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Craniometry and Malocclusion in Mentally Disabled Subjects in India

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Abstract

Background: The study aims to determine variations in craniofacial regions in mentally challenged individuals and to determine prevalence of malocclusion in these individuals.

Methods: The malocclusion was identified and craniometric measurements were obtained among patients attending a special education program in Faculty of Dentistry, India.

Results: The prevalence of malocclusion in the study population was 83%. Craniometric analysis revealed that brachycephalic, mesocephalic and hyperbracycephalic head shapes in different groups.

Conclusion: In India, mentally disabled individuals have a higher prevalence of malocclusion than the general population and assessment of cranial characteristics of these persons may be of help to clinicians and researchers.

Keywords: Craniofacial; Malocclusion; Craniometry; Mentally disabled

Introduction

Mental retardation is defined as an effectual theoretical intelligence, which can be congenital or acquired early in life. Based upon the intelligence quotient (I.Q.) the American academy of mental deficiency classified mental retardation into four categories as mild, moderate, severe or profound retardation [1]. An individual is classified as having mild mental retardation if his or her IQ score is 50-55 to about 70; moderate retardation, IQ 35-40 to 50; severe retardation, IQ 20-25 to 35; and profound retardation, IQ below 20-25 [2]. Several studies reported that malocclusion is more common in mentally disabled individuals compared to the general population [3-6]. Malocclusion plays an important role in the overall oral health of an individual because it is associated with periodontal disease, temporo-mandibular disorders, and may be complicated by an individual's disability [7-10]. Although the epidemiology of malocclusion is extensively studied in mentally disabled individuals worldwide, there is scarce data regarding the same from India.

Normal Facial morphology and its components are necessary for harmonious aesthetics of the craniofacial complex [3-6]. Oral & dental anomalies are frequent accompaniment of mentally challenged, leading to improper functioning of stomatognathic complex. Various studies have reported morphological changes in the craniofacial complex of mentally challenged individuals, autistic and Down's syndrome patients [4-13]. It has been reported that there are approximately 80 different syndromes showing craniofacial distortion of which 21 are related with mental retardation [12]. Although craniofacial anomalies in various syndromes have been described previously, the craniometry in the mentally retarded has not been studied. Amongst the cranial anthropometric measurements, head length and head width are considered most important, as they are used to determine the cranial size expressed as a cephalic index [13]. Thus the study aims to determine variations in craniofacial regions in mentally challenged individuals and to determine prevalence of malocclusion in these individuals. To the best of our knowledge this is the first study done to determine the cephalic dimensions in mentally disabled individuals. This may aid in the diagnosis of several dysmorphic syndromes, supplying the clinician with useful indications about the anatomical structures that differ from the norm. Further, this knowledge is also imperative for planning reparative procedures.

Material and Methods

The cross-sectional study was conducted among patients attending a special education program at Faculty of Dentistry, Jamia Millia Islamia, New Delhi, India. The study protocol was approved by Institutional review board prior to the start of the study. Subjects were included in the study if they had parental consent/proxy consent, were present on the day of examination, and were willing to participate. Children were excluded from the study if they were uncooperative or had medical conditions, such as infective endocarditis, coagulopathy, abscess, etc., which contraindicated an oral examination without appropriate modifications. Informed consent was obtained from their guardian with whom they were accompanied. The intelligence quotient (IQ) of these children in these schools ranged between 20 to 80. This IQ had been determined prior to placing the children in schools by educational diagnosticians involved in the assessment of mentally handicapped children. All the mentally handicapped individuals between 6 years and 40 years were examined but children with severe retardation in this age group who were difficult to examine properly were excluded from the study.

The study design consisted of close-ended questions on demographic characteristics, dietary habits, oral hygiene habits, and type of disability. Clinical examination included assessment of dentition status and head anthropometry. The malocclusion was identified and classified into Class I, Class II [divisions 1 and 2], and Class III in accordance with

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Angle's classification of malocclusion [14]. The divisions 1 and 2 of Class II malocclusions were combined. Craniometric measurements i.e maximum head length (HL) and head breadth (HB) were measured for each subject using Martin spreading calipers centered on standard anthropological methods. The craniometric measurements were taken according to the technique defined by Kalia et al. [15]. The head length was measured as the straight distance between from opisthocranion to glabella and head width was measured as the distance between two most lateral points of the skull above the level of supramastoid crest at right angles to the median sagittal plane. Subsequently, cephalic Index (CI) was calculated using the formula head breadth/head length X 100. All the examinations were carried out by two dentists, however, throughout the examinations, every 10th child was re-examined independently by each examiner to test for possible intra- and interobserver variation, which was less than 5% for each of the studied variables. Recording procedures were carried out according to the criteria described by WHO [16].

