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Evaluation of Accelerated Skeletal Maturation Period in Population of Bihar between 7 to 14 Years of Age Group

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Abstract

Evaluation of growth status is important aspect in orthodontics and dentofacial orthopedics for diagnosis and treatment planningin young children having skeletal malocclusion. Factors like "Genetic and epigenetic" have major effect on the overall growth and development of dentofacial skeleton in children. Therefore, there is a need ofvarious skeletal maturation indices to determine the period of accelerated growth.

Aims and Objective: This study is an attempt to assess the level of skeletal maturation and period of accelerated growth in population of Bihar between 7 to 14 Years of age groupusing Cervical maturation stage index (CVMS).

Materials and Method: Lateral cephalogram of 210 individuals were selected, i.e. 105 male and 105 female, each between the age group of 7 to 14 years. It was observed that Cervicalmaturation stage index used is highly significant and effective for this purpose.

Conclusion: The children of Biharwere having rate of growth and maturation of cervical vertebraeearlierand faster in females then that of males of the same age group.This lead to advanced skeletal development in the beginning as well as at the peak of growth spurt, which can be implicated orthodontically while formulating a treatment plan.

Keywords: *Cervical vertebrae, Growth spurt, Maturation, Age.*

Introduction

Diagnosis and treatment in orthodontics in young growing patient is important for correctly assessing the growth status for a definitive treatment plan and its successful outcome. Growth progression follows a variable rate with certain periodsof accelerated growth, popularly known in orthodontic literature as growth spurts. The clinical significance of assessing the growth spurt is to relate it with the ideal time of growth modification in order to intercept the underlying skeletal problem. Various skeletal maturation indices[1-3]are used for this purpose among which one of the most popular is improved version of cervical vertebral maturation stage (CVMS)[4]

Morphological and structural changes can be seen in cervical vertebrae with the advancement of age from childhood to adulthood. It becomes mandatory to evaluate the changes in CVMS index with advancement of age to assess the rate and pattern of skeletal maturation in males and females.The present study is conducted for the assessment of rate of skeletal growth in population ofBihar between 7 to 14 Years of age groupto assess the growth pattern, growth rate and period of growth spurt in both sexes.

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Aim & Objectives

1. To evaluate the effectiveness and accuracy of CVMS index for the assessment of skeletal maturation of an individual.

2. To estimate the period of rapid accelerated growth (growth spurt) by CVMS in population of bihar between7 to 14 years of age group

Materials and Method

The lateral cephalograms of 210 individuals (105 males and 105 females) were randomly selected from the pre-treatment patient's records. This study was done atdepartment of dentistry, Patna Medical College and Hospital,Bihar, India. Patients were divided into seven sets as per their chronological age. These seven sets were grouped age-wise from 7 to 8 years, 8 to 9 years,9 to 10 years, 10 to 11 years, 11 to 12 years, 12 to 13 years and 13 to 14 years. Each set comprised of 15 patients of both the sexes.

The inclusion criterion were patients having no past medical history of major illness or trauma, no clinical/ radiological evidence of developmental anomaly and no past dental history of orthodontic treatment.

Radiographic Evaluation

Lateral cephalogram of each subject was evaluated for different stages of maturation of vertebra using improved version of cervical vertebral maturation index[4]. The various stages are differentiated on the basis of size, shape and curvatures of surfaces of the bodies of the cervical vertebrae as shown in Figure 1.

The data for each age group for males and females were tabulated to derive the conclusions.

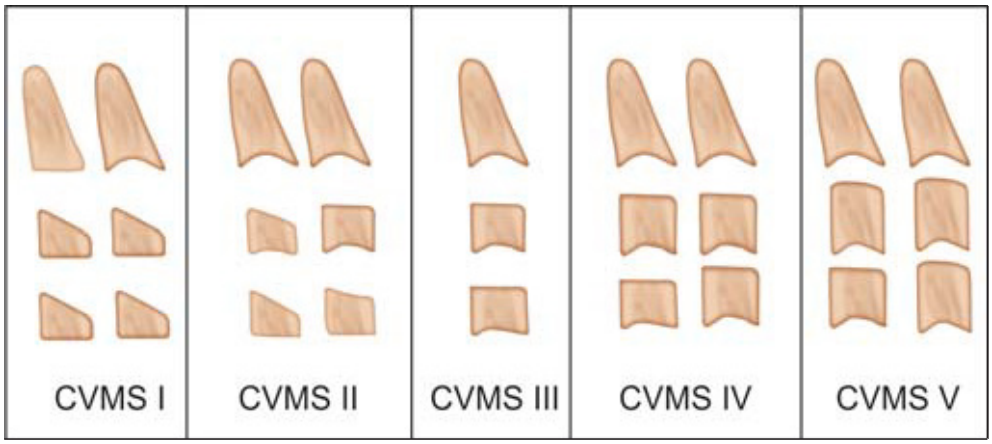

Fig.1 : Different stages of CVMS

Data Analysis

Above gathered data's were evaluated with highly significant Chi-square value = 74.68 % significant at probability $p < 0.001$ and $r = 0.97$.

