ORIGINAL ARTICLE

PRE AND POST TREATMENT DENTAL ANALYSIS AT LATERAL CEPHALOGRAMS

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ABSTRACT

The study was carried out to evaluate dental changes in pre and post treatment lateral cephalograms in orthodontic individuals treated with extraction of first premolars.

Pre and post treatment lateral cephalometric radiographs of 20 patients were taken from orthodontic department, the University of Lahore. These lateral cephalograms were collected from the data present in orthodontic record room from 1/1/ 2007 t0 31/12/2012. Inclination of upper and lower incisors were assessed with respect to cranial base, maxilla, mandible and with respect to each other.

The results showed a significant change in all dental variables after orthodontic treatment when simple t-test was applied. In case of paired sample t-test , significant change was noted in two variables only which are upper incisor to nasion –point A angle and distance.

Orthodontic patients treated with therapeutic extraction showed significant improvements in their dental relationship.

Key Words: *Dental analysis, first premolar extraction, lateral cephalograms.*

INTRODUCTION

The introduction of radiographic cephalometrics by Broadbent[1] in the united states in 1931 provided both a research and a clinical tool for the study of malocclusion and underlying skeletal disproportions.

Perhaps the most important clinical use of radiographic cephalometrics is in recognizing and evaluating changes brought about by orthodontic treatment. Superimpositions taken from serial cephalometric radiographs before, during, and after treatment can be superimposed to study changes in jaw and tooth positions retrospectively.[2]

Cephalometric analysis is commonly carried out , not on the radiograph itself, but on a tracing or digital model. The manual tracing was done on conventional cephalograms using 0.5mm mechanical lead pencil on to 0.003 inch matte acetate paper taped to it. All tracings were performed on a view box under dim-lighted conditions. The measurements were made by using a cephalometric protractor for angular measurements and a millimeter ruler for linear measurements to the nearest 0.5mm.

Different cephalometric analysis were developed by Downs[3], Steiner[4], and many others which demonstrated dental, skeletal and facial soft tissue relationships to each other and to the cranial base.

In the present study, dental analysis was used to asses the post treatment changes in the upper and lower dentition in class II malocclusion groups.

METHODOLOGY

This was a cross sectional study carried out in Orthodontic Department at University of Lahore. Pre and post treatment lateral cephalograms of 20 patients (16 females and 4 males) representing class II malocclusion were selected and then manually traced out by a single operator. Mean age of the patients at start of treatment was 18.8 years with an age range of 12.5 years to 30 years. Ten patients had been treated with extraction pattern of upper first premolar and lower second premolar.The ten patients with extraction of upper first premolars only. Table 1.

Following landmarks were identified and reference planes were drawn on tracing of lateral cephalogram. Fig 1

Landmarks :

Sella (S)

Nasion (N)

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TABLE 1: DIFFERENT EXTRACTION PATTERNS FOR CLASS II MALOCCLUSION

	Ext* pattern	No of pts**
	Upper first premolars	10
	Upper first,lower second premolars	10
Total		20

* extraction
** patients

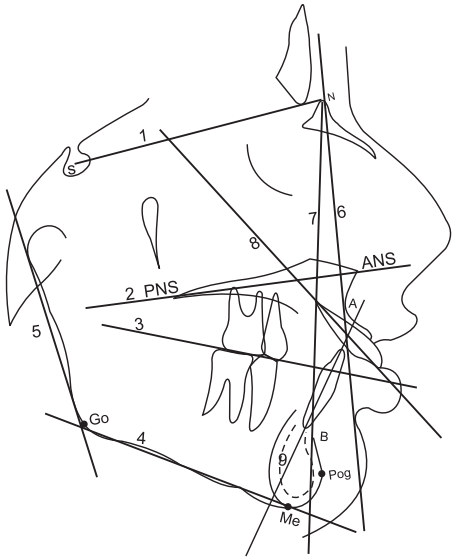

Fig 1: Landmark identification and reference planes drawn at tracing of lateral cephalogram.

