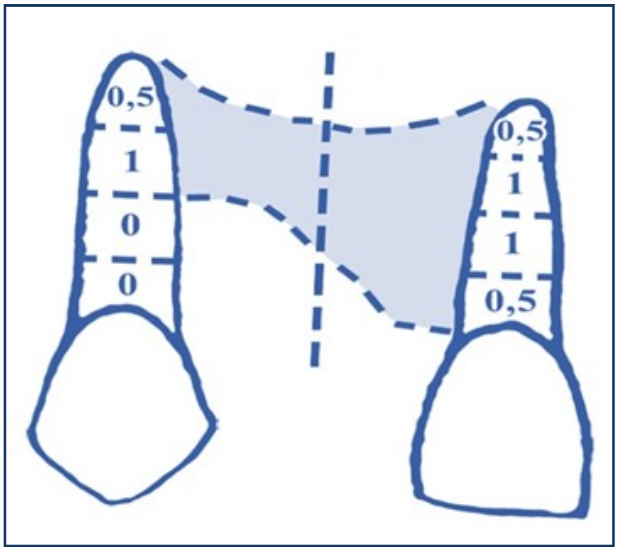

Figure 5. Schematic representation of the Chelsea scale

SWAG Scale: The Standardized Way to Assess Grafts - SWAG scale was developed by the Americleft project in North America (10), (21), (28). The aim of the Americleft project is to outline the essential components of different protocols that are linked to positive results and to highlight the anticipated benefits of team care for patients with clefts. Based on periapical or occlusal x-rays, the SWAG scale was developed.In order to assign a score of 0 (absence of bony bridge with exposed tooth roots), 1 (absence of bony bridge with bone covering of tooth roots), or 2 (presence of bony bridge), the bone tissue is independently assessed in each of the three areas of the cleft site (apical, middle, and coronal). Table 6 shows the total score for each case, which ranges from 0 (failed graft with poor re-graft prognosis) to 6 (completely filled cleft site with normal alveolar bone height), based on the sum of the scores of all thirds.

Table VI. SWAG scale

Score 0:	**No bone bridge; permanent tooth roots exposed in cleft site**
Score 1:	No bone bridge; no permanent tooth roots exposed in cleft site
Score 2:	Bone bridge present in a cleft third; permanent tooth roots exposed in both other thirds (cleft site filled less than 1/2)
Score 3:	Bone bridge present in a cleft third; permanent tooth roots exposed in one of the remaining thirds (cleft site filled less than 1/2)
Score 4:	Bone bridge present in a cleft third; no permanent tooth roots exposed in both other thirds (cleft site filled less than 1/2) or Bone bridge present in two of the cleft thirds; permanent tooth roots exposed in the remaining third (cleft site filled more than 1/2)
Score 5:	Bone bridge present in two of the cleft thirds; no permanent tooth roots exposed in the remaining third (cleft site filled more than 1/2)
Score 6:	Complete bone fill-in; definitely more than 2/3 cleft site filled including up to and beyond actual or projected root apices

Scores 5 and 6 correspond to totally successful results

A bony bridge is present in at least two thirds of the cleft site in cases with a score of 5 or 6, and there are no exposed permanent tooth roots. These cases are presumed completely successful, according to Ruppel et al. (2016). The alveolar bone throughout the cleft site is assessed using the SWAG

