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Distribution of face types in the ethnic himachali's of upper sirmour region and their correlation with the maxillary dental arch measurements

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Abstract

Objective: Evaluate the distribution of face types in the Ethnic Himachali's of Upper Sirmour region and their correlation with upper dental arch measurements.

Materials and Methods: 200 subjects (equal no. of males and females) of Ethnic Himachal Pradesh population of upper Sirmour District (age group18-30 years) were included, anthropometric points were measured by using digital vernier calliper and study models were constructed to measure maxillary arch, palatal dimensions dimensions.

Result: A statistically significant difference was found in the facial indices (p=0.001) between males and females. Comparison of maxillary arch parameters showed that the majority of mean maxillary arch dimensions were significantly greater in men than in women. Comparison of Maxillary arch parameters in various facial types shows

that the transverse maxillary arch dimensions were greater in europroscopic face.

Conclusion: Specific face types does have specific type of dental measurements and relationships of the canines to one another and to other teeth thus had the widest ranges, implying that these dimensions are the strongest determinants of maxillary arch size.

Keywords: Craniofacial indices, Anthropometric points, Ethnic Himachali population

Introduction

No two individuals are exactly alike in all their measurable traits,[1] even genetically identical twins (monozygotic) differ in some respects.[1] These traits tend to undergo changes in varying degrees from birth to death in health and disease and since skeletal development is influenced by a number of factors producing[1] differences in skeletal proportions between different geographical areas[1], it is desirable to have some means of giving quantitative expression to variations which such traits exhibit.[1] Anthropometry as a study is a technique of expressing quantitatively the different forms of the human body.[2] In other words, anthropometry means the measurement of human beings, whether living or dead or on skeletal material.[2]

Anthropometric characteristics have direct relationship with sex, shape and form of an individual and these factors[2] are intimately linked with each other and are manifestation of the internal structure, tissue[2] components which in turn and are influenced by environmental and genetic factors.[3-4]

The human face, with its bone and muscle structures, presents its own peculiar characteristics.[1] It may be classified into basically three types,[5] which relate to the growth and variation in format and craniofacial configuration, both in the vertical and horizontal directions.[5] One form of classification, which takes into account the vertical plane of the face divides it into: long or dolichofacial, medium or mesofacial and short or brachyfacial.[5]

It is important to diagnose facial type, for each one presents singular characteristics according to dental occlusion, facial harmony and orofacial muscles.[6]

Craniofacial anthropometry, is an important part of anthropology and medicine and is used for the determination of the morphological characteristics of the head and face.[7]

The human body dimensions are affected by ecological, biological, geographical, racial, sex and age factors.[8] Comparison of changes between parents, offspring and siblings can give a clue to genetic transmission of inherited character.[8] Anthropometric measurements especially craniofacial measurements are important for determining various head and face shapes.

Proscopic (Facial) index

Proscopic index is the relation to the length of the face to its maximum width between zygomatic prominences. The length of face is measured from the nasion to mental tubercle and face breadth is measured as bizygomatic width. The total facial index is calculated as

Formula: Proscopic (facial) index (FI) = [Total facial height/ Bizygomatic width] X 100[9]

The relation between the facial forms and the dental arch forms had been studied by different authors. The long-face pattern included a narrow dental arch, while the short face pattern had wide arch.[10] Leptoprosopic (dolichocephalic) individuals have narrow dental arches, while euryprosopic (brachycephalic) individuals have broad, round dental arches. Mesoprosopic (mesocephalic) individuals fit somewhere in between these two.[11]

As a general rule facial morphology has a certain relationship to the shape of the dental arch However,

direct relationship hasn't been established.[12] Study cast analysis is a three dimensional assessment of maxillary and mandibular dental arches and the occlusal relationships. Despite of certain limitations, a great advantage of dental cast analysis is that the degree of malocclusions can be diagnosed in three dimensions which is essential for precise diagnosis of an orthodontic case. The size and form of the dental arches vary among individuals according to tooth size, tooth position, pattern of craniofacial growth and by several genetic and environmental factors.[13,14]

In present study an attempt was made to evaluate the distribution of face types, in the ethnic Himachali's of upper Sirmour region and their correlation with upper and lower dental arch measurements which are important to orthodontists in their diagnosis, treatment, and evaluation of orthodontic treatment outcomes.

