ISSN: 2581-5989
PubMed - National Library of Medicine - ID: 101738774

International Journal of Dental Science and Innovative Research (IJDSIR)
IJDSIR : Dental Publication Service
Available Online at: www.ijdsir.com
Volume – 5, Issue – 1, January - 2022, Page No. : 277 - 283

Influence of lateral cephalometric radiography on treatment planning and preferences in various malocclusions

[1]Lucky Yadav, Senior Resident, Department of Dental and Maxillofacial Surgery, Lady Hardinge Medical College and Associated Hospitals, New Delhi, India.

[2]Renuka Bamal, Senior Lecturer, Department of Orthodontics and Dentofacial Orthopaedics, NIMS Dental College and Hospital, Jaipur, Rajasthan, India.

[3]Akanksha Jaswal, Senior Lecturer, Department of Orthodontics and Dentofacial Orthopaedics, Mahatma Gandhi Dental College and Hospital, Jaipur, Rajasthan, India.

[4]Ashish Kumar, Senior lecturer, Department of Orthodontics and Dentofacial Orthopaedics, Rajasthan Dental College and Hospital, Jaipur, Rajasthan, India.

[5]Pankaj Kumar Pareek, Senior lecturer, Department of Orthodontics and Dentofacial Orthopaedics, Rajasthan Dental College and Hospital, Jaipur, Rajasthan, India.

[6]Monika Khairwa, Post graduate student, Department of Orthodontics and Dentofacial Orthopaedics, Rajasthan Dental College and Hospital, Jaipur, Rajasthan, India.

Corresponding Author: Dr. Renuka Bamal, Senior Lecturer, Department of Orthodontics and Dentofacial Orthopaedics, NIMS Dental College and Hospital, Jaipur, Rajasthan, India.

Citation of this Article: Lucky Yadav, Renuka Bamal, Akanksha Jaswal, Ashish Kumar, Pankaj Kumar Pareek, Monika Khairwa, "Influence of lateral cephalometric radiography on treatment planning and preferences in various malocclusions", IJDSIR- January - 2022, Vol. – 5, Issue - 1, P. No. 277 – 283.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Objective: The aim of this study is to evaluate the influence of lateral cephalometric radiograph on treatment planning and preferences in various malocclusions and to determine the extent to which the presence of lateral cephalogram influences orthodontic treatment planning.

Methods: Diagnostic records of 30 patients who had been treated at the Rajasthan Dental College, Department of Orthodontics. Records without lateral cephalogram were digitally presented to five orthodontists and after six months the same records with lateral cephalogram were provided and diagnosis, treatment preferences and mechanotherapy were asked using Likert-type questionnaires.

Results: Minor changes were recorded only in five questions among all three sections. In diagnosis, skeletal relationship (5 responses), nasolabial angle (9 responses) and extraction decision (7 responses). In treatment planning question related to extraction decision changed

in 8 responses and in mechanotherapy section choice of retainer is changed in 7 responses.

Conclusion: The use of cephalometric as a diagnostic record neither changed orthodontic treatment planning nor significantly affected the level of consistency and its use as a diagnostic record does not seem to have an impact on orthodontic treatment planning.

Keywords: Lateral cephalometric radiography, diagnosis, treatment planning, tooth extraction.

Introduction

Lateral cephalometric radiography (LCR) has been widely used in orthodontic assessment and treatment planning, Since the commencement of lateral cephalometric radiography (LCR) by Broadbent in 1931. Despite that, its functionality remains questionable in orthodontics.[1] A thorough information obtained from the patient forms basis of orthodontic diagnosis and treatment planning, these usually comprise of comprehensive medical history, clinical examination, study models, extraoral radiographs including panoramic and lateral cephalometric, intraoral radiographs involving bitewing and periapical and intraoral and extraoral.[2]

Among all diagnostic means, radiographs and their routine prescription remains an utmost importance issue as to proven harms of radiation. Especially specified is the Lateral Cephalometric Radiography (LCR), which is considered as the “gold standard” at the commencement of an orthodontic treatment. An average number of three lateral cephalometric radiographs were proclaimed to be taken during an orthodontic treatment,[3] for diagnosis, to check the progress of the treatment and to check for the end result. The cephalogram taken to check the end result of treatment has been questioned recently, since it is used only for professional purpose, or educational purpose and for legislative purpose, whereas in regard to patient comfort it gives information only about the changes made in the treatment so that the orthodontist analyses or reorient his treatment decision and decide the retention phase.[4]

LCR is a two-dimensional diagnostic tool for recognizing different patterns of growth, dentofacial proportions and skeletal and dental relations, pathologies and occlusal discrepancies. However, transverse cranial level information is not provided by it.[3] Silling et al.[5] emphasized that only for Class II division 1 patients LCR is needed. Later, Han et al.[6] stated that to render a diagnosis, patient examination together with dental casts is sufficient. In the same vein, Bruks et al.[7] proposed that even after LCR evaluation treatment plans remained unaffected in 93% of the cases. They only examined the patient, dental casts, and extraoral photographs.