Statistical Methods

Chi-square tests were used to test the variation of the prevalence among groups and for testing the associations of the background factors (age groups, gender, type of disability etc.). One-way Analysis of Variance (ANOVA) was used to analyse the differences in the mean scores of cranial parameters. The associations of various socio-demographic and other factors with the occurrence of malocclusion and cranial parameters were assessed using multivariate analysis (logistic regression). Odds ratios (OR) with 95% confidence interval (95% CI) were estimated for the studied background factors in relation to the occurrence of malocclusion. The following factors were included in the logistic regression model: age, gender, and type of disability. The statistical analyses were performed on SPSS 10.0 software package (SPSS Inc., Chicago, Illinois, USA).

Results

Out of 310 individuals selected for the study, 258 (83%) patients could be examined. The rest did not cooperate for an oral examination. Depending on the type of disability, patients were classified into five groups mental retardation (MR) (n=168), autistic disorder (AD) (n=24), down syndrome (DS) (n=30), cerebral palsy (CP) (n=15) and other (OTH) (hemiplegia, spinal muscular atrophy, dysmorphic syndrome, hydrocephaly, goldenhar syndrome (n=21). Patients were further subdivided into four groups according to their age, 1-10 years (n=42), 11-20 years (n=156), 21-30 years (n=51) and 31-40 years (n=9).

The demographic profile of the study population revealed that the majority of the patients were males (n=171; 66%) with age ranging from 6-40 years (Table 1). 7% of the study population had the positive family history for the disease. The prevalence of malocclusion in the overall study population was 83% (Table 2). Individuals with DS had the highest range of malocclusion prevalence (97%), followed by CP (87%), MR (83%), AD (71%) and OTH (71%). In general, maximum Class III malocclusions belonged to DS group (40%) followed by MR group (11%). Moreover individuals with MR were found to have mostly Class I, or normal incisor relationships. High percentage of individuals with CP had class II malocclusion (40%) compared to other study groups. Further 16.3% presented with fractured anterior teeth primarily central incisor (Table 2). Gender was not associated with traumatized teeth. Of the group with traumatized teeth, 79% had one damaged incisor, 21% had two damaged incisors. Maxillary central incisors were the teeth most often traumatized for all groups (93%) followed by maxillary laterals (4.0%), mandibular centrals (2%) and mandibular laterals (1.0%). Among all the groups fractured teeth were more evident in patients with OTH (57%) and CP (40%).

The descriptive statistics for cranial parameters is depicted in Table 3. The brachycephalic type of head shape was dominant in the DS (60%) and AD (50%), while the mesocephalic type was dominant in the MR (67%) and CP (60%; Table 4). The hyperbracycephalic type, rare types of head shape observed in this study was dominant in OTH group (52%). The logistic regression analysis revealed that gender is a significant factor in cranial measurements. The head length among cranial measurements was most significantly affected by gender. Though the head length and head width were significantly more in males ($P < 0.01$), the cephalic index showed no significant sex difference.

Discussion

Though in India, only 20-36% of children in general population have been found to have a definitive malocclusion [17], the mentally disabled individuals in the present study had 83% incidence of definitive malocclusion. Additionally, individuals with Down syndrome showed the highest prevalence of malocclusion among all the study groups. This is in strong agreement with previous studies which suggested that DS is a significant risk factor for severe malocclusion [18-21]. Further DS subjects appeared to exhibit highest incidence Angle class III malocclusion when compared to other groups. Our results are consistent with the findings of previous studies [18,19] who reported an increase in Class III malocclusion coexistent with a reduction of Class II cases in patients with DS compared to controls. These results could be due to altered cranial–base relationships [3,22,23], diminished dental arch size, decreased arch length, and reduced maxillary size in Downs syndrome patients [24].

Furthermore Angle class II malocclusions were the most common form of malocclusion in individuals with CP which confirms with the previous studies [5,24,25]. These results could be ascribed to early eruption of primary teeth among CP patients and aberrant tongue and head posture [24,26-28]. Furthermore, it has been established that lip incompetence, and failure of the maxillary orbicularis muscle In CP patients is the cause of excessive overjet in them [29-32].

Another interesting finding in the present study was that tooth fractures were more prevalent in mentally disabled population (16.3%) than in general population in India [2]. Further the prevalence was higher in the 11-20 year age group than the other groups, thus agreeing with the previous study by Shyama et al. [24]. Trauma was found more often in the maxillary central incisors, which is consistent with the findings of the other studies of normal children [29,33,34] suggesting that these teeth are at a greater risk of being traumatized. There is also increased risk of traumatic injuries to the maxillary incisors, due to the higher frequency of extreme maxillary over jet, Angle class II division I malocclusion, short or incompetent upper lip, and accident-proneness of children with disabilities [35]. Additionally CP group showed increased prevalence of fractured teeth which agrees with the findings of Bhowate et al. [36]. This could be due to their increased susceptibility to trauma. Thus preventive measures regarding trauma to the face, jaw, and teeth need to be included in the oral health promotion programs and disseminated to the children with disabilities.