Material and methods

A Sample of 200 subjects (equal no. of males and females) falling in the age group of 18- 30 years belonging to Ethnic Himachal Pradesh population of upper Sirmour District were selected for the study.

Inclusion Criteria

- Ethnic Himachali's of upper Sirmour region.
- The age ranged from 18-30 years.
- Healthy and without any obvious craniofacial abnormalities like occulofacial trauma, craniofacial congenital anomaly, and had no history of plastic or reconstructive surgery.
- Subjects with full complement of permanent teeth (excluding third molars)

Exclusion Criteria

Subjects:

- Who had undergone any orthodontic or surgical treatment.
- Without full complement of teeth
- Congenital anomalies like cleft lip and palate, Down syndrome.
- Clinically obvious asymmetry and disharmony of face

All individuals were examined under natural light with plane mouth mirrors. During examinations, each individual was seated on a chair with their head positioned so that the Frankfort horizontal plane was parallel to the floor. Hooten's Method used for assessing Total facial index using by digital vernier caliper (FIGURE 1).

Total facial height (Nasion – Gnanthion) (N-Gn). (FIGURE1

Bizygomatic breadth (Bizygomatic, Zy- Zy). (FIGURE 1

Depending on these indices the types face shapes were classified according to Martin & saller (1957) method and Farkas (1981, 1994) method.[8]

After taking the measurements on head and face, alginate impressions of maxillary arches of all the subjects were made using perforated stock trays and poured immediately with the type III dental stone using three pour technique. Labelling of the poured impressions was done with the help of marker. Dental arch dimensions and palatal length and width were measured using a modified digital vernier caliper. Palatal depth was measured using a palatometer.

Landmarks [15]

The following landmarks were used:

1. Incisal point: The point midway between the incisal edges of the two central incisors[17]

2. Canine cusp tips: The cusp tips of the right and left permanent canines [17]

3. Premolar Cusp Tips: The buccal cusp tips of the right and left second premolars

4. Mesiobuccal First Molar Cusp Tips: The mesiobuccal cusp tips of the right and left permanent first molars

5. Mesiolingual First Molar Cusp Tips: The mesiolingual cusp tips of the right and left permanent first molars

6. Distobuccal Second Molar Cusp Tips: The distobuccal cusp tips of the right and left permanent second molars

Maxillary arch width (Figure 2) [15]

1. Intercanine distance: The linear distance between canine cusp tips
2. Interpremolar distance: The linear distance between the buccal cusp tips of the second premolars[15]
3. Inter–first molar distance: The distance between the mesio-buccal cusp tips of the first molars
4. Inter–second molar distance: The distance between the disto- buccal cusp tips of the second molars.

Maxillary arch length (FIGURE 3) [15]

1. Anterior arch length: The vertical distance from the incisal point to the intercanine distance line[15]
2. Molar-vertical distance: The vertical distance from the incisal point perpendicular to a line between the mesiolingual cusp tips of the first molars
3. Total arch length: The vertical distance from the incisal point to the midpoint of a line between the distobuccal cusp tips of the second molars. [15]

Palatal width, length, and depth (FIGURE 4) [15]

1. Palatal width: the linear distance between the mesiolingual cusp tips of the right and left first molars[15]
2. Palatal length: equivalent to the molar-vertical distance
3. Palatal depth: the vertical distance from a point on the palatal width line to the palatal vault in the midline. [15]

2.1. Ethical Committee permission

The study was approved by ethical committee of Himachal institute of dental sciences, Paonta sahib.

2.2. Informed consent

Informed consents were attained from each subject for the purpose of this study.

2.3. Statistical analysis

Statistical analysis was done using Statistical Package for the Social Sciences (SPSS for Windows, SPSS Inc, v.16, USA). Prior to the analysis, normality testing of data was done using Shapiro-Wilk test which showed that the data were normally distributed ($p>0.05$). Quantitative data were calculated as means and standard deviations and qualitative data as numbers and percentages. Comparison of study variables between males and females was done using independent t-test. Comparison among various facial types was done using ANOVA (Analysis of Variance). Multiple comparisons were done using post-hoc Tukey's test. The level of significance for the present study was set at a p-value of less than 0.05.

