



COMPARISON OF PANORAMIC RADIOGRAPH AND LATERAL CEPHALOGRAM IN ASSESSING GONIAL ANGLE AND RAMAL LENGTH IN PATIENTS UNDERGOING ORTHODONTIC TREATMENT IN SOUTH INDIA- AN RETROSPECTIVE STUDY

Dr. Muskan salgia^{1*}, Dr. Nidhi Angrish², Dr. Deepak Chandrasekharan³, Dr. Akshay
Tandon⁴, Dr. Katepogu Praveen⁵, Dr. Deenadayalan.P⁶, Dr. A. Krithika⁷

Abstract

Background: One of the most important values in cephalometric tracing is the gonial angle and ramal length. Gonial angle is used to measure growth pattern of patients, teeth extraction pattern in Class II patients, surgical decision in class III skeletal base patients and age estimation in forensic medicine. Ramal length is the mandibular height. If ramal length is a few millimeters too short or too long, there is a basis for a vertical malocclusion. Both orthopantomogram (OPG) and lateral cephalograms can be used for the measurement of gonial angle and ramal length. In lateral cephalogram, superimposition of the left and right sides angle, makes it difficult to measure the gonial angle and ramal length accurately. Thus, gonial angle and ramal length measured from panoramic radiographs is found to be more reliable than lateral cephalogram.

Aim: To compare panoramic radiograph and lateral cephalogram in assessing gonial angle and ramal length in patients undergoing orthodontic treatment in South India.

Materials and methods: 386 pre-treatment lateral cephalograms and panoramic radiographs were collected from the records of the patients from Department of Orthodontics, SRM Kattankulathur Dental College and Hospital. Radiographs were digitally traced and the gonial angle and ramal length was measured. Paired t-test was used to find the difference in mean gonial angle and mean ramal length between the panoramic radiograph and lateral cephalogram. A simple regression analysis was performed to find the relationship between the gonial angles and ramal lengths in two different radiographs.

Results: The results of the study show that there is no statistically significant difference in gonial angle when compared between OPG and lateral cephalogram while statistically significant difference exists for ramal length between OPG and lateral cephalogram.

Conclusion: It may be concluded that panoramic radiography can be used to determine the gonial angle as accurately as a lateral cephalogram. However, clinicians should be vigilant when predicting ramal length from OPG.

^{1*}Intern, Department of Orthodontics and Dentofacial Orthopaedics, SRM Kattankulathur Dental College and Hospital ORCID-0000-0003-1187-2843

²Assistant Professor², Department of Orthodontics and Dentofacial Orthopaedics, SRM Kattankulathur Dental College and Hospital 2 ORCID ID: 0000-0002-9925-5526

³Professor and Head of the department³, Department of Orthodontics and Dentofacial Orthopaedics, SRM Kattankulathur Dental College and Hospital 3 ORCID ID: 0000-0002-5375-5824

⁴Assistant Professor⁴ Department of Orthodontics and Dentofacial Orthopaedics, SRM Kattankulathur Dental College and Hospital 4 ORCID ID: 0000-0001-7469-9617

⁵Assistant Professor⁵, Department of Orthodontics and Dentofacial Orthopaedics, SRM Kattankulathur Dental College and Hospital 5. ORCID- 0000-0001-6049-6173

⁶Associate Professor⁶, Department of Orthodontics and Dentofacial Orthopaedics, SRM Kattankulathur Dental College and Hospital 6 ORCID ID: 0000-0003-3103-2075

⁷Assistant Professor⁷, Department of Orthodontics and Dentofacial Orthopaedics, SRM Kattankulathur Dental College and Hospital 7 ORCID ID:0000-0002-8429-1620

***Corresponding Author :** Dr. Katepogu Praveen

*MDS., Assistant Professor, Department of Orthodontics and Dentofacial Orthopaedics, SRM Kattankulathur Dental College and Hospital, SRM Institute of Science and Technology, SRM Nagar, Kattankulathur, Chengalpattu District, Tamil Nadu – 603203 Mob : 7660929564

E mail id: praveenk2@srmist.edu.in, ORCID- 0000-0001-6049-6173

DOI: - 10.31838/ecb/2023.12.s3.723

INTRODUCTION

Orthodontic diagnosis and treatment planning require a thorough examination of dental occlusion, relationships between hard tissues, and soft tissue proportions. The history, clinical examinations, and analysis of diagnostic records (including dental casts, radiographs, and photographs) are the three main sources from which the orthodontic diagnosis is obtained. For every orthodontic patient, routine lateral cephalograms and orthopantomograms are taken. Cephalometric analysis measures the horizontal and vertical relationship between the skull and cranial base, skeletal maxilla, skeletal mandible, the maxillary dentition and alveolar process, as well as the mandibular dentition and alveolar process, which are the five main facial components. Since the treatment plan and the final result are influenced by the vertical relationships and the patient's growth pattern, the vertical relationships of these structures are just as crucial as the horizontal relationships.¹

