The accuracy of cone-beam computed tomography in the evaluation of boney support of teeth among patients with a unilateral cleft of lip and palate among Iraqi Population

Sahar SH Kadhim, B.D.S. M.Sc. (Oral Radiology) [1]

ABSTRACT

Background: To evaluate the bony supports of the teeth adjacent to the area of cleft in patient with unilateral cleft lip and palate and to compare these measurements with the measurements of the same teeth in non-cleft side by using CBCT.

Materials and methods: The CBCT scans of 30 patients having cleft lip(unilateral) and palate(unilateral), were analyzed and the measurements of the alveolar bony support for teeth that are adjacent to the cleft area were measured with those teeth located on opposite side (non- clef) side. For each tooth, the measurements will taken for the distance between the(cementoenamel junction) (CEJ) and the bony crest (AC) at the(buccal area) was measured and the thickness of the buccal plate At zero, one, two, and four mm.

Results: The thickness of the bony support of central incisor at zero and one mm apically were statistically significantly thinner in cleft regions than in the non cleft regions. The CEJ-AC distance of the central teeth that are adjacent to the area of cleft was higher significantly than those for non-cleft area. For the canine teeth at 0, 1, 2, and 4mm apically were similar to those results obtained for central teeth at 0 and 1mm levels. Also, the CEJ-AC distance of the canine teeth that are adjacent to the cleft area was higher significantly than those for non-cleft area.

Conclusion: person with unilateral cleft lip and palate showed a reduced alveolar bony support of the teeth located adjacent to the area of cleft when compared with the controls and This will cause a lot of problems in the future, so professional dental control is very essential for the maintaining of good periodontal health for those patients.

Key words: Cleft of lip and palate; CBCT; Alveolar bone support. **(Received: 10/6/2017; Accepted: 13/7/2017)**

INTRODUCTION

One of the most common malformations of the face and oral cavity that occur very early during pregnancy is a complete cleft of lip, alveolar bone, and/or palate (CLAP).Mostly the affected children by a (CLAP) have a deficiency in the (soft tissue) and the alveolar bone and a malformation in the cleft region and the teeth[1]. So we can see problems commonly in the speaking, hearing feeding, esthetic, and psychological problems it may also be seen[2].In addition to that, young and children with CLAP may suffer from periodontitis and mucogingival problems [3] for many reasons:

1. Folds of Soft tissues may persist before the closure, so it will be very difficult to reach during cleaning.
2. Orthodontic treatment for long-term may also cause(iatrogenic trauma) for the periodontium.
3. Poorly developed osseous structures [4].

Persons with (CLAP) showed a high degree of periodontal attachment loss with plaque and bleeding on probing also the bony structures are poorly developed or absent in the area of periodontal(supportive tissues). there is large loss of the bony support as compared with the contra lateral (non- cleft) controld teeth [5, 6].

When we do comparison of the bony loss between the patients with a unilateral cleft of lip and palate (UCLP) and patients with a cleft of palate (CP) only using peri-apical radiographs (parallel technique), we can see that those Patients with (UCLP) had poorer periodontal health with higher alveolar bone loss than those patients with cleft palate only[7,8,9]. Development of lip can occur separately also the palate development may occur separately, it is possible that a cleft of the lips occur without a cleft of palate, or the cleft of the palate occur without a cleft of lip, or both together may occur. Children affected by (CLAP) shows malformations in the area of cleft and in the teeth.

For our knowledge, there is previous study that analyze the alveolar bone support of teeth in the patients whose affected by the cleft of lip and palate by using cone beam computed tomography (CBCT). This new technology facilitates the true images (1:1 size) without possibility of magnification and shows high interobserver-intraobserver and the reproducibility when compared with conventional radiographs [10,11].