4. Results And Observations

In the present study, various facial parameters were statistically analyzed, to obtain the facial index and dental arch measurements Digital Verneir Caliper was used and the palatal depth was measured with the use of a Palatometer. The reproducibility of the sample was tested by taking the measurements thrice.

Table 1 represents the descriptive values of various parameters of facial indices in Ethinic Himachalis of upper Sirmour Region for both males and female.

Table 2 represents gender wise distribution of face types which showed mesoproscopic face type was the predominant type (31%) in females whereas in males, europroscopic was the predominant type (40%).

Table 3 represents comparison of facial index between males and females.

Table 4 represent gender-wise comparison of maxillary arch dimensions respectively.

Table 5 represent the comparison of facial type with maxillary arch measurements.

Discussion

It is generally accepted among orthodontists that there exists a relationship between dental arch width and vertical facial morphology. A long face (leptoprosopic) individual usually has narrower arch dimensions and a short face individual (euryprosopic) has wider arch dimensions according to Rickets et al.[16]

The present study provides a valuable data pertaining to facial indices in individuals between 18-30 years of age; belonging to Ethnic Himachali population of upper Sirmour.

The predominant face type in this population was Europroscopic in overall population (Table 1). Interaction of gene expression and craniofacial dimensions can make the gene expression differs in various racial and ethnic groups in geographical zones[17]

Gender wise distribution of face type showed Mesoproscopic face was the predominant type in females and in males Europroscopic face was the predominant type (Table 2). The results from the study were in contrast with the study conducted by Jahanshahi et al (2008)[21]and Pavlica et al. (2006). Facial index is crucial for orthodontic treatment. Facial indices are important in anthropometry, forensic medicine and genetics as development of face of the embryo starts by third to eight week of intra uterine life. They consist of three germ layers, ectoderm, mesoderm and endoderm, which form the mesenchyme. The facial prominences are formed by five swellings that appear in the fourth week and come from the first and second pharyngeal arch.[9] In our study it was found that specific type of face has specific type of dental measurements. The reason for it might be probably attributed to the dominance of one germ layer on the other germ layers.

(Table 3) shows the comparison of Facial index in males and females. Comparison between the Facial index with race and age and sex is important, which are valuable for treatment monitoring and prediction of orthodontic treatment.

Gender-wise comparison of Maxillary arch dimensions showed a significant sex differences (Table 4). These results were in contrast to the studies conducted by N.M. Al-Zubair(2014), Cohen (1940)[18] and Borgan (2001).[19] This difference may be attributable to differences in ethnicity, sample size, tooth or environmental factors.

Maxillary arch parameters in various facial types showed that the mean intercanine, the mean inter second premolar, the mean inter first molar was more in europroscopic face while the mean anterior arch length, the mean molar vertical distance ,the total arch length and the palatal length was more in leptoproscopic face (Table 5). Present study found that specific type of face has specific type of dental malocclusion. Leptoprosopic individuals had Narrow dental arches, while Euryprosopic individuals had broad, round dental arches; whereas Mesoprosopic individuals fitted somewhere in between the two types. Al Shalabi (2002)[20]agrees on that there is no clear relationship between facial forms and arch forms. It was noticed that there was an association between Leptoprosopic and Dolichofacial, and between Euryprosopic face type and Brachyfacial.

Strengths and Limitations of the study

The strengths of the study are that the study suggests facial index with the dental arch measurements can be used as dental norms of Ethnic Himachali's of Upper Sirmour, this study might be better for large scale epidemiologic studies. In addition, no previous such study was conducted.

However, the limitations were that the sample was restricted to Ethnic Himachali's of upper Sirmour Region only and may not benefit much to the other Ethnic groups of Himachali population.

Conclusion

The predominant facial type was Europroscopic (33.5%) followed by Mesoproscopic (23.5%).

In the gender-wise distribution of face type, Mesoproscopic face was the predominant in females (31%) whereas in males, Europroscopic was predominant (40%).

Gender-wise comparison of Maxillary arch dimensions shows the mean intercanine, inter second premolar, molar vertical distance, total arch length, palatal width, palatal length, palatal depths was greater in the Ethnic male population. Measurements related to the canines and palatal are the strongest determinants of maxillary arch size.