Among orthodontists’ extraction rates vary greatly and data obtained from LCRs are usually used to sustain the extraction v/s non-extraction decision, which is mainly affected by other factors such as types of malocclusions, possible treatment techniques and expected treatment outcomes.[2] Pae et al.[8] revealed that radiography could change the conclusion in patients with Class II division 2 occlusion and bimaxillary protrusion with regard to teeth extraction. Nijkamp et al.[9] accentuated that in Class II division 1 patients LCR does not seem to have any influence on orthodontic treatment planning. In 2011 Devereux et al.[10] summed up that only in one out of six patients’ orthodontists decided to change their treatment choice with regard to tooth extraction.

In agreement with the Directive 97/43/EURATOM, radiographic exposure is justified only when the administration of the patient depends on the information obtained from the radiograph. Moreover, according to European Commission, 1997 exposure should be “as low as reasonably achievable”.[9] LCRs are continued to be

regularly requested despite the existence of these guidelines and regulations, as it is the only quantitative method in evaluation and assessment of the spatial relationships between dental and cranial structures. However, there is crucial influence of LCRs on diagnosis but only minor influence on treatment planning even after the presence of skeletal discrepancies.[2]

These examinations raise the question, if the existence of LCR is influential on orthodontic treatment planning decisions, especially on permanent decisions such as extractions. Therefore, there is need to analyses whether LCRs alter orthodontic treatment planning in various malocclusions. Thus, the aim of this study is to evaluate the influence of lateral cephalometric radiograph on treatment planning and preferences in various malocclusions and to determine the extent to which the presence of lateral cephalogram influences orthodontic treatment planning.

Materials and methods

Five orthodontists with experience ranging from 5 – 18 years participated in this study as evaluators. (Fig.1) Complete pre-treatment diagnostic records including extra-oral and intra-oral photograph, diagnostic casts and cephalometric radiographs were collected for 30 patients with 10 from each malocclusion (Class I, Class II and Class III) undergoing orthodontic treatment in Department of Orthodontics and Dentofacial Orthopaedics in Dental College.

For calibration purposes, 5 subjects from the total subjects were examined twice, on different days, in order to calculate the intra-examiner reliability (minimum 0.85, intraclass correlation coefficient). Measurement error was calculated by the Dahlberg's formula that determined the method error as negligible.

A. Data presentation

Patient files were summed up and the identification data were kept hidden. Digital orthodontic diagnostic records, comprising of five intra oral and four extra oral pictures with five photographs of the dental casts, OPG and lateral cephalometric. All blinded information was saved in a Power Point presentation and presented to each observer with the web-based questionnaire. Patient records were evaluated during two sessions the time interval between two observations was at least 6 months. At first session orthodontists evaluated records without LCR. In the second session the same information was presented but this time LCR was added.

B. Questionnaire

The questionnaire was given with no time limit. The main treatment objective was to achieve a normal functional occlusion. Whether extraction is to be done or not was defined as the removal of at least one permanent tooth with do not include third molars. The questionnaire consisted of three sections (Diagnosis, Treatment plan and Mechanotherapy) with total of 25 questions, in linear Likert-type scale pattern.[4]

In diagnosis molar relationship, canine relationship, incisor relationship, horizontal and vertical relationship, transverse and sagittal relationship, skeletal relationship, midline, facial asymmetry, growth pattern, nasolabial angle and soft tissue profile were assessed. In treatment planning need for extraction, need for removable appliance and fixed functional appliance during treatment, surgical treatment and need for space gain was assessed. In mechanotherapy, choice of prescription, anchorage consideration, method of anchorage control, choice of retainer and expected duration of treatment was evaluated.

Results

Molar and incisor relationship in both the evaluation sessions with and without lateral cephalogram did not show any statistically significant differences whereas the decision on canine relationship changed in few cases after inclusion of lateral cephalogram but was not statistically significant. Inclusion of lateral cephalogram did not show statistically significant difference in case of vertical and horizontal relationship as assessed by all five examiners. Transverse / sagittal relationship deviation and growth pattern observed in both the sessions are consistent for all the five examiners with change in few cases. Midline deviation and facial asymmetry showed no statistically significant difference in both the sessions.

Choice of removable appliance did not get influenced with inclusion of lateral cephalogram with main choice has biteplates, as choice of removable appliance in both the sessions. Decision for using fixed function appliance during treatment got influenced in few cases. Inclusion of lateral cephalogram in second session did not make any statistically significant change in decision about proceeding during treatment. Decision regarding surgical treatment is not influenced by lateral cephalogram and need for space gain in both the sessions remained same with extraction being the first choice of space gain followed by proclination of anteriors and arch expansion for the examiner.

