ORIGINAL ARTICLE POJ 2016:8(1) 2-6

Can photographs replace lateral cephalograms? An evaluation of orthodontic clinician's ability to assess selected cephalometric readings from extra-oral photographs

Mahera Hasan[a], Owais Khalid Durrani[b], Kamran Khan[c], Rebea Khurshid Ali[d], Syed Imran Tasneem[e], Ulfat Bashir[f]

Abstract

Introduction: The lateral cephalogram has become an integral part of the diagnosis and treatment planning of orthodontic patients. However, there have been rising concerns over unnecessary exposure to X-rays. The purpose of this study was to evaluate whether the orthodontists working in three dental hospitals of Rawalpindi and Islamabad were able to judge cephalometric values using only photographs.

Material and Methods: This was a questionnaire based study. The sample consisted of 24 orthodontists divided into 2 groups according to their number of years of clinical experience (more than 5 years and less than 5 years of experience). The subjects were asked to diagnose the sagittal, vertical and soft tissue discrepancies of a series of patients using only the lateral profile photographs. An independent t-test was used to compare the diagnostic abilities of the two groups.

Results: The independent t-test showed a statistically insignificant difference (p-value > 0.05) in the diagnostic abilities of the two groups. 83% of the orthodontists with less than 5 years of experience were able to diagnose the sagittal discrepancy correctly, compared to 81 % of the orthodontists with more than 5 years of experience. 74% of the less experienced clinicians estimated the vertical discrepancy and 71% the soft tissue discrepancy, compared to the more experienced clinician's results of 76% and 79%, respectively.

Conclusions: Photographs cannot be used solely to form an accurate diagnosis and treatment plan for orthodontic patients. The number of years of clinical experience has no effect on the accuracy of the diagnosis of cephalometric values from a lateral profile photograph by an orthodontist.

Keywords: Diagnosis; lateral cephalogram; lateral profile photograph

Introduction

Just how much do we need a lateral cephalogram in orthodontics today? Since the advent of the cephalostat, the lateral cephalogram has become an integral part of the diagnosis and treatment planning of orthodontic patients, with multiple analyses being proposed throughout the past 8 decades. The last 20 years have seen a rise in concerns over the possibility of unnecessary X-ray exposure. The average expected dose from a lateral cephalogram is 3 μSv, which is very minor compared to the International Commission of Radiological Protection's (ICRP) recommendation that the dose limit should be 1mSv annually for the public.[1] Although this indicates that the risks are very minimal, with the chances of malignancy being less than 1 patient per million,[2,3] any reduction in the amount of possible exposure

[a,d,e] BDS. House Officers, Department of Orthodontics, Riphah International University, Islamabad

[b] Corresponding Author: BDS, FCPS, MOrthRCSI, FFDRCSI. Associate Professor, Department of Orthodontics, Riphah International University, Islamabad. Email: owais.durrani@riphah.edu.pk

[c] BDS, FFDRCSI. Assistant Professor, Department of Oral & Maxillofacial Surgery, Riphah International University, Islamabad

[f] BDS, MCPS, FCPS. Professor and head, Department of Orthodontics, Riphah International University, Islamabad

from lateral cephalograms would be beneficial for patients.[4] This is especially true for patients under the age of 15 years, in whom the thyroid gland is highly radiosensitive.[1]

Majority of patients, seeking orthodontic treatment are adolescents and coupled with high cost of radiographs which often lie outside patient's affordability in a developing country such as Pakistan and minimizing the need for lateral cephalograms in orthodontic diagnosis would prove to be of great benefit.

The aim of the present research was to establish whether the orthodontists were able to determine the relationship between different cephalometric landmarks by viewing only the profile photograph of the patient.

A questionnaire based study was conducted amongst the orthodontists and post-graduate residents of three dental teaching hospitals of Rawalpindi and Islamabad. There were a total of 24 participating orthodontists in the study. Any resident with less than one year of experience in orthodontics was excluded from the study.

Each subject was shown a series of 10 pre-treatment orthodontic cases with a lateral profile picture and intra-oral buccal views of each. Of the 10 cases, there was one of each of the following skeletal discrepancies: Class I bimaxillary retrognathism, Class I bimaxillary prognathism , Class II bimaxillary prognathism, Class II composite, Class II due to mandibular retrognathism, Class II due maxillary prognathism, Class III due to maxillary retrognathism, Class III due to mandibular prognathism, Class III composite and Class III bimaxillary prognathism. The participants were then asked to estimate 3 cephalometric values and their severity from these lateral profile pictures. The questionnaire (Annexure 1) was divided into 3 sections; the sagittal, vertical and soft tissue analyses of each case and each section focused on the estimation of one angular measurement from photograph, namely the A point-Nasion-B point angle (ANB), Frankfort mandibular angle (FMA) and nasolabial angle (NL) respectively, followed by an estimation of their severity.

A reference table showing the values we categorized as normal or deranged with the mild, moderate and severe values was also provided to the subjects as a guideline while answering the questions (Table I).