Maxillary arch parameters in various facial types showed which shows that the mean intercanine, the mean inter second premolar, the mean inter first molar was more in europroscopic face while the mean anterior arch length, the mean molar vertical distance, the total arch length and the palatal length was more in leptoproscopic face type which may be related to the morphological and dento-alveolar pattern of both maxilla.

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Legend Table and Figures

Figure 1: Facial heightand bizygomatic breadth

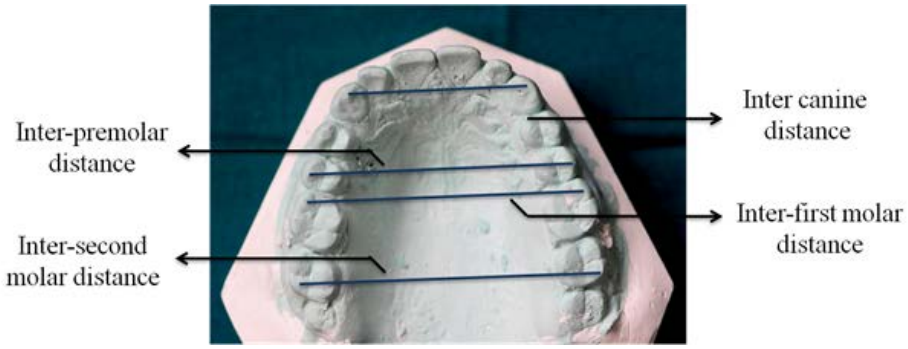

Figure 2: Maxillary arch widths

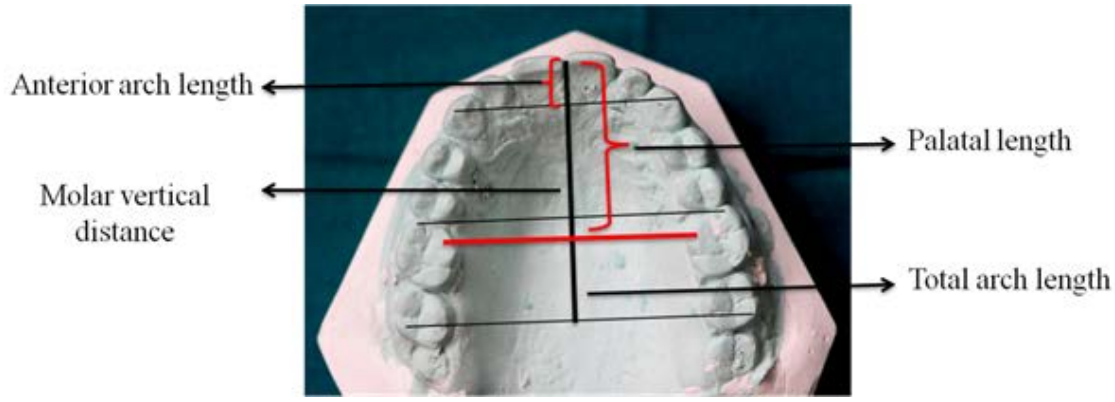

Figure 3: Maxillary arch lengths

Figure 4: Measurement of Palatal Depth Using Palatometer

Table 1: Facial Type (Overall)

Facial type	N	%
Leptoproscopic	39	19.5
Mesoproscopic	47	23.5
Europroscopic	67	33.5
Hypereuroproscopic	21	10.5
Hyperleptoproscopic	26	13.0

Table 2: Gender Wise Distribution of Face Type

Facial Type	Female Count	p-value	%	Male Count	%	p-value
Leptoproscopic	15	0.008	15.0%	24	24.0%	0.008
Mesoproscopic	31		31.0%	16	16.0%	
Europroscopic	27		27.0%	40	40.0%	
HyperEuroproscopic	9		9.0%	12	12.0%	
Hyperleptoproscopic	18		18.0%	8	18.0%	

*Statistically significant (Chi-square test, $p<0.05$)

Table 3: Comparison of Facial Index between Males and Females

Index	Sex	N	Mean	Std. Deviation	p-value
Facial Index	Female	100	89.3278	11.86824	0.001* p-value
	Male	100	84.1771	8.46185	

*Statistically significant (Independent t-test, p<0.05)