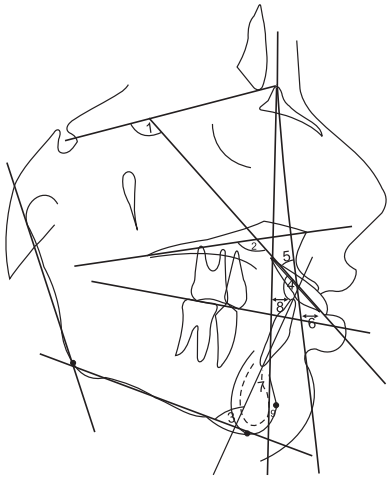

Fig 2: Linear and angular measurement for dental analysis

Anterior nasal spine (ANS)
Posterior nasal spine (PNS)
Point A
Point B
Pogonion (pog)
Menton (Me)
Gonion (Go)

Reference planes

1 Sella nasion plane
2 Palatal plane (ANS-PNS)
3 Occlusal plane
4 Mandibular plane

Reference lines

5 Tangent line from posterior surface of condyle and ramus
6 Nasion – point A line (NA line)
7 Nasion - point B line (NB line)
8 Line from long axis of Upper incisor to SN line
9 Line from long axis of lower incisor to mandibular plane.

Following linear and angular measurements were calculated on tracings of pre and post treatment lateral cephalograms. Fig 2

1: UI-SN >
2: UI-PAL>
3: IMPA
4: I.I >
5: UI-NA distance
6: UI-NA >
7: LI-NB distance
8: LI-NB>
9: Holdaway ratio (LI-NB distance: Pogonion – NB distance).

Statistical analysis

After normal distribution which was confirmed through the Kolmogorov-Simrnov test, pre and post treatment measurements were compared through a paired t test.

Intra-examiner reliability was determined by repeating cephalometric tracing and analysis of ten lateral cephalograms at one month interval. Intraclass agreement was checked using Pearson's correlation coefficient. The correlation coefficient was 0.96, which shows excellent intra-operative reliability for the examiner.

RESULTS

Descriptive statistics including means, standard deviations and standard errors were calculated for all variables. Table 2

One sample t test was applied to all 20 patients with 40 lateral cephalogram (pre and post), including both extraction groups. It was noticed that the mean

TABLE 2: DESCRIPTIVE STATISTICS INCLUDING MEAN, STANDARD DEVIATION AND STANDARD ERROR OF ALL VARIABLES

Variables	No *	Mean	SD **	SE ***
PRE				
UI-SN<	20	107.5	8.80	1.96
UI-PAL<	—	115.1	8.73	1.95
IMPA	—	99.2	13.23	2.95
IIA	—	121.5	13.05	2.91
UI-NA<	—	27.9	8.59	1.92
UI-NA dist	—	8.32	5.25	1.17
LI-NB<	—	28.2	7.02	1.57
LI-NB dist	—	6.12	3.53	0.78
H.R	—	7.40	5.33	1.19
POST				
UI-SN<	—	104.7	7.90	1.76
UI-PAL<	—	113.2	7.30	1.63
IMPA	—	95.0	8.56	1.91
IIA	—	122.1	11.19	2.50
UI-NA<	—	18.5	12.97	2.90
UI-NA dist	—	3.3	3.25	0.73
LI-NB<	—	30.02	5.90	1.32
LI-NB dist	—	6.2	2.83	0.63
H.R	—	7.3	6.07	1.35

No : Number of patients
SD : Standard Deviation
SE : Standard Error

difference of all the variables showed a significant change. Table 3

In paired sample t- test , two variables (UI-NA< and UI-NA distance) showed a statistically significant change (p value <0.005) and all remaining variables proved insignificant statistically. Table 4

DISCUSSION

Lateral cephalogram play a very important role in diagnosis of various craniofacial disharmonies. It also helps in diagnosing skeletal as well as dental malrelationships of maxillary and mandibular teeth with respect to each other and to their skeletal basis.

The original purpose of cephalometrics was research on growth patterns in the craniofacial complax. Pretreatment and post treatment lateral cephalometric analysis also demonstrate the changes produced after orthodontic treatment in dentoskeletal relationship. In both the situations either to asses the growth status or to evaluate the results of orthodontic and orthopedic treatment, lateral cephalogram should br recorded by the same x-ray unit. By convention, the distance from the x-ray source to the subject's midsagital plane is 5 feet. The distance from the midsagital plane to the cassette can vary but must be same for anyone patient every time.[2]

Through cephalometric tracing, angular and linear measurements can be noted accurately and precisely using the superimposition on stable reference planes.

Erdinac et al[5] reported that many authors did not eliminate the effect of growth in facial changes observed with treatment, once it is difficult to separate the effects of growth and therapy.