The gonial angle is a useful marker for determining the mandibular rotation, facial skeleton symmetry, and pattern of vertical growth. The pattern of extraction in Class II patients and the decision to conduct orthognathic surgery in Class III skeletal base patients can be assessed with the help of the gonial angle. Additionally, it is useful for forensic science, sleep disorders, the risk of mandibular angle fracture, and facial aesthetics. Therefore, gonial angle is a crucial factor for planning orthodontic treatment.²

A vertical malocclusion may occur if the ramal length is a few millimeters long or short. Hence, ramal length is also a crucial factor for planning orthodontic treatment.²

The superimpositions seen on the lateral cephalogram make it challenging to determine the gonial angle and ramal length with accuracy. In

orthodontic practise, panoramic radiography is widely used to offer crucial information regarding the teeth, their axial inclinations, maturation periods, and surrounding tissues. It was first presented by Professor Yrjö Paatero of the University of Helsinki in 1961.¹ Dentistry has embraced panoramic radiographs, mostly because the process is easy and the radiation exposure is quite minimal.³ Panoramic radiography is an essential technique for orthodontic screening because it may capture a single image of the complete stomatognathic system, including the teeth, jaws, temporomandibular joints, and sinuses. The gonial angle and ramal length can be accurately measured with OPG, which is a crucial diagnostic tool.¹

MATERIALS AND METHODS

Records of patients who reported to Department of Orthodontics in SRM Kattankulathur Dental College were included in this study. The sample size comprised of 386 patients. Radiographs selected were of patients undergoing orthodontic treatment. Patients with previous history of facial or mandibular surgery, syndromes affecting the jaw or face and TMJ ankylosis were excluded. The radiographs were digitally traced using WebCeph Software.

In the lateral cephalograms, the gonial angle was measured at the point of intersection of the plane tangential to the lower border of the mandible and another line tangent to the distal border of the ascending ramus and the condyle. The gonial angle at the intersection of these planes was measured. In the panoramic radiograph, the gonial angle was measured by drawing a line tangent to the lower border of the mandible and another line tangent to the distal border of the ascending ramus and the condyle on both sides.



Figure 1: The approach used to measure gonial angle on a representative panoramic radiograph investigated.



Figure 2: The approach used to measure gonial angle on a representative lateral cephalogram investigated.

Ramal length was determined by the linear distance between the condyion and gonion in both lateral cephalogram and panoramic radiograph.

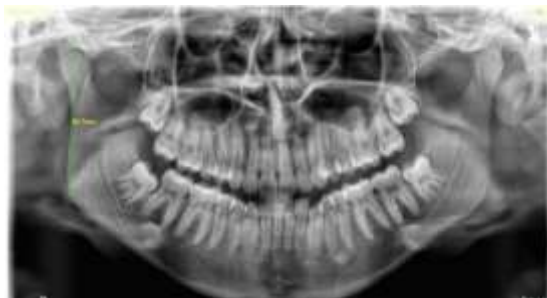


Figure 3: The approach used to measure ramal length on a representative panoramic radiograph investigated.



Figure 4: The approach used to measure ramal length on a representative lateral cephalogram investigated.

The data was analysed. Paired Student's t-test was used to compare the variables. The level of significance was set at $p \leq 0.05$.

RESULTS

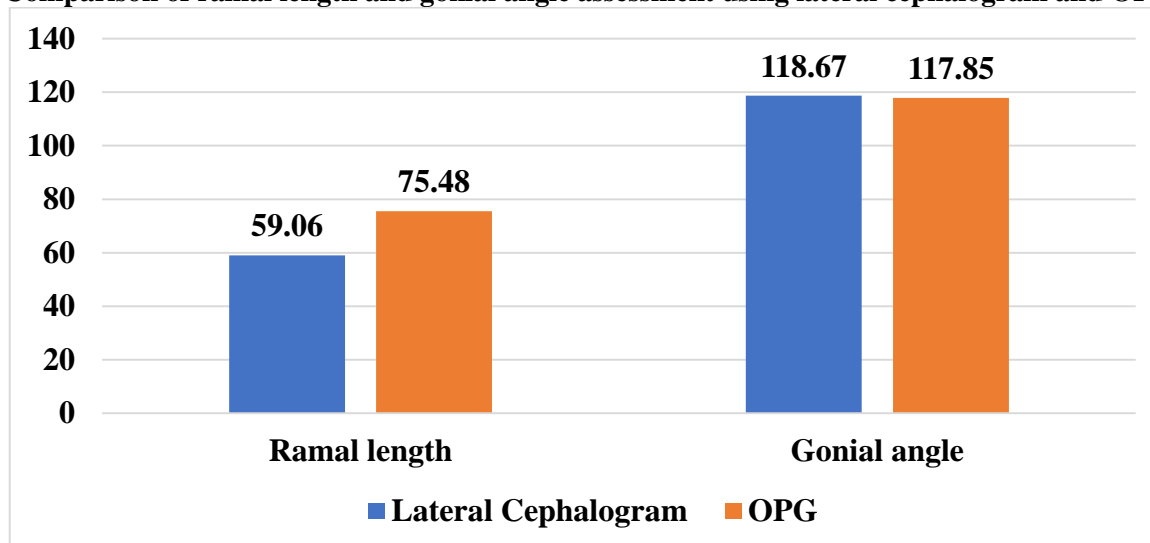
The mean \pm standard deviations of gonial angle measured from lateral cephalometric radiographs vs. panoramic radiographs were 118.67 ± 5.46 and 117.85 ± 7.53 respectively. No statistically significant difference in gonial angle when compared between OPG and lateral cephalogram

was found ($p < 0.001$). The mean \pm standard deviations of ramal length measured from lateral cephalometric radiographs vs. panoramic radiographs were 59.06 ± 4.93 and 75.48 ± 9.17 respectively. Statistically significant difference for ramal length between OPG and lateral cephalogram was found ($p = 0.085$).