Table 4: Gender-Wise Comparison of Maxillary Arch Dimensions

Maxilla	Female Mean (mm)	Std. Deviation female (mm)	Male Mean (mm)	Std. Deviation Male (mm)	p-value
Intercanine Width	33.1299	1.92122	34.0537	2.82115	0.007*
Inter Second Premolar Width	45.2317	2.36441	47.6536	5.47843	<0.001*
Inter First Molar Width	50.8426	2.14064	51.1497	3.07872	0.414
Inter Second Molar Width	56.2852	2.99007	55.9440	6.67989	0.642
Anterior Arch Length	7.8743	2.34345	7.6919	2.30485	0.580
Molar Vertical Distance	28.7582	3.31911	31.0126	3.12576	<0.001*
Total Arch Length	41.6147	2.79377	42.9222	4.47289	0.014*
Palatal Width	38.3447	3.93670	40.1687	2.43421	<0.001*
Palatal Length	29.3969	3.73906	31.3227	5.88255	0.006*
Palatal Depth	18.2600	1.74437	18.9400	2.22847	0.017*

*Statistically significant (Independent t-test, p<0.05)

Table 5: Comparison of Facial Type with Maxillary Arch Dental Measurements

Maxilla	Face Type	Mean(mm)	Std. Deviation(mm)	p-value
Intercanine Width Maxilla	Leptoproscopic	32.2331	1.89968	<0.001*
	Mesoproscopic	32.4357	1.42060	
	Europroscopic	35.3266	2.60071	
	Hypereuroproscopic	33.9162	1.79721	
	Hyperleptoproscopic	32.9873	2.06783	
Inter Second Premolar Width Maxilla	Leptoproscopic	45.0826	3.41552	<0.001*
	Mesoproscopic	44.2255	.94566	
	Europroscopic	49.3669	5.85526	

	Hypereuroproscopic	45.9233	1.88587	
	Hyperleptoproscopic	45.3746	1.87940	
Inter First Molar Width Maxilla	Leptoproscopic	50.0256	3.47142	
	Mesoproscopic	49.9902	1.27993	
	Europroscopic	52.3864	2.82664	<0.001*
	Hypereuroproscopic	51.5810	.84312	
	Hyperleptoproscopic	50.2154	1.84480	
Inter Second Molar Width Maxilla	Leptoproscopic	55.7985	3.65676	
	Mesoproscopic	55.4611	1.03825	
	Europroscopic	56.0545	8.19200	0.571
	Hypereuroproscopic	57.5533	2.50590	
	Hyperleptoproscopic	56.7631	2.16610	
Anterior Arch Length Maxilla	Leptoproscopic	9.2274	2.14088	
	Mesoproscopic	7.5132	2.58668	<0.001*
	Europroscopic	7.3804	2.13108	
	Hypereuroproscopic	8.6438	1.02390	
	Hyperleptoproscopic	6.4469	2.10704	
Molar Vertical Distance Maxilla	Leptoproscopic	32.3085	1.60437	<0.001*
	Mesoproscopic	29.0011	2.54727	
	Europroscopic	29.9604	4.42136	
	Hypereuroproscopic	28.2305	3.09870	
	Hyperleptoproscopic	28.9927	1.88833	
Total Arch Length Maxilla	Leptoproscopic	43.4313	3.40125	
	Mesoproscopic	41.0026	3.60897	
	Europroscopic	43.1070	4.52115	0.002*
	Hypereuroproscopic	42.1171	1.61281	
	Hyperleptoproscopic	40.7738	2.57118	
Palatal Width	Leptoproscopic	38.8341	2.70900	0.482
	Mesoproscopic	38.8974	1.20538	
	Europroscopic	39.4972	5.07237	
	Hypereuroproscopic	40.2922	1.91902	
	Hyperleptoproscopic	39.0838	2.27641	
Palatal Length	Leptoproscopic	32.3064	1.60411	
	Mesoproscopic	28.3413	3.89748	
	Europroscopic	32.0507	6.97662	<0.001*

	Hypereuroproscopic	27.5600	2.76744	
	Hyperleptoproscopic	28.9927	1.88833	
Palatal Depth	Leptoproscopic	18.5128	1.39306	0.82
	Mesoproscopic	18.8298	1.40371	
	Europroscopic	18.6269	2.80603	
	Hypereuroproscopic	18.1905	1.63153	
	Hyperleptoproscopic	18.5769	1.70113	