Many researchers emphasized the importance of quantitative evaluation of the morphological changes in mentally challenged individuals [30,31,37,38]. Furthermore, the present study states that the mean cephalic index of the study group is 82% (brachycephalic head shape) though in India there is predominance of mesocephalic

Variables		Mental Retardation	Autism	Downs syndrome	Cerebral palsy	Others	P value
Age	10-Jan	30	3	3	0	6	>0.05
	20-Nov	87	21	21	15	12	
	21-30	42	0	6	0	3	
	31-40	9	0	0	0	0	
Gender	Male	114	12	27	9	9	>0.05
	Female	54	12	3	6	12	
Family history	Present	9	3	3	0	3	>0.05
	Absent	159	21	27	15	18	
IQ score	Mild (50-70)	75	2	21	9	3	>0.05
	Moderate(35-49)	78	22	6	6	15	
	Severe (20-34)	15	0	3	0	3	
Dentition	Permanent	120	15	23	5	10	>0.05
	Deciduous	9	0	0	0	0	
	Mixed	39	9	7	10	11	

Table 1. Demographic characterstics of study population.

Variables		Mental Retardation n (%)	Autism n (%)	Downs syndrome n (%)	Cerebral palsy n (%)	Others n (%)	P value
Fractured teeth	Present	21 (12.5)	0	3 (10)	6 (40)	12 (57.1)	>0.05
	Absent	147 (87.5)	24 (100)	27 (90)	9 (60)	9 (42.9)	
Malocclusion	Class 1	108 (64.3)	9 (37.5)	16 (56.7)	7 (46.7)	9 (42.8)	**<0.05***
	Class 2	14 (8.3)	8 (33.3)	0 (0)	6 (40)	6 (28.6)	
	Class 3	18 (10.7)	0 (0)	12 (40)	0	0	

*p< 0.05 is considered significant

Table 2. Distribution of malocclusion and fractured teeth by type of disability

Variables	Mental Retardation (Mean±SD)	Autism (Mean±SD)	Downs syndrome (Mean±SD)	Cerebral palsy (Mean±SD)	Others (Mean±SD)	P value
Head breadth	14.0±1.08	13.83±1.64	14.24±0.86	12.45±1.29	14.16±0.76	>0.05
Head length	17.45±1.42	16.78±1.47	16.94±0.95	16.25±1.51	16.29±0.81	>0.05
Cephalic index (%)	79.6	82.2	84.4	76.8	86.9	>0.05

Table 3. Distribution of cranial values by type of disability.

	Mental Retardation n (%)	Autistic disorder n (%)	Downs syndrome n (%)	Cerebral palsy n (%)	Others n (%)
Dolicocephalic (<74.9)	9 (5.3)	0	3 (10)	2 (13.3)	0
Mesocephalic (75-79.9)	112 (66.7)	7 (29.3)	0	9 (60)	4 (19)
Brachycephalic (80-84.9)	40 (23.8)	12 (50)	18 (60)	4 (26.7)	6 (28.6)
Hyperbrachycephalic (85-89.9)	7 (4.2)	5 (20.7)	9 (30)	0	11 (52.4)

Table 4. Distribution of head shapes by type of disability.

head in both males and females with cephalic index ranging from 76 in males and 77 in females [29,33,34]. Further, the findings of the present study classify the Down syndrome patients as brachycephalic. This is in good accord with the stigmata of Down syndrome reported in the literature. The principal stigmata of DS includes modifications in head size (overall reduction) and shape (brachycephaly with a flattened occipital bone) [31,38-42]. The peculiar aspect of these subjects is partly a result of developmental anomalies of the craniofacial skeleton [43,44]. Subjects with Down syndrome possess a peculiar and immediately recognizable craniofacial aspect [44,45], but a correct assessment of their morphology substantiated by a quantitative evaluation can be used profitably to monitor facial modifications during growth, development, and aging [46-49]. Additionally largest proportion of patients with AD showed brachycephalic head shape. Although preliminary and in need of replication, these results are consistent Deutsch et al. who determined that enlarged head circumference in autism is primarily due to an increase in head width [50]. This was further supported by Tager-Flusberg et al. who concluded that the increased head width in AD would be consistent with enlargement of parieto-temporal cortex and is possibly associated with abnormal development of the visuoperceptual skills mediated by these brain areas [51].

The present study also states that mesocephalic head shape is dominant in MR and CP group and hyperbrachycephalic in OTH group. These results could be attributed to the altered growth rate in patients of various syndromes. The size, growth, and time of maturation may all be distorted, as observed sometimes in healthy individuals also [44,45]. The disparity of head shape also exists in various races and geographical zones which has been ascribed to hereditary factors, environmental influences [31,38,39,42] and also food habits [52]. The absence of quantitative evaluation of the morphological changes in mentally challenged individuals (except Down syndrome) in the literature generally prevents direct comparison with our data.

In India, mentally disabled individuals have a higher prevalence of malocclusion and get less oral care than the general population. There is a great need for the strengthening of Oral health promotion programs

that will ensure the availability of comprehensive preventive and oral health care for these risk groups. It is imperative that preventive measures to be initiated at an early age. Although it may not be possible to obtain an ideal result with treatment, every possible effort should be made to help these individuals to a better functioning dentition. Given the rising number of subjects with disabilities living in the community, the assessment of the characteristics of these persons may be of help to clinicians and researchers. But a larger sample size is recommended in further studies.

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