Results

The results of our study are summarized in Figures 1 and 2 and Table II. Statistical analysis was performed using IBM Statistical Package for Social Sciences (SPSS) version 19.0. An independent t-test was performed to compare the results. P-value of 0.05 was taken to be significant. The results showed that the difference between the two groups was insignificant (p-value of 0.66).

Discussion

A review of the literature shows a strong correlation of the angles measured between the cephalometric landmarks to those of corresponding landmarks determined on the condyles.[5,6] Our research differed from those carried out previously in that the examiners in our study were not provided any measuring apparatus to judge the lateral profile photographs, but were instructed to estimate the values using only their visual judgment. The present research was conducted amongst the orthodontists of three teaching hospitals in Islamabad to evaluate the accuracy with which they were able to estimate cephalometric values on a lateral profile picture. The results showed that when asked to estimate the sagittal discrepancy of each case, 82.5% of the orthodontists were able to correctly estimate it (Fig.1).

The ability of the Orthodontists to diagnose the sagittal discrepancy was in accordance to the findings of Gomes et al,[5] whose computerized analysis of the lateral cephalogram and profile photograph showed

that ANB angle has the strongest correlation. Barnett DP[7] concluded that the points A and B on the skeleton correspond closely to the soft tissue points A′ and B′ and the soft tissue projection of A′ and B′ accurately reveal the relative hard tissue projections. Of those who diagnosed the correct sagittal discrepancy, only 68.2% of the orthodontists were able to estimate its severity too (Fig.1). Results of the present study differed from the findings of Gomes et al.[5]

A lesser percentage of the subjects (75%) estimated the divergence of the mandible correctly (Fig. 1). The results of previous studies[6,8] showed that the FMA has a stronger correlation between the radiographic and soft tissue values than the ANB, but our subjects were not able to estimate the FMA values with as much accuracy as they did the ANB. Harry and Sandy also stated in their publication[9] that despite the strong correlation, few clinicians are capable of identifying the Frankfort Plane properly. Another reason may be that hyper-divergent individuals appear to have a flat mandibular plane at times due to the overlying subcutaneous fat[10] which may have confounded the orthodontists. 80.6% were able to correctly asses the severity of the divergence (Fig.1). The precision with which the subjects in our research estimated the severity of the FMA was the highest, possibly because the LAFH is a value easily judged accurately by the soft tissues[11] and may have assisted the subjects in estimating the extent of the divergence.

With regards to the estimation of the nasolabial angle, 73.75% of the subjects estimated the nasolabial angle accurately (Fig. 1). Of these, 75.1% were able to estimate its severity (Fig.1). Of the three analyses, the subjects performed most poorly in the estimation of the nasolabial angle.

One of the major goals of orthodontic treatment today is a balanced soft tissue profile[12] and since the nasolabial angle has become a definitive parameter in determining the changes in the profile,[13] much emphasis is required in this area when training future orthodontists to ensure they can correctly determine the nasolabial angle.

The subjects were grouped into 2 categories according to their number of years of clinical experience in orthodontics in order to compare the diagnostic abilities of more senior orthodontists with their junior colleagues. There were 16 in the first category of less than 5 years of experience, and 8 in the second category of more than 5 years of experience. The interval of 5 years was chosen because of the 4 years required to complete post-graduate training, followed by an assumed average of 1 year to obtain the post-graduate qualification.

The percentages of orthodontists who correctly diagnosed the sagittal discrepancy, mandibular divergence and nasolabial angle were similar for both groups (p-value of 0.66, Figure 2). This reflects on the deficiency of not only the junior clinicians but also the seniors with regard to evaluation of lateral profile photographs, and indicates the weak emphasis placed on lateral profile photographs in the diagnostic process during the training period of orthodontists in our area.

A limitation of our study was the use of non-standardized photographs. Roberts-Harry and Sandy concluded in their study that head posture can affect how the skeletal relationship appears in a photograph, depending on whether the head is tipped backwards or forwards.[9] The lack of non-standardized equipment to capture the lateral profile photographs could have made precise measurement difficult for the subjects.

Conclusions

Photography has become an essential component of the diagnosis and treatment planning phase in recent years, but as the present study revealed, it cannot completely replace lateral cephalograms or be used interchangeably with them. In the present

study more than 70% of the subjects were able to correctly diagnose the cases overall in terms of the sagittal, vertical and soft tissue analysis. The highest percentage of subjects was able to diagnose the angular measurement of sagittal discrepancy, followed by the mandibular divergence and finally, the nasolabial angle. The findings of this research indicate the current overall abilities of orthodontists in our region may be sufficient for epidemiological or screening purposes. However, for accurate diagnosis of an orthodontic case, a greater percentage of clinicians must be able to correctly judge the severity of a case than was found in this research. Stronger emphasis should be placed at under-graduate and post-graduate level on using the photographs as the prime diagnostic tool for orthodontic treatment planning.