There was no considerable change in in decision regarding anchorage, all the examiners preferred Nance palatal button as choice for anchorage control followed by TADs and trans palatal arch. Choice of choosing type of retainer changed in few cases, but is not significant, overall combination of retainers was preferred followed by removable retainer, fixed retainer and vacuum formed retainer respectively.

Discussion

In this study, impact of lateral cephalometric radiography on treatment planning and preferences in various malocclusions was evaluated. The study was conducted to evaluate the effectiveness of two-dimensional cephalometric imaging for orthodontic treatment planning. According to the ALARA principle, there is a need to reduce radiation exposure and eliminate needless radiographs.[1]

We selected 30 patients, 10 of each malocclusion and 5 evaluators. However, the emphasis was on verifying a difference between specific treatment decisions with/without LCR, neglecting possible individual factors of each orthodontist. The patient files were presented digitally and this might be an influencing factor on the orthodontists decisions since they are used to evaluating patients physically and this might have affected the reliability of data. Similarly, dental casts were not physically presented only photographs were there. However, it was shown formerly that two-dimensional digital images can be used as a substitute to study casts to examine the actual need of an orthodontic treatment and this was the only way of presenting the patient files to visualize the patient in professional platforms and discussions.[4]

Variation was observed among examiners in cases of skeletal relationship, nasolabial angle, soft tissue profile supporting extraction and need for extraction after inclusion of lateral cephalogram but these variations do not show statistically significant difference. Parameters for extraction decision in both the sessions for all five examiners did not show statistically significant changes in results, where inadequate space in arch is major reason of extraction followed by reason for improving soft tissue profile. Exclusion of the LCR did not impact the orthodontic treatment decision of extraction, which is

rather an unalterable decision. This recognition corresponds with previous studies by Devereux et al,[10] Dincer et al,[2] Han et al,[6] Ritschel et al.[11]

Lateral cephalogram influenced the duration of treatment in few cases which was not significant and need for additional information for making treatment plan decreased to 16.7 percent from 31 percent after inclusion of lateral cephalogram. In day-to-day practice, before beginning with treatment planning, a patient undergoes a clinical examination. Information on diagnostic records, such as intra- and extraoral photographs, dental casts and radiographs, completes the documentation of data obtained during the examination and results eventually in an orthodontic treatment plan. In this study, only records of the patients were analysed. However, some information given at the start of the evaluation might possibly be obtained during the clinical examination. Nevertheless, this comparative lack of information might have influenced the consistency of treatment planning.[9]

Theoretically, panoramic and cephalometric radiographs should be taken, when information from the clinical examination is considered insufficient. Guidelines for orthodontic radiographs authorizes panoramic radiographs as part of an orthodontic assessment to identify the condition of the dentition and presence or absence of unerupted teeth.[12] Cephalometric radiography is only justified if it directly effects information on non-radiographic records used for orthodontic treatment planning. Besides the role of LCR in orthodontic treatment planning, anatomical structures on cephalometric radiographs need to be explained for evidence of disease or injury.[9]

Further implementation of cephalometric radiography has also been declared as a screening tool to determine the need for a more rigorous ear – nose – throat follow-up concerning deviant measurements of adenoid size.[9] Cephalometric radiographs might also be used for evaluation of possible difficulty of achieving an ideal occlusion after specific orthodontic treatment, to aid in the location and evaluation of unerupted, malformed, or misplaced teeth, and to identify optimal treatment timing in dentofacial Orthopaedics using a modified version of the cervical vertebral maturation index.[8.9] Restricted serial cephalometric radiographs may help in the evaluation of a trend in growth, or to monitor treatment changes.[12]

Limitation of the present study is that the orthodontists made the treatment decisions by looking at the patient documentation file and were not able to investigate them personally. The problems encountered according to their opinions were (1) the impossibility of examining real patients' postural positions; (2) the quality of pictures which in few cases were little blurred; and (3) difficulty in analyzing the dental casts virtually. These are some factors which could have influenced the decisions of the evaluators. One other possible disadvantage of the study might be that third molars were ignored in the definition of extraction. In proposition, third molar extractions are involved in treatment planning regarding the posterior borders of permanent dentition. However, evading possible positive extraction decisions regarding only the third molars was aimed by excluding them.[13]

The contribution of the LCR to orthodontic decision making, as one of the crucial orthodontic diagnostic materials might be questionable.[10, 14] In this study, no statistically significant difference was found between consistencies of orthodontic treatment planning with or without cephalometric information. Thus, cephalometric as a diagnostic record, does not seem to have an influence on orthodontic treatment planning with different malocclusions.