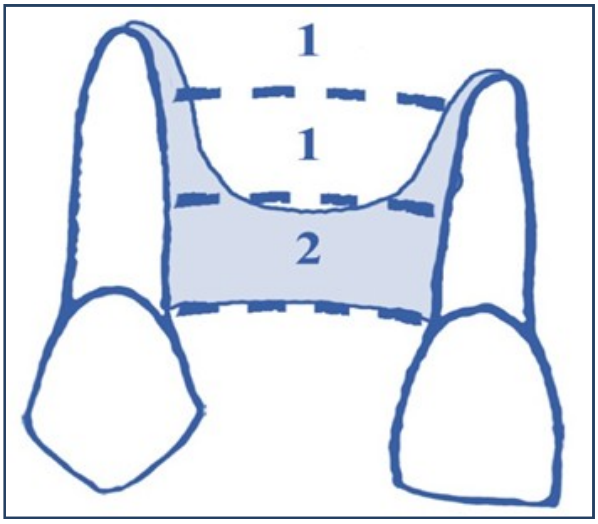

Figure 6. Schematic representation of the SWAG scale

scale, both apically and coronally. Because the thirds relate to the cleft site and not the adjacent teeth, the assessment can be done during the mixed dentition. Additionally, by assessing the bone coverage of the adjacent teeth, the scale offers a relative prognosis for regrafting. In comparison to cases with scores of 1 or 2, those with a total score of 3 or 4 are thought to have a better prognosis for regrafting (21). The SWAG scale's application may be more challenging than others, even though it doesn't require any unique measurements. (Table VI) (Figure 6). Below is a summary of each scale's benefits and drawbacks based on plain radiographs and the qualities that these scalesought to have:

Simple: An easy clinical application is crucial for widespread usage of the scale. The Bergland scale outperforms other complex scales, demonstrating its effectiveness.

Reproducible: For the Bergland, Kindelan, Chelsea, and SWAG scales, reproducability between the same or different assessors is typically regarded as excellent (18-20)

Assessment of the bone across the cleft site's height: Newer scales assess bone levels both coronally and apically, whereas older ones just assessed coronally.Bone deficits in the middle or apical third of neighbouring roots can impact orthodontic mobility and implant placement. (5,21)

Clear outcome criteria: Except for the Long scale, all agree that a bone bridge alone is insufficient.A case with a marginal bone level below 50% of normal height or bone fill below 50% of the shortfall is unlikely to be effective. Most scales, except Enemark and Chelsea, have a separate category for the absence of bony bridge.

Relevance in both mixed and permanent dentition: The challenge is that the canine typically erupts many years after grafting, and the dimensions are typically taken with respect to the teeth that are next to the cleft area. Since the Kindelan scale assesses the bone fill of the deficiency, it is the only one that is unaffected by the nearby teeth. Conversely, the Long and Chelsea scales are used irrespective of the kind of teeth that are next to each other. Even after the canine's eruption, the outcome is unlikely to change substantially, according to Witherow et al. (2002). (4)The SWAG scale evaluates the bony bridge in each third of the cleft site, with the highest limit

uncertain. At the same time, it assesses tooth root exposure, creating confusion. Some studies apply the Bergland scale in mixed dentition, despite its intended use only after all orthodontic movements are accomplished.(26), (29)

CONCLUSIONS

- Successful outcome measures for alveolar cleft repair rely heavily on plain radiographs, with the Bergland scale being the most well recognised.
- These two-dimensional radiographic scales should be straightforward and reproducible, assessing the entire height of the cleft site in both mixed and permanent dentition, with a clear success criterion.

