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**Original Article**

# COMPARISON OF PAKISTANI AND CAUCASIAN CEPHALOMETRIC VALUES ACCORDING TO STEINER'S ANALYSIS

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## ABSTRACT

***Objectives:*** *To develop Pakistani norms or standards for young people in terms of their skeletal and dental cephalometric values, and then to compare those norms to Caucasian norms using Steiner's technique.*

***Materials and Methods:*** *A cross-sectional study was carried out on 1000 young adults in Pakistan; lateral cephalograms were acquired, traced, and measured. There were six angular measurements and five linear measurements made. Using Steiner's methodology, the mean of all the values was computed and compared to Caucasian norms. Data analysis was done using SPSS-26.*

***Results:*** *The sample included 1000 young adults, (459 males and 541 females). The overall mean age of the sample was 24.69 ± 4.1 years. "The results indicated that all cephalometric values assessed were statistically different for our population except for ANB (p=0.06)". SNB (81.07+2.46), UINAmm (4.71+3.07), UINAangle (27.21+6.83), LINBmm (4.86+2.32) and LINBangle (27.14+5.14) were more in Pakistani population as compared to Caucasian norms with statistically significant difference (p < 0.05), whereas, SNA (81.71+3.05) and ANB were found to be lower in Pakistani population as compared to Caucasian norms.*

***Conclusion:*** *The results of this study are based on samples from the Pakistani population. All of the lateral cephalograms underwent Steiner's analysis, and significant deviations from the standard Steiner's norms for Caucasians were found.*

***Key words:*** *Caucasian, cephalometric norms, Pakistani adults, Steiner's analysis.*

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## INTRODUCTION

Cephalometric radiography was first used in orthodontic research and clinical practice in 1931 by "Hofrath in Germany and Broadbent in the United States"[1]. It is a dependable and repeatable diagnostic technique that has helped orthodontists create treatment plans and assess changes in the locations of the jaw and teeth as a result of orthodontic therapy and growth. Radiographic surgery, cephalometric ranges have been applied and used to define cephalometric standards for orthodontic diagnosis, treatment planning, and orthognathic surgery, among other analyses[2-5]. Cephalometric evaluation has grown in importance throughout time, and a great deal of research and study has been done, leading to the creation of cephalometric norms. According to one study, genetics plays a crucial part in how the orofacial

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features and teeth develop[6]. Applying cephalometric norms from one population to another is therefore not against scientific principles or methodology because the analysis can only be trustworthy and helpful if the patients are compared with people of the same ethnicity as the population[7]. Cephalometric values for their population have been established by researchers. These studies should be viewed as relevant to their community only, as their conclusions do not apply to other ethnic groups. Other academics were inspired by this to look at cephalometric standards in their own groups, including Bangladeshi, European, Malaysian Indian and Americans[8-10].

Steiner's analysis, created in the 1950s by Cecil C. Steiner, is one of the most widely used facial analyses used in orthodontics[9]. The results of white American and white Caucasian populations were used to construct the values he provided and confirmed for this analysis, which may not be a suitable benchmark for patients from other ethnic groups who are undergoing orthodontic evaluation and treatment planning.

For many years, demographic groupings all across the world were measured according to the cephalometric standards for Caucasians. However, over time, many researchers concluded that there were variations in cranial morphology among other ethnic groups, and they came to the conclusion that the normal measures of one group could not be regarded as normal for other ethnic groups[4-10].

The purpose of this study is to achieve the next set of goals. Skeletal and dental parameters for young adults in Pakistan are established using Steiner's analysis.

## MATERIALS AND METHODS

This cross-sectional study was carried out over six months (1st January 2022 to June 2022) at the Hamdard College of Medicine and Dentistry, Karachi. The research was reviewed and approved by the IRB at the same institution, NO ERC/BDS/015/2022. A total of 1000 Pakistani adults were included via non-probability consecutive sampling technique. Given that full craniofacial skeletal growth was required, age was regarded as a significant determinant in the selection of participants. Skeletal growth in girls often ends by the age of 15, but it can last until the age of 18, according to a research on Caucasians conducted by Ricketts.[11] Accordingly, the male participants in this study had to be at least 18 years old, while the female participants had to be at least 15 years old. Subjects having Pakistani origin and aesthetically acceptable profiles as judged by photos were the main focus of the inclusion criteria. These profiles were orthognathic, with normal vertical dimensions, competent lips, normal nasolabial angle and normal mentolabial sulcus on photographic examination. Three orthodontists independently assessed each participant's photo to make sure it satisfied the requirements for inclusion. Only those participants who were deemed aesthetically acceptable by all three examiners were chosen for the study. Each examiner conducted the evaluation separately. Those with a history of trauma, previous orthodontic treatment, developmental dentofacial abnormalities, or facial cosmetic surgery were not included.

All participants' lateral cephalograms and photos were taken in the Natural Head Position (NHP) in accordance with the instructions, making sure that the images were taken at the same level. A single, skilled author performed the cephalometric analysis, guaranteeing data consistency and dependability. An intra-examiner test was used to assess measurement consistency. 25 cephalograms were selected at random from the final sample for this reason, and the same researcher reevaluated them two weeks later. “The correlation between the two sets of measurements was calculated using Dahlberg’s formula and the intraclass correlation coefficient (ICC)”. “Data from Caucasian populations in previous studies were used for comparison with the Pakistani sample”.