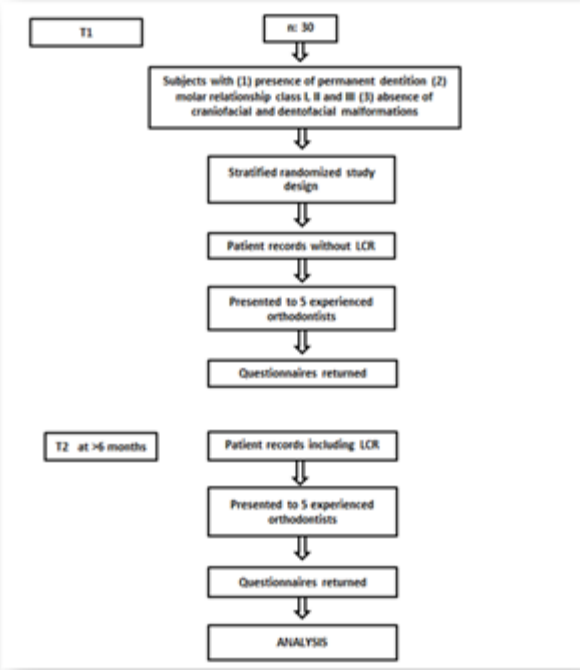

Figure 1

Conclusion

Subsidiary use of cephalometric as a diagnostic record neither changed orthodontic treatment planning nor significantly affected the level of consistency and its use as a diagnostic record does not seem to have an impact on orthodontic treatment planning.

The diagnostic validity and benefit of LCRs in orthodontic treatment planning may not be the same for all discrepancies and patients. In order to reduce that amount of radiation exposure of patient careful evaluation of patient should be done.

References

1. Durão AR, Alqerban A, Ferreira AP, et al. Influence of lateral cephalometric radiography in orthodontic diagnosis and treatment planning. Angle Orthod. 2015;85(2):206-10.

2. Dinçer B, Yetkiner E, Aras I, et al. Influence of lateral cephalometric radiographs on extraction decision in skeletal class I patients. Head Face Med. 2013; 4; 9:36.

3. Stupar I, Yetkiner E, Wiedemeier D, et al. Influence of Lateral Cephalometric Radiographs on Orthodontic Treatment Planning of Class II Patients. Open Dent J. 2018;16; 12:296-302.

4. Stupar I, Yetkiner E, Attin T, et al. Influence of Lateral Cephalometric Radiography on Treatment Planning and Preferences in Skeletal Open- Bite Patients: Do Lateral Cephalograms Influence Treatment Planning? TurkJ Orthod. 2016 ;29(4):87-90.

5. Silling G, Rauch MA, Pentel L, Garfinkel L, Halberstadt G. The significance of cephalometrics in treatment planning. Angle Orthod. 1979; 49:259–262.

6. Han UK, Vig KW, Weintraub JA, Vig PS, Kowalski CJ. Consistency of orthodontic treatment decisions relative to diagnostic records. Am J Orthod Dentofacial Orthop. 1991; 100:212–219

7. Bruks A, Enberg K, Nordqvist I, Hansson AS, Jansson L, Svenson B. Radiographic examinations as an aid to orthodontic diagnosis and treatment planning. Swed Dent J. 1999; 23:77–85.

8. Pae EK, McKenna GA, Sheehan TJ, Garcia R, Kuhlberg A, Nanda R. Role of lateral cephalograms in assessing severity and difficulty of orthodontic cases. Am J Orthod Dentofacial Orthop. 2001; 120:254–262.

9. Nijkamp PG, Habets LL, Aartman IH, Zentner A. The influence of cephalometrics on orthodontic treatment planning. Eur J Orthod. 2008;30(6):630-5.

10. Devereux L, Moles D, Cunningham SJ, McKnight M. How important are lateral cephalometric radiographs in orthodontic treatment planning? Am J Orthod Dentofacial Orthop. 2011; 139:175–181.

11. Ritschel R, Bechtold TE, Berneburg M. Effect of cephalograms on decisions for early orthodontic treatment. Angle Orthod. 2013 ;83(6):1059-65.

12. Abdelkarim A. Guidelines for the use of radiographs in clinical orthodontics. 4th edition, Am J Orthod Dentofacial Orthop. 2016;149(1):141-142.

13. Jones ML. A comparison of orthodontic treatment changes as measured from study casts and cephalometric radiographs. Br J Orthod. 1991;18(2):99-103.

14. Baumrind S, Korn EL, Boyd RL, Maxwell R. The decision to extract: part II. Analysis of clinicians' stated reasons for extraction. Am J Orthod Dentofacial Orthop. 1996;109(4):393-402.