REFERENCES

1. Boyne P. J. and N. R. Sands, 1972. "Secondary bone grafting of residual alveolar and palatal clefts.," *J. Oral Surg.*, vol. 30, no. 2, pp. 87–92, Feb.
2. Tai, C. C. E. I. S. Sutherland, and L. McFadden, 2000. "Prospective analysis of secondary alveolar bone grafting using computed tomography," *J. Oral Maxillofac. Surg.*, vol. 58, no. 11, pp. 1241–1249.
3. Dempf, R. T. Teltzrow, F.-J. Kramer, and J.-E. Hausamen, 2002. "Alveolar bone grafting in patients with complete clefts: a comparative study between secondary and tertiary bone grafting," *Cleft Palate. Craniofac. J.*, vol. 39, no. 1, pp. 18–25, Jan.
4. Feichtinger, M. R. Mossböck, and H. Kärcher, 2007. "Assessment of bone resorption after secondary alveolar grafting using three-dimensional computed tomography: A three-year study," *Cleft Palate-Craniofacial J.*, vol. 44, no. 2, pp. 142–148, Mar.
5. Åbyholm, F. E. O. Bergland, and G. Semb, 1981."Secondary bone grafting of alveolar clefts. A surgical/orthodontic treatment enabling a non-prosthodontic rehabilitation in cleft lip and palate patients," *Scand. J. Plast. Reconstr. Surg.*, vol. 15, no. 2, pp. 127–140.
6. Enemark, H. S. Sindet-Pedersen, and M. Bundgaard, 1987. "Long-term results after secondary bone grafting of alveolar clefts," *J. Oral Maxillofac. Surg.*, vol. 45, no. 11, pp. 913–918, Nov.
7. Helms, J. A. T. Michael Speidel, and K. L. Denis, 1987. "Effect of timing on long-term clinical success of alveolar cleft bone grafts," *Am. J. Orthod. Dentofac. Orthop.*, vol. 92, no. 3, pp. 232–240, Sep.
8. Han K. *et al.*, 2017. "Long-term results of secondary alveolar bone grafting using a technique to harvest pure calvarial cancellous bone: Evaluation based on plain radiography and computed tomography," *J. Plast. Reconstr. Aesthetic Surg.*, vol. 70, no. 3, pp. 352–359, Mar.
9. Kumar, R. A. Heggie, J. Shand, S. Dominguez-Gonzalez, N. Kilpatrick, and J. Shah, 2017. "Secondary bone grafting of alveolar clefts: a review of outcome at two centres in Australia and the UK," *Br. J. Oral Maxillofac. Surg.*, vol. 55, no. 5, pp. 496–499, Jun. 2017.
10. Russell K. *et al.* 2017. "Reliability of the SWAG—The Standardized Way to Assess Grafts Method for Alveolar Bone Grafting in Patients with Cleft Lip and Palate," *Cleft Palate Craniofacial J.*, vol. 54, no. 6, pp. 680–686, Nov. 2017.
11. Bergland, O. G. Semb, and F. E. Aabyholm, "Elimination of the residual alveolar cleft by secondary bone grafting and subsequent orthodontic treatment," *Cleft Palate J.*, vol. 23, no. 3, pp. 175–205, 1986.
12. Bergland, O. G. Semb, F. Abyholm, H. Borchgrevink, and G. Eskeland, "Secondary bone grafting and orthodontic treatment in patients with bilateral complete clefts of the lip and palate," *Ann. Plast. Surg.*, vol. 17, no. 6, pp. 460–474, 1986.
13. Witherow, H. S. Cox, E. Jones, R. Carr, and N. Waterhouse, "A new scale to assess radiographic success of secondary alveolar bone grafts," *Cleft Palate. Craniofac. J.*, vol. 39, no. 3, pp. 255–260, May 2002.
14. Hynes P. J.and M. J. Earley, "Assessment of secondary alveolar bone grafting using a modification of the Bergland grading system," *Br. J. Plast. Surg.*, vol. 56, no. 7, pp. 630–636, 2003.
15. Semb, G. E. Rønning, and F. Åbyholm, "Twenty-Year Follow-Up of 50 Consecutive Patients Born with Unilateral Complete Cleft Lip and Palate Treated by the Oslo Cleft Team, Norway," *Semin. Orthod.*, vol. 17, no. 3, pp. 207–224, Sep. 2011.
16. Opitz, C. B. Meier, C. Stoll, and D. Subklew, "Radiographic evaluation of the transplant bone height in patients with clefts of the lip/alveolus/palate after secondary bone grafting," *J. Orofac. Orthop.*, vol. 60, no. 6, pp. 383–391, 1999.
17. Schultze-Mosgau, S. E. Nkenke, A. K. Schlegel, U. Hirschfelder, and J. Wiltfang, "Analysis of Bone Resorption After Secondary Alveolar Cleft Bone Grafts Before and After Canine Eruption in Connection With Orthodontic Gap Closure or Prosthodontic Treatment," *J. Oral Maxillofac. Surg.*, vol. 61, no. 11, pp. 1245–1248, 2003.
18. BAYERLEIN, T. P. PROFF, A. HEINRICH, W. KADUK, N. HOSTEN, and T. GEDRANGE, "Evaluation of bone availability in the cleft area following secondary osteoplasty," *J. Craniomaxillofac. Surg.*, vol. 34 Suppl 2, no. SUPPL. 2, pp. 57–61, Sep. 2006.
19. Long, R. E. B. E. Spangler, and M. Yow, "Cleft width and secondary alveolar bone graft success," *Cleft Palate. Craniofac. J.*, vol. 32, no. 5, pp. 420–427, Sep. 1995.
20. Aurouze, C. K. T. Moller, R. R. Bevis, K. Rehm, and J. Rudney, "The presurgical status of the alveolar cleft and success of secondary bone grafting," *Cleft Palate. Craniofac. J.*, vol. 37, no. 2, pp. 179–184, Mar. 2000.
21. Ruppel J. K. *et al.*, "The Americleft Project: A Comparison of Short- and Longer-Term Secondary Alveolar Bone Graft Outcomes in Two Centers Using the Standardized Way to Assess Grafts Scale," *Cleft Palate. Craniofac. J.*, vol. 53, no. 5, pp. 508–515, 2016.
22. Kindelan, J. D.R. R. Nashed, and M. R. Bromige, "Radiographic assessment of secondary autogenous alveolar bone grafting in cleft lip and palate patients," *Cleft Palate. Craniofac. J.*, vol. 34, no. 3, pp. 195–198, May 1997.
23. Paterson, M. J. Rae, P. Paterson, T. Gilgrass, M. Devlin, and G. McIntyre, "Secondary Alveolar Bone Grafting (CLEFTSiS) 2007-2010," *Cleft Palate. Craniofac. J.*, vol. 53, no. 2, p. 150115125313003, Jan. 2016.
24. Revington, P. J. C. McNamara, S. Mukarram, E. Perera, H. V. Shah, and S. A. Deacon, "Alveolar bone grafting: results of a national outcome study," *Ann. R. Coll. Surg. Engl.*, vol. 92, no. 8, pp. 643–646, Nov. 2010.