Results

Table 1. CVMS of male child at different stages

Age	Stage I	Stage II	Stage III	Stage IV	Stage V	Total
>8 years	15	0	0	0	0	15
>9 years	6	9	0	0	0	15
>10 years	5	9	1	0	0	15
>11 years	4	8	2	1	0	15
>12 years	2	5	6	1	0	15
>13 years	0	4	9	2	1	15
>14 years	0	0	10	3	2	15
Total	32	35	28	7	3	105

Table 2. CVMS of female child at different stages

Age	Stage I	Stage II	Stage III	Stage IV	Stage V	Total
>8 years	15	0	0	0	0	15
>9 years	5	9	1	0	0	15
>10 years	2	10	2	1	0	15
>11 years	3	6	4	2	0	15
>12 years	1	4	7	3	0	15
>13 years	0	1	8	5	1	15
>14 years	0	0	3	9	3	15
Total	26	30	25	20	4	105

Table 3. Mean CVMS of male n female children at different ages

Age in years	8	9	10	11	12	13	14
Mean CVMI in males	1	1.5	1.6	1.7	2.2	2.6	3.2
Mean CVMI in females	1	1.6	1.8	1.8	2.6	3.4	3.7

Table.4. Mean age of male and female children at different CVMS.

CVMS	I	II	III	IV	V
Mean age in males	9.2	10.8	13.2	13.9	14
Mean age in females	9.2	10.2	12.1	13.3	13.9

The cervical vertebral maturation stages of both male and female subjects of different age groups is depicted in Tables 1 and 2. These table shows variation in the rate of cervical vertebral maturation in both sexes. The cervical vertebrae are in their initial stage of maturationtillthe age of 8 years and can be clearly understood. There is aincrease in percentage of femalesas compared to malesat age of 9 yearstowards stage II. Further by 10 years of age, there isa increase in percentage of males reaching CVMS stage II. Onthe contrary, approximately only 12% of females reachedstage III which lead to increase in percentage at stage II. There is a minimal increase in percentage maturation of both sexes reaching to CVMS stage III by 11 years of age. There wasaincrease in percentage maturation to stage III in considerable amount in both the sexes at 12 years of age.At the age of 13 years, stage IV of CVMS showed less number of males in comparison to females. By this time, only two male had entered to stage IV. Results at age 14 years, showedthat 60% of females are in CVMS stage IV, 20% are in stage III and rest have reached to their final stage V of maturation. As against this, in males, we observe that 75% are still in stage III while only 25% had reached to stage IV and V respectively. As per the data collected lead to interpretationthat , the growth is completed at slower rate in males as compared to females.

Table 3 data depicts the rate of growth of maturation of cervical vertebrae in both males and females. At the age of 8 years, both males and females are at the same status of maturation. Thereafter, at an interval of each year, the level of skeletal maturation appears slightly higher in females as compared to males. This difference is highest at the age of 13 years.

Table 4 data shows the comparison in mean age at which particular maturation stage is acquired in both sexes. Females reach higher maturation stage earlier than males which is remarkable at stage III. This suggests that skeletal maturation rate is higher in females between the stages II and III. Later, the males catch up this difference between the stages IV and V.

Discussions

Growth is the physicochemical process by which an organism becomes larger. Development is the sequence of changes from fertilization to maturity. Development may or may not show itself as an increase in size. It consists of histologic, morphologic, functional, and maturative changes.Growth and development of human body have phases. Various organs of human body develops at different intervals of time and their rate of growth varies among individuals and sexes. All the tissues or structure do not develop at the same timesois craniofacial growth. Hence, the period of active and accelerated growth is of utmost importance in diagnosis and treatment planning for skeletal malocclusion treatment. Review of literature reveals that hand-wristradiographs are used to assess the accelerated growth[5-7] and skeletal maturation status[7-11]. Hassel and Farman[2] in their study concluded that shape of vertebrae changes with maturation. Lamparski[1] was the first to correlate the cervical vertebrae maturation to skeletal age. It was also found that cervical vertebrae were as reliable and valid as the hand-wrist radiographs for assessing the skeletal age for both males and females which is in accordance to our study.Franchi G [11-13] had well illustrated the validity of the method of cervical vertebrae maturation for the evaluation of skeletal maturity and identification of the pubertal peak in craniofacial growth rate in individual subjects. The present study,also reveals that each stage of cervical maturation is attained little early in females than in males. The rate of growth varies between the different time intervals in both sexes.However, the average growth rate is faster in females than in males. Females show acceleration in growth rate (spurt) at around 11 years with high velocity which ceases down by 13 years. In males, there is a slight acceleration in growth rate at the age of 11years. However, they attain peak velocity (growth spurt) ataround 13 years of age. Grave KC[11]in his study reported that the peak growth velocity occurs at 11.8 years in girls and 13.8 years in boys, which is similar to the result of our study.Hagg&Trangerobserved the correlation between mandibular growth changes and maturation of cervical vertebra. They concludedthat skeletal development is more advanced in girls than in boys ofthe same ageat the beginning and peak of pubertal growth spurt. Hefound significant correlation between mandibular growth changes and maturation of cervical vertebrae.

Thus, this study is well supported withthe earlier ones.Hence, we conclude that the cervical vertebrae mature and grow faster in females than in males suggesting early onset of growth spurt. Literature supports the fact that ‘female bones are usually smaller and more slender than their male counterpart[14] which could be a possible reason for the early maturation of cervical vertebrae of females.

Conclusion

The rate of growth and maturation of cervical vertebrae in females population of bihar is earlier and faster as compared to males of the same age group. This lead to advanced skeletal development inthe beginning and at the peak of growth spurt. The rate of maturation is not constant between the various stages and period of accelerated growth and has been evaluated for different ages and levels in both sexes.

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Ethical Clearance- Taken from Ethical committee

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