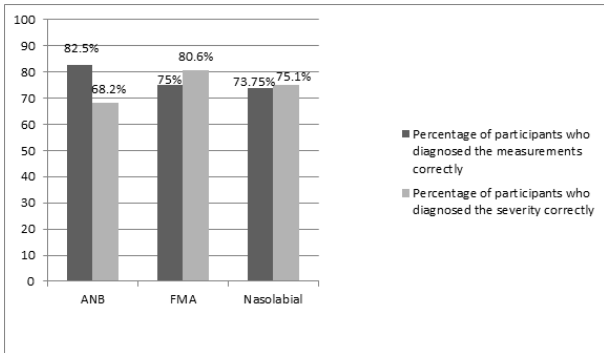

Figure 1: Percentage of participants who diagnosed the ANB, FMA and nasolabial angles and their severity correctly

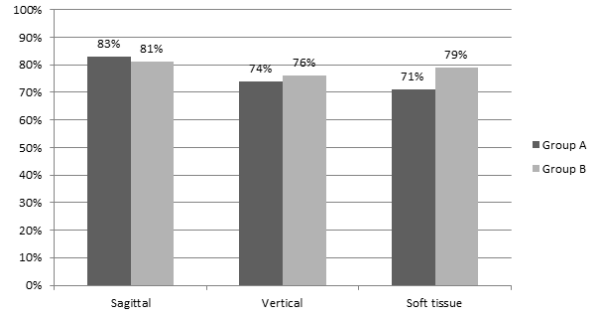

Figure 2: Percentage of participants who estimated the sagittal, vertical and soft tissue discrepancy correctly.

Group A = participants with less than 5 years of clinical experience. Group B = participants with more than 5 years of clinical experience.

Table I: Range of values provided to the participants

ANB Values			
	Mild	Moderate	Severe
Class I (0 - 4°)	-	-	-
Class II	5° - 6°	7° - 8°	> 8°
Class III	−1° - −2°	−3° - −4°	> −4°

FMA Values			
	Mild	Moderate	Severe
Normodivergent (21° - 29°)	-	-	-
Hypodivergent	18° - 20°	15° - 17°	< 15°
Hyperdivergent	30° - 32°	33° - 35°	> 35°

Nasolabial Values			
	Mild	Moderate	Severe
Normal (94° - 110°)	-	-	-
Acute	91° - 93°	88° - 90°	< 88°
Obtuse	111° - 113°	114° - 116°	> 116°

Table II: Mean results of orthodontists' estimation of sagittal, vertical and soft tissue analysis and the p-value of each

	Years of clinical experience	**Number of orthodontists**	**Mean number of correct diagnoses**	**p-value**
Sagittal	More than 5	16	8.31	0.574
	Less than 5	8	8.13	
Vertical	More than 5	16	7.31	0.523
	Less than 5	8	7.63	
Soft tissue	More than 5	16	7.13	0.141
	Less than 5	8	7.88	

References

1. Recommendations of the International Commission on Radiological Protection, 2006.
2. Isaacson KJ, Thom AR, Horner K and Whaites E. Orthodontic Radiographs - Guidelines. British Orthodontic Society. 2008.
3. Wall BF, Kendall GM. Collective doses and risks from dental radiology in Great Britain.Br J Radiol 1983;56(668):511-6.
4. Forsyth DB, Shaw WC, Richmond S. Digital imaging of cephalometric radiography, Part 1: Advantages and limitations of digital imaging. Angle Orthod 1996;66(1):37-42.
5. de Carvalho Rosas Gomes L, Horta KO, Gandini LG Jr, Gonçalves M, Gonçalves JR. Photographic assessment of cephalometric measurements. Angle Orthod 2013;83(6):1049-58.
6. Patel DP, Trivedi R. Photography versus lateral cephalogram: Role in facial diagnosis. Indian J Dent Res 2013;24:587-92.
7. Barnett DP. Variations in the soft tissue profile and their relevance to the clinical assessment of skeletal pattern. Br J Orthod 1975;2:235-8.
8. Pogulwar S, Gautam R, Kalia A, Hegde A, Ahmad E. Photographic Assessment of Cephalometric Measurements. Int J of Craniofac Res 2014;2(5):21-26.
9. Roberts-Harry D, Sandy J. Orthodontics. Part 2: Patient assessment and examination. Br Dent J 2003;195(9):489 – 93.
10. Rongo R, **Antoun JS**, Lim YX, Dias G, Paduano S, Farella M. Three-dimensional evaluation of the relationship between jaw divergence and facial soft tissue dimensions. Angle Orthod 2014;84(5):788-94.
11. Staudt CB, Kiliaridis S. A non-radiographic approach to detect Class III skeletal discrepancies. Am J of Orthod Dentofacial Orthop 2009;136(1):52-8.
12. Ackerman JL and Proffit WR. Soft tissue limitations in orthodontics: Treatment planning guidelines. The Angle Orthodontist1997;67(5):327-36.
13. Nandini S, Prashanth CS, Somiah SK, Reddy SR. An evaluation of nasolabial angle and the relative inclinations of the nose and upper lip. J Contemp Dent Pract 2011;12(3):152-7.