25. Trindade, I. K. R. Mazzottini, O. G. Da Silva Filho, I. E. Kiemle Trindade, and M. C. Zindel Deboni, "Long-term radiographic assessment of secondary alveolar bone grafting outcomes in patients with alveolar clefts," *Oral Surg. Oral Med. Oral Pathol. Oral Radiol. Endod.*, vol. 100, no. 3, pp. 271–277, 2005.
26. Peamkaroonrath, C. K. Godfrey, and S. Chatrchaiwiwatana, "New clinical method for alveolar bone graft evaluation in cleft patients: A pilot study," *Cleft Palate-Craniofacial J.*, vol. 48, no. 3, pp. 286–292, May 2011.
27. Maeda, A. S. Uehara, M. Suga, K. Nishihara, N. Nakamura, and S. Miyawaki, "Changes in grafted autogenous bone during edgewise treatment in patients with unilateral cleft lip/palate or alveolus," *Cleft Palate. Craniofac. J.*, vol. 51, no. 5, pp. 525–532, Sep. 2014.
28. Russell K. *et al.*, "A Multicenter Study Using the SWAG Scale to Compare Secondary Alveolar Bone Graft Outcomes for Patients With Cleft Lip and Palate," *Cleft Palate. Craniofac. J.*, vol. 53, no. 2, pp. 180–186, Mar. 2016.
29. Nightingale, C. H. Witherow, F. D. A. Reid, and R. Edler, "Comparative reproducibility of three methods of radiographic assessment of alveolar bone grafting," *Eur. J. Orthod.*, vol. 25, no. 1, pp. 35–41, 2003.

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