TABLE 3 : RESULTS OF THE ONE SAMPLE t-TEST SHOWED A SIGNIFICANT CHANGE

Variables Pre treatment	Signi-ficance	Mean difference
UI-SN<	0.000	107.5
UI-PAL<	0.000	115.1
IMPA	0.000	99.3
IIA	0.000	121.6
UI-NA<	0.000	27.9
UI-NA dist	0.000	8.3
LI-NB<	0.000	28.2
LI-NB dist	0.000	6.1
H.R	0.000	7:4
Post treatment		
UI-SN<	0.000	104.75
UI-PAL<	0.000	113.25
IMPA	0.000	95.10
IIA	0.000	122.10
UI-NA<	0.000	18.45
UI-NA dist	0.000	3.32
LI-NB<	0.000	30.02
LI-NB dist	0.000	6.02
H.R	0.000	7:25

P : Significance value
P<0.01 : very significant
P<0.05 : significant
p>0.05 : not significant

TABLE 4: RESULTS OF THE PAIRED SAMPLE t-TEST

Paired sample test					
Paired differences (pre and post difference)					
Sr No		**Mean**	**SD**	**SE**	**Si (2-tailed)**
1	UI-SN<	2.70	11.35	2.54	0.30
2	UI-PAL<	1.85	10.87	2.43	0.45
3	IMPA	4.17	13.09	2.93	0.17
4	IIA	-.55	15.27	3.42	0.84
5	UI-NA<	9.47	13.42	3.00	0.005
6	UI-NA dist	5.00	5.26	1.17	0.000
7	LI-NB<	-1.82	6.83	1.52	0.24
8	LI-NB dist	-0.75	2.32	0.51	0.88
9	H.R	0.15	8.00	1.78	0.93

SD Standard deviation
SE Standard error

In one study, pre and post treatment dental and soft tissue changes were assessed in 20 patients with bimaxillary dentoalveolar protrusion with extractions of four first premolars through lateral cephalometric analysis. The mean age of the patients at start of treatment was 12 years and 4 months. Upper and lower lips presented an increased distance to Ricketts' E line[6] showing retraction of incisors and retrusive profile. In this study , it was suggested that this change is due more to the growth of nose and chin than to a real change in their position.[7]

The present study was a pre-post design research analysed with a paired data t-test from 40 lateral cephalogram of 20 patients with class II malocclusion treated using Edgewise standard fixed orthodontic appliance. The extraction pattern was upper first and lower second premolars in ten patients and upper first premolars extraction only in ten patients. Paired sample t-test was applied. The results showed a statistically significant change (p value < 0.005) in two variables (UI-NA< and UI-NA distance).

It is probably due to the fact that in all the cases there is extraction of upper first premolars which showed a significant retraction.

Lateral cephalometric radiographs were manually traced by a single operator in this study.

When the hand tracing method was investigated, no differences were found between operators 1 and 2 for any variable.[8]

The reliability of hand tracing has been well demonstrated in other previous studies also.[9]

In 1948, the first cephalometric analysis in the USA was published by Downs, who introduced a practical analysis for diagnostic purposes.[10]

The 2002 JCO study of orthodontic diagnosis and treatment procedures among orthodontists in the USA (response rate 9%), previously conducted in 1986, 1990, and 1996, showed that the most commonly used analysis was the Steiner analysis (in 45.1% of the practices) and its relative popularity as compared to other analyses remained about the same over the years.[11]

A survey among all orthodontist working in the Netherland (response rate 78%) showed similar findings. The most commonly used analtsis also was the Steiner analysis, used by 58% of the Duch orthodontist, followed by the Downs analysis that was used by 22%.[12]

Another study also showed that most orthodontist used more than one cephalometric analysis for diagnosis and treatment planning.[13]

In the present study also, most of the variables were taken from Steiner[4], Downs[10] and Holdaway analysis.[14,15]

Linear and angular measurements which were used in the present study demonstrated only upper and lower incisor inclination change in cases of first premolar extractions in upper arch only in half of the patients and upper first and lower second premolars extractions in the other half of the patients. So two dental variables such as upper incisor to nasion – point A angle and distance which addressed only the upper incisor inclination and which was most influenced by extraction of upper first premolars in cases of class II division 1 malocclusions. Therefore these two variables responded well to treatment with good anchorage control, showed statistically significant result. P value < 0.005 for UI-NA angle and p value < 0.000 for UI-NA distance. Although all the other variables improved after treatment but the result was insignificant statistically.

CONCLUSION

This study showed a statistically significant change in two variables (UI-NA< and UI-NA distance).

It is probably due to the fact that in all the cases there is extraction of upper first premolars which showed a significant retraction.

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