The aim of this study was to clarify the usefulness of (CBCT) in the evaluation of alveolar bone support of teeth adjacent to the cleft in patients with unilateral cleft of lip and palate (CLAP), and compare these measurements with

(1) Assistant Lecturer, Dentistry Department (Oral Radiology), Usul Aldeen University College.

the measurements of the same teeth in non-cleft side.

MATERIALS AND METHODS

A retrospective study of CBCT scans for(30) Iraqi adult patients (18 males and12 females), age ranged from (14-25) yrs. were analyzed .The sample collected from patients attending AL-Sadar Specialized Dental Center for different diagnostic purpose, the patients signed an information on a consent form that allowing their data to be used for a scientific purposes.

In this study we use(CBCT) Scans from patients with (unrepaired UCLP),they should had a good oral hygiene and periodontium. All the images obtained by using a standardized device (CBCT KODAK 9500).C S 3D imaging software (voxel size: 300, 90 kV, 10 mA). The obtained data were reconstructed with the slices at an interval of 0.25 mm, positioned parallel to the (horizontal axis of alveolar bone), **as shown in figure 1.**

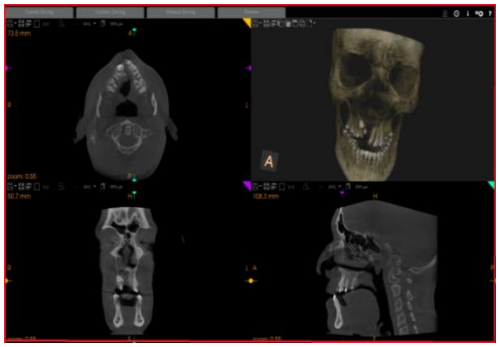

Figure 1:a three-dimensional model and axial, coronal, and sagittal views by using the (CS 3D imaging software).

All of the patients were normal medically and should had any history of radio-therapy or chemo-therapy. The Patients who have scattered images due to the presence of(restorations, root canal treatment, root resorption, or any apical surgery) were also excluded. In this study 4 teeth were analyzed for 30 patients were affected by a unilateral cleft lip and palate ,information for the central teeth and canine which are located close to the area of cleft were used as test and the contra lateral central teeth and canine were used as(the controls). Because 2 teeth at the area of cleft were missed, the contralateral lateral teeth were not evaluated, **as shown in table 1.**

Table 1:The total Number teeth and the Position of the analyzed Teeth

Number	Central		Canine	
	Cleft Side	Normal Side	Cleft Side	Normal Side
	30	30	30	30

In the analysis of the teeth, the distance between the cement-enamel junction CEJ and the crest of the bone AC was measured, and the thickness of the buccal plate at the level 0, 1, 2, and 4 mm apical to the crest of alveolar bone, the measurements taken for centrals and canines on both sides (cleft and non –cleft) areas and comparison done by an experienced operator, **as shown In figure 2 and3.**

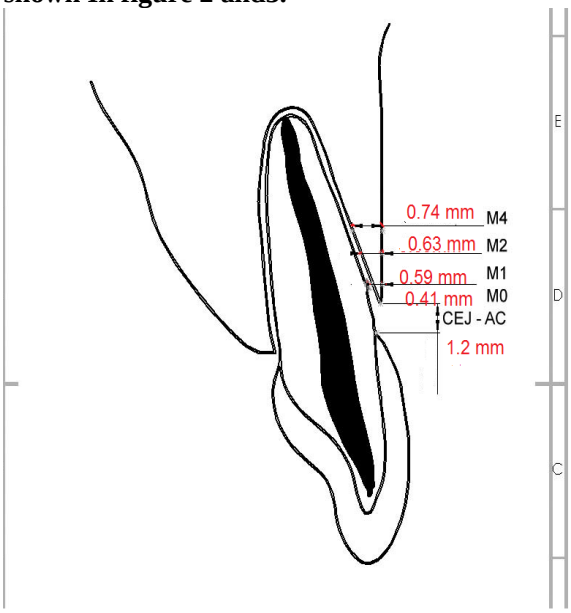

Figure2: Diagram of the measurements on CBCT(sagittal image) at the crest and sites 1, 2, and 4 mm at the apical area to the crest of alveolar bone.

