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EVALUATION OF PREVALENCE OF ANDREWS' KEYS: CROWN ANGULATION, CROWN INCLINATION AND CURVE OF SPEE IN BIHAR POPULATION

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ABSTRACT

Objectives: Given the widespread use and dissemination of the concepts of Andrews' six occlusion keys as a tool for diagnosis and treatment planning, it becomes necessary to establish the norms for every ethnic group as Caucasian norms show a great degree of variation when applied to different populations.

Aim: To evaluate the prevalence of three Keys; key II (Crown angulation), key III (Crown inclination) and key VI (curve of Spee) in a sample population from Bihar having occlusion near normal.

Methodology: 100 study models from Bihar population with natural normal occlusion were studied. The frequency with which the three keys: Key II, Key III and Key VI were found in everyone was observed, as well as which keys were most and least frequent.

Statistical analysis: SPSS software and various analytic tools were used to evaluate the data.

Results and Conclusions: The evaluation of the prevalence of the three keys of Andrews optimal occlusion in Bihar population showed a prevalence rate of 96 percent for curve of Spee, second most prevalent being crown inclination with a prevalence rate of 90.25 percent whereas a prevalence rate of 84.71 percent was found for crown angulation. Thus, it can be concluded that most people in the Bihar population closely follow Andrews' norms particularly for the key IInd, IIIrd and VIth.

INTRODUCTION

It was not until 1972 that Andrews [1] conducted research which led to the development of the six basic keys to normal occlusion, which served as a guide for perfect completion of orthodontic treatment. Andrews conducted research on dental models showing normal occlusion and found out six common characteristics among these models: 1) Molar relationship - Mesiobuccal cusp of the maxillary first permanent molar occludes with the mesiobuccal cusp of the lower first permanent molar. 2) Angulation of the crowns - the cervical/gingival portion of the long axis of each crown of tooth is located distally to the portion occlusal to it; 3) Inclination of the crowns - the cervical/gingival portion of the long axis of the tooth crown of the maxillary incisors is located lingual to the surface which is incisal to it. The lingual inclination increases steadily in the posterior arch; 4) Rotations - both the dental arches should not have any tooth rotations; 5) Interproximal contacts - there should not be any spaces in the interproximal region of teeth; 6) Curve of Spee - curve of Spee should be slightly curved or smooth. Based on the results obtained, Andrews developed the pre-adjusted bracket system, in which the normal characteristics of each tooth were incorporated into the orthodontic accessories, greatly facilitating the treatment and construction of arches.

With the advent of six keys to occlusion by Andrews, it is widely acknowledged that normal occlusion is constituted by ideal incisor angulation and inclination [2]. But what Andrew's considers as normal is not applicable universally due to racial and ethnic variations [3]. The understanding that everyone requiring

orthodontic treatment is different in unique ways should refrain the orthodontist from superimposing a standardized smile to all his/her patient [4]. The extensive review of literature pertaining to this topic showed a paucity of research pertaining to the established norms of the incisor angulation and inclination among the Indian population.

Considering that the dental and cephalometric normative values proposed by various authors are based on research conducted with samples obtained from racial and ethnic groups with peculiar characteristics and that, therefore, may not be applicable to other populations, we conducted the present study to evaluate prevalence of Andrews keys, particularly Key II, Key III and Key VI in a sample of Bihar population.

MATERIALS AND METHODS

The sample for this study was obtained from Department of Orthodontics and Dentofacial Orthopaedics, Patna Dental College and Hospital, Patna. This cross-sectional study aimed at evaluating prevalence of Andrews' keys, particularly Key II, Key III and Key VI in a sample of Bihar population was conducted on 100 subjects (50 males and 50 females) with an age range of 18 to 30 years. The inclusion criteria included class I molar and canine relation with normal overjet and overbite, no history of orthodontic treatment, no significant medical history, no craniofacial deformity, and lower decayed, filled and missing tooth index. Alginate impressions were made of dental arches to fabricate dental stone study casts. These study casts were then evaluated for the presence of three study parameters: Key II, Key III and Key VI according to Andrews.

STUDY PARAMETERS

Key II: Crown Angulations: Crown angulation (or tip) refers to the angle formed between long axis of the clinical crown and a line perpendicular to the occlusal plane [Figure 1].To assess dental angulations, the long axis of the dental crowns was marked with a pencil. The positioning of the cervical portion of the long axis in relation to the incisal/ occlusal portion was observed. According to Andrews [1], when the cervical portion is distal in relation to the incisal/occlusal, the angulation is positive, if mesial, the angulation is considered negative.

***Key III: Crown Inclinations*:** Crown inclination is the angle between a line 90 degrees to the occlusal plane and a line tangent to the middle of the labial or buccal clinical crown [Figure 2]. For the measurement of crown inclination, the buccolingual positioning of the cervical and incisal/occlusal portions was observed. If the incisal/ occlusal portion was buccolingual in relation to the cervical, the inclination was taken as positive, whereas if lingual, the inclination was taken as negative

Key VI: Curve of Spee: Curve of Spee commonly refers to the arc of a curved plane that is tangent to the incisal edges and the buccal cusp tips of the mandibular dentition viewed in the sagittal plane [Figure 3]. To visualize the depth of the curve of Spee, we used a transparent template, touching the incisal edge of the incisors and the highest cusp of the last molar in occlusion, cut at the height of the canines so as not to interfere with the measurement. Using a millimeter ruler, the greatest distance between the template and the lowest premolar, usually the second was measured.

Data collection and statistical analysis:

Tooth crown angulations, inclinations and curve of Spee were measured using the method described by Andrews [5]. Value of each measured tooth was checked with the range of Andrews' findings (mean and standard deviation). If the value was within the range of Andrews' findings, it was taken as satisfactory, but if not, it was taken as non-satisfactory [9]. Data thus obtained were subjected to statistical analysis. SPSS software was used for the analysis.

RESULTS

The results were distributed in tables (Table 1, Table 2 and Table 3) and graphs (Graph 1), demonstrating the prevalence of the three occlusion keys in the studied sample. Curve of Spee was found to be the most prevalent with a prevalence rate of 96% (Table 3), crown inclination was second most prevalent key with a prevalence rate of 90.25% (Table 2, Graph 1) whereas crown angulation was least prevalent which showed a prevalence rate of 84.71% (Table 1, Graph 1).

DISCUSSION

When, in 1899, Angle [6] postulated that in a normal occlusion the mesiobuccal cusp of the upper first molar should occlude in the buccal groove between the mesiobuccal and median cusp of the lower first molar, he did not specify that this factor alone would not be sufficient to produce an appropriate occlusion. Therefore, the occlusion may be inadequate even when the Angle's Class I molar relationship is present. In this study, we set out to verify the prevalence of the three keys, Key II, Key III and Key VI out of six keys of Andrews' norms with the aim of identifying which keys are most and least prevalent.

Result of the present study showed that curve of Spee was found to be lower than 2.5 in 96 % of sample and this key shows the highest prevalence among all the three keys. In a previous similar study by Maltagliati et al.[7], all the