The statistical software SPSS 26 used for data analysis. Descriptive analysis was used to obtain the mean, standard deviation, and cephalometric values of the Pakistani population. Independent Student’s t-test was used to compare the mean values of the Pakistani population with values of Cucasian standards. A p-value of $< 0.05$ was considered as significant.

## RESULT

The sample included 1000 participants, (459 males and 541 females). The overall mean age of the sample was 24.69±4.1 years. The results indicated that all cephalometric values assessed were statistically different for our population except for ANB ($p=0.06$). SNB (81.07+2.46), UINAmm (4.71+3.07), UINAangle (27.21+6.83), LINBmm (4.86+2.32) and

LINBangle (27.14+5.14) were more in Pakistani population as compared to cucasian norms with statistically significant difference p-value < 0.05, whereas, SNA (81.71+3.05) and ANB were found to be lower in Pakistani population as compared to cucasian's norms, as shown in table #1.

## DISCUSSION

By combining clinical face analysis with hard- and soft-tissue cephalometry, recent advancements in diagnosis and treatment planning have made it easier to comprehend facial balance, proportions, and esthetics. There are still not enough cephalometric studies conducted in Pakistan[7-8]. To develop Steiner Analysis cephalometric norms for the Pakistani population, the current study was conducted in light of this (Karachi).

Researchers worldwide have attempted to formulate cephalometric standards for different ethnic groups, and their results show considerable variation among populations. This study focused on a sample of 1,000 Pakistanis with normal occlusion and well-balanced facial profiles.

In the present study, the SNA angle was observed to be statistically significant in the Pakistani population (81.71°±3.05°) compared with Caucasians (82°±3°). This indicates that the Pakistani population tends to have a more normal maxilla than Caucasians. Similarly, the SNB angle was higher in Pakistanis (81.07°±2.46°) as opposed to Caucasians (78°±3°). The ANB angle, however, was slightly higher in Caucasians (3°±2°) than in Pakistanis (2.85°±1.63°),

**Table 1: Comparision of Pakistani and caucasian cephalometric values according to Steiner's analysis**

| Parameters | Caucasian norms | Sample Mean + SD | P-value |
|---|---|---|---|
| **SNA** | 82 + 3 | 81.71+3.05 | 0.00 |
| SNB | 78 + 3 | 81.07+2.46 | 0.00 |
| ANB | 3 +2 | 2.85+1.63 | 0.06 |
| UINAmm | 4+1 | 4.71+3.07 | 0.00 |
| UINAangle | 22+5.5 | 27.21+6.83 | 0.00 |
| LINBmm | 4+1 | 4.86+2.32 | 0.00 |
| LINBangle | 25+6.25 | 27.14+5.14 | 0.00 |
| I.I | 131 + 8 | 123.43+10.09 | 0.00 |
| Occ.SN | 14+ 3.5 | 13.36+2.13 | 0.00 |
| GOGN.SN | 31.73+ 7.9 | 27.07+4.49 | NA |
| S.UL | 0.00 | -2.14+2.38 | NA |
| S.LL | 0.00 | -0.36+2.24 | NA |

though this difference was not statistically significant. "Nisa and Khayam also conducted a study on a localized population in Jamshoro and reported comparable results (ANB increased by 1.8°)[12]. On the other hand, Khan et al. reported different findings, noting significantly lower SNA and SNB values, while ANB showed no difference[11]. Similarly, Alam and colleagues documented a comparable variation in ANB values between Caucasians and South Asians, further supporting the view that an esthetically pleasing facial profile in this region tends to be more convex than what is typically regarded as attractive in the West"[13].

These results are consistent with the findings of Alassiry, MA, Shalhoub, Sarhan, Nashashibi, Al-Jasse, and Hassan, who conducted similar studies on the Saudi population[6,14-17].

Besides, Usman Ahmed and colleagues discovered that in the anterior dental region, all values, including UINA angle, UINA distance mm, LINB angle, and LINB distance mm, are higher in the Pakistani population than Steiner's analysis of Caucasian norms with statistically significant difference, indicating that bimaxillary protrusion is more common in the Pakistani population[18]. This finding is consistent with our own.

The current investigation found that the mean values for the Pakistani sample were considerably different from the mean of Steiner's analysis of Caucasians in all measured values. The same results were found in a research by Zia B et al which found that the mean values for the Pakistani sample were significantly different from the mean of Steiner's analysis of Caucasians in all measured dimensions[19].

In this study, only cephalograms of patients seeking orthodontic treatment were included. This may explain the finding of greater proclination and protrusion observed here. For future research, a larger sample encompassing different age groups, additional variables, and stricter selection criteria should be considered. Furthermore, the present study evaluated values based on Steiner's analysis; therefore, other cephalometric norms derived from different analyses may also vary and warrant investigation in the Pakistani population.

## CONCLUSION

The results of this study are based on samples

from the Pakistani population. All of the lateral cephalograms underwent Steiner's analysis, and statistically significant difference was observed from all the standard Steiner's norms for Caucasiansexcept ANB. The investigation's findings can be applied to the adult population of Pakistan and can serve as a guide and a reference for orthodontic treatment.

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CONFLICT OF INTEREST
Authors declare no conflict of interest.
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## AUTHORS' CONTRIBUTION

The following authors have made substantial contributions to the manuscript as under:

| | |
|---|---|
| Conception or Design: | QA, AF, AN, SS, EA |
| Acquisition, Analysis or Interpretation of Data: | QA, AF, AN, SS, EA |
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All the authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.