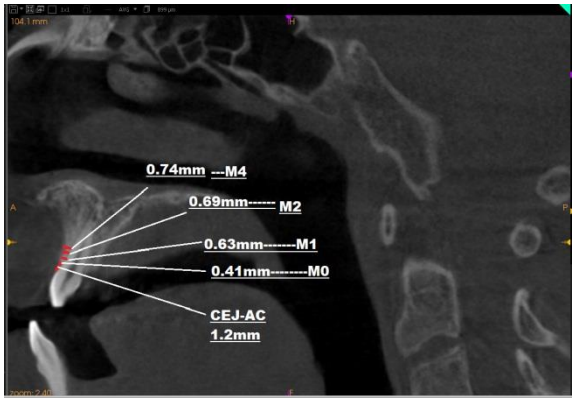

Figure 3: Measurements for the central incisor on CBCT(sagittal image).

Statistical Methods

Levene variance homogeneity tests were performed to the test of normality of the data distribution and it was found that the data distributed normally ($p>0.05$). The parametric tests were used, paired t-test was performed so that to compare the thickness of bone at the healthy and cleft sides of both centrals teeth and

the canine teeth. A(student's t-test)was used so to compare each groups, **as shown in table 2.**
For the evaluation of random error, (15 images)were selected randomly. The same operator conducted all the measurements four weeks after the 1st examination who had no knowledge of the first measurements.

Table 2: The comparison of the Bony Thickness Distribution at a Different Levels in 1and 3Teeth in Cleft and non cleft regions

Bone Thickness	Central				P Value	Canine				P Value
	Cleft Side		Normal Side			Cleft Side		Normal Side		
	Mean	S.D	Mean	S.D		Mean	S.D	Mean	S.D	
M0	0.353	0.127	0.560	0.161	0.00(S)	0.446	0.206	0.680	0.229	0.00(S)
M1	0.553	0.209	0.880	0.280	0.00(S)	0.673	0.311	1.060	0.290	0.00(S)
M2	0.833	0.327	0.960	0.226	0.086(NS)	0.880	0.285	1.340	0.312	0.00(S)
M4	1.033	0.446	1.260	0.422	0.071(NS)	1.123	0.332	1.740	0.457	0.00(S)

- M0, M1, M2, and M4: thickness of the buccal bone at 0, 1, 2 and 4mm, respectively.
- P values determined by paired t-test.

RESULTS

In total, 60 (central teeth) (30 cleft, 30contralateral non cleft regions) and 60 (canine teeth)(30 cleft, 30 contralateral non-cleft regions) were analyzed **(table one)**. **Table two** represents comparison of the mean value of the bony thickness distribution at a different levels of central and canine teeth. The mean of bone thickness of central teeth at the crest of the alveolar bone (M0) was (0.353mm) at the cleft region, and 0.560mm at non-cleft region. The difference was statistically significant (P=0.00). The mean of bony thickness at 1mm apically to the alveolar bony crest (M1) was also thinner at the region of cleft for the central teeth. The central teeth values were **(0.**553mm) and (0.0.880mm) at cleft and non cleft areas respectively (p=0.00). The mean of bone thickness at (M2andM4) for the central teeth were similar in cleft and non cleft areas.
For canine teeth the mean of bone thickness at levels (M0, M 1, M2 and M4) were also thinner for cleft region than non cleft region. This difference was statistically significant (P=0.00).
The distance between the CEJ and AC are shown **in table 3**. The mean of CEJ-AC distance for central teeth at cleft region was 2.753mm, and 1.280mm for no cleft areas. The difference was statistically significant (p=0.00), conforming that the crest of bone of central teeth is positioned more apically in the cleft region. Also for canine teeth the mean of CEJ-AC distance for cleft region was 3.700mm, and 1.446mm for non cleft region. This difference was also statistically significant (P=0.00).

Table 3: Comparison of CEJ-AC at central and canine teeth in cleft and non cleft regions

CEJ-AC	Central				P Value	Canine				P Value
	Cleft Side		Normal Side			Cleft Side		Normal Side		
	Mean	S.D	Mean	S.D		Mean	S.D	Mean	S.D	
	2.753mm	0.695	1.280mm	0.171	0.00(S)	3.700mm	1.11	1.446mm	0.267	0.00(S)

- CEJ-AC the distance between the cement enamel junction and the alveolar bone crest
- P-value determined by student's t-test

DISCUSSION

The amount of the bony loss of teeth adjacent to the area of cleft was evaluated radiographically previously [12, 13, 14, and 15]. **Bragger et al.** [12] demonstrated that alveolar bone loss radio graphically was greater at the cleft area as compared with the controls, despite the similar clinical attachment levels and suggests the presence of(periodontal attachment apparatus) that is characterized by presence of a (long connective supracrestal tissue attachment). In another study done by **Teja et al.**[11], the conditions of periodontium and the alveolar bone level in patient having unilateral cleft lip and palate were evaluated using standardized periapical radiographs. The result of this study was a reduction of the bone levels on both mesial and distal surfaces of the central teeth adjacent to the area of cleft. However, no differences were noted in the bone levels for canine teeth between cleft and non cleft regions. **Quirynen et al.** [2] examined 75 patients having UCLP with regard to the periodontal health status. Bone loss was noticed when the measurements between the CEJ and AC more than1.5mm. These

results showed that the amount of bone loss was significantly higher for the teeth located at the cleft region as compared with those at the contralateral non-cleft control teeth and these results was in agreement with our finding in this study. However in our study we use(CBCT) to evaluate the bony support of teeth that are adjacent to the cleft area.

The results in our study indicated that the bone thickness of the central teeth at M0 and M1 levels were thinner in cleft regions than in contralateral non cleft area. Also, the CEJ-AC distance of the central teeth that are adjacent to the cleft area was significantly higher. Thus, the alveolar bony support for the central incisor teeth in cleft area would show a further bone loss, periodontal inflammation, and gingival recession. The results obtained for canine teeth at M0, M1, M2, and M4 levels were very similar to the results that obtained for the central teeth at M0 and M2 levels. Also, the CEJ-AC distance of the canine teeth that are adjacent to the cleft area was significantly higher.

In a non-cleft study by **Papapanou et al**. [16] showed that incisors showed a highest frequency of the advanced bone loss, which may be possibly because of the canine erupted later than the central incisor teeth .

Also the periodontal status of teeth located closely to the cleft areas has been showed in several studies of periodontal disease, reported an increased attachment loss, pocket depth, , and gingival inflammation at the cleft area versus controls.

Gaggi et al. [7] reported several types of clefts including (UCLP, CP, and bilateral CLP).The patients who has Bilateral CLP and UCLP showed highest amount of periodontal lesions in the(maxillary anterior teeth) as compared with the general population. However, some studies done by **Lages et al.**[3]demonstrated that the disease of periodontal tissue in cleft people was similar when compared with that in the other non-cleft people, and these variations may be attributed to the differences in the study population in term of education, oral hygiene status and socioeconomic status.

patients with CLP, it is very difficult to maintain a good oral hygiene because of the oro-nasal communication.

Stec et al. [17] reported a high plaque indices in the patient with cleft when compared with those with non-cleft patient. **Bragger et al.** [12] reported that the area of the cleft as a(developmental defect) with along supracrestal connective tissue attachment without complete the supporting bone; this long connective tissue attachment does not prevent the progression of periodontal inflammation . also, scores of plaque in the cleft areas were high and the mean full-mouth PD and CAL scores deteriorated significantly over 25 years. [18, 19, and 20]

CONCLUSIONS

- The bony thickness of the central incisor teeth at the crest of alveolar bone M0 and M1 as well as for canine teeth at M0, M1, M2, and M4 levels was statistically significantly thinner at the cleft areas than controls (p=0.00). However, the bony thickness of central incisor teeth at M3 and **M4** levels were similar in the cleft and non-cleft areas.
- The mean of CEJ-AC distance for the central teeth in the cleft areas was 2.753mm, it was statistically significantly higher than that for the central in non-cleft areas, it was 0.171mm (P=0.00) as well as for canine teeth the mean CEJ-AC distance in cleft region was 3.700mm, it was statistically significantly higher than that for canine in non-cleft areas, it was 1.446mm (P=0.00).
- The reduced bony support might cause several problems in the future. So a regular professional dental care is essential for maintaining a good periodontal health for these patients.

REFERENCES

1. Perdikogianni H, Papaioannou W, Nakou M, Oulis C, Papagiannoulis L. Periodontal and microbiological parameters in children and adolescents with cleft lip and/or palate. Int J Paediatr Dent. 2009;19:455–467.
2. Quirynen M, Dewinter G, Avontroodt P, Heidbuchel K, Verdonck A, Carels C. A split-mouth study on periodontal and microbial parameters in children with complete unilateral cleft lip and palate. J Clin Periodontol. 2003;30:49–56.
3. Lages EM, Marcos B, Pordeus IA. Oral health of individuals with cleft lip, cleft palate, or both. Cleft Palate Craniofac J. 2004;41:59–63.
4. Boloor V, Thomas B. Comparison of periodontal status among patients with cleft lip, cleft palate, and cleft lip along with a cleft in palate and alveolus. J Indian Soc Periodontol. 2010;14:168–172.
5. Quirynen M, De Soete M, Dierickx K, van Steenberghe D. The intra-oral translocation of periodontopathogens jeopardises the outcome of periodontal therapy. A review of the literature. J Clin Periodontol. 2001;28:499–507.
6. Wehrbein H, Diedrich P. The periodontal changes following orthodontic tooth movement—a retrospective histological study in man. 2 [in German]. Fortschritte der Kieferorthopadie. 1992;53:203–210.
7. Gaggl A, Schultes G, Karcher H, Mossbock R. Periodontal disease in patients with cleft palate and patients with unilateral and bilateral clefts of lip, palate, and alveolus. J Periodontol. 1999;70:171–178.
8. Salvi GE, Bragger U, Lang NP. Periodontal attachment loss over 14 years in cleft lip, alveolus and palate (CLAP, CL, CP) subjects not enrolled in a supportive

periodontal therapy program. J Clin Periodontol. 2003;30:840–845.
9. Mutthineni RB, Nutalapati R, Kasagani SK. Comparison of oral hygiene and periodontal status in patients with clefts of palate and patients with unilateral cleft lip, palate and alveolus. J Indian Soc Periodontol. 2010;14:236–240.
10. de Almeida AL, Gonzalez MK, Greghi SL, Conti PC, Pegoraro LF. Are teeth close to the cleft more susceptible to periodontal disease? Cleft Palate Craniofac J. 2009;46: 161–165.
11. Teja Z, Persson R, Omnell ML. Periodontal status of teeth adjacent to nongrafted unilateral alveolar clefts. Cleft Palate Craniofac J. 1992;29:357–362.
12. Bragger U, Nyman S, Lang NP, von Wyttenbach T, Salvi GS, Church E Jr. The significance of alveolar bone in periodontal disease. A long-term observation in patients with cleft lip, alveolus and palate. J Clin Periodontol. 1990;17: ? 379–384.
13. Celikoglu M, Halicioglu K, Buyuk SK, Sekerci AE, Ucar FI. Condylar and ramal vertical asymmetry in adolescent patients with cleft lip and palate evaluated with cone-beam computed tomography. Am J Orthod Dentofacial Orthop. 2013;144:691–697.
14. Celikoglu M, Nur M, Kilkis D, Sezgin OS, Bayram M. Mesiodistal tooth dimensions and anterior and overall Bolton ratios evaluated by cone beam computed tomography. Aust Orthod J. 2013;29:153–158.
15. Celikoglu M, Buyuk SK, Sekerci AE, Ucar FI, Cantekin K. Three-dimensional evaluation of the pharyngeal airway volumes in patients affected by unilateral cleft lip and palate. Am J Orthod Dentofacial Orthop. 2014;145:780–786.
16. Papapanou PN, Wennstrom JL, Grondahl K. Periodontal status in relation to age and tooth type. A cross-sectional radiographic study. J Clin Periodontol. 1988;15:469–478.
17. Stec M, Szczeanska J, Pypec J, Hirschfelder U. Periodontal statu and oral hygiene in two populations of cleft patients. Cleft Palate Craniofac J. 2007;44:73–78.
18. Costa B, Lima JE, Gomide MR, Rosa OP. Clinical and microbiological evaluation of the periodontal status of children with unilateral complete cleft lip and palate. Cleft Palate Craniofac J. 2003;40:585–589.
19. de Almeida AL, Esper LA, Pegoraro TA, do Valle AL. Gingival recession in individuals with cleft lip and palate: prevalence and severity. Cleft Palate Craniofac J. 2012;49: 92–95.
20. Huynh-Ba G, Bragger U, Zwahlen M, Lang NP, Salvi GE. Periodontal disease progression in subjects with orofacial clefts over a 25-year follow-up period. J Clin Periodontol. 2009;36:836–842.

المستخلص:

المقدمة:لتقييم العظم السنخي للاسنان المجاورة للشق عند الاشخاص الذين يعانون من الشق الاحادي للشفة واللهاة ومقارنة هذه القياسات مع القياسات الماخوذة للجهة السليمة .

المواد والطريقة: شملت هذه الدراسة المسح الضوئي لصور التصوير المقطعي باستخدام الشعاع المخروطي ل30شخص عراقي بالغ(18ذكور و 12اناث)تتراوح اعمارهم بين 14-25سنة يعانون من الشق الاحادي للشفة واللهاة وقد تم اخذ القياسات للعظم السنخي للاسنان المجاورة للشق ومقارنتها بالجهة السليمة.واجريت القياسات التالية:

قياس المسافة بين تقاطع السمنت مع المينا الى قمة العظم السنخي وقياس ثخن العظم السنخي عند النقاط 0,1,2,4ملم للاسنان القواطع الامامية والانياب.

النتائج: الدراسة الحالية بينت ثخن العظم السنخي للاسنان **القواطع الامامية** عند النقاط 0,1ملم انحف في منطقة الشق مقارنة بالاسنان القواطع الامامية.والمسافة بين تقاطع السمنت مع المينا الى قمة العظم السنخي للاسنان القواطع الامامية في منطقة الشق اعلى مقارنة بالجهة السليمة.

بالنسبة **للانياب** القياسات الماخوذة عند النقاط 0,1,2,4مشابهة للقياسات الماخوذة للاسنان القواطع الامامية (منطقة الشق انحف في هذه النقاط الاربعة بالمنطقة والمسافة بين تقاطع السمنت مع المينا الى قمة العظم السنخي للانياب في منطقة الشق اعلى مقارنة بالجهة السليمة.

الاستنتاج: الاشخاص الذين يعانون من الشق الاحادي للشفة واللهاة يعانون من نحافة العظم السنخي للاسنان المجاورة للشق وهذا يسبب العديد من المشاكل الصحية في المستقبل ولهذا السبب هؤلاء الاشخاص بحاجة الى عناية منظمة للاسنان بشكل اساسي للحفاظ على صحة اللثة .