Table 1: Comparison of ramal length and gonial angle assessment using lateral cephalogram and OPG

Parameter	Group	N	Mean	Std. Deviation	P value
Ramal length	Lateral cephalogram	386	59.06	4.93	<0.001
	OPG	386	75.48	9.17	
Gonial angle	Lateral cephalogram	386	118.67	5.46	0.085
	OPG	386	117.85	7.53	

Comparison of ramal length and gonial angle assessment using lateral cephalogram and OPG



DISCUSSION

This study was undertaken to assess the reliability of measurements of gonial angle and ramal length yielded from panoramic radiograph as compared to the values obtained from lateral cephalogram in patients undergoing orthodontic treatment.

The mandibular profile, alterations, growth, and position of the mandibular anterior teeth are all influenced by the gonial angle. The gonial angle also plays a crucial role in predicting future mandibular growth.⁴ Ramal length is the mandibular height. Vertical malocclusion is shown by ramal length. For this reason, ramal length and gonial angle are necessary for various orthodontic treatments and orthognathic surgery.

The primary goal of the current study was to increase the use of panoramic radiography in clinical practise to measure the ramal length and gonial angle.⁴

The results of our study show that there is no statistically significant difference in the gonial angle between OPG and lateral cephalogram. Whereas, statistically significant difference exists for ramal length between OPG and lateral cephalogram.

Due to the fact that left and right gonial angles and ramal lengths are not superimposed on panoramic radiographs, as opposed to lateral cephalograms, which show superimposition, panoramic radiographs are clinically useful for evaluating gonial angle and ramal length.⁴ In an earlier study from 1971, Mattila et al. discovered that measurements taken from cephalograms were less accurate than those taken from panoramic radiographs.⁵

Nohadani et al. in 2008 compared vertical facial and dentoalveolar alterations as measured on panoramic and lateral cephalometric radiographs. They claimed that assessing changes in the vertical facial dimension is not feasible with panoramic radiography. Additionally, the angle values obtained from a panoramic radiograph are more accurate than the vertical readings. This is due to the fact that picture distortion caused by panoramic radiography does not affect the angular values in the posterior and lateral parts of the mandible.⁶

CONCLUSION

When opposed to lateral cephalograms, panoramic radiographs have the benefit of providing a better diagnostic yield on a single film, even if they don't always measure angles and vertical measurements with absolute precision. With less radiation exposure to the patients, they

demonstrated improved dental arch coverage. Furthermore, OPG may be a superior option, particularly in cases of asymmetry, as it is a simpler technique for evaluating the patient's right and left side without any interference from superimposed structures. Although lateral cephalograms and panoramic radiographs both accurately measure the gonial angle, clinicians should use caution when using OPGs to infer ramal length.⁷

REFERENCE

1. Bhullar MK, Uppal AS, Kochhar GK, Chachra S, Kochhar AS. Comparison of gonial angle determination from cephalograms and orthopantomogram. *Indian Journal of Dentistry* . 2014 Jul;5(3):123.
2. Rajak, Ravi Ranjan Kumar; Shrestha, Rabindra Man; and Koju, Sushmit (2021) "Reliability of Panoramic Radiography in Assessing Gonial Angle Compared to Lateral Cephalogram in Patients with Class I Malocclusion," *Taiwanese Journal of Orthodontics*: Vol. 33: Iss. 2, Article 2.
3. Najm AA. Evaluation of Gonial Angle, Ramus Height and Bigonial width in Relation to Age and Gender using Digital Panoramic Radiograph.
4. Kundi I. Accuracy of assessment of gonial angle by both hemispheres of panoramic images and its comparison with lateral cephalometric radiographic measurements. *J Dent Health Oral Disord Ther*. 2016;4(4):1-6.
5. Mattila K, Altonen M, Haavikko K. Determination of the gonial angle from the orthopantomogram. *The Angle orthodontist*. 1977 Apr 1;47(2):107-10.
6. Nohadani N, Ruf S. Assessment of vertical facial and dentoalveolar changes using panoramic radiography. *The European Journal of Orthodontics*. 2008 Jun 1;30(3):262-8.
7. Kumar SS, Thailavathy V, Srinivasan D, Loganathan D, Yamini J. Comparison of orthopantomogram and lateral cephalogram for mandibular measurements. *Journal of pharmacy & bioallied sciences*. 2017 Nov; 9 (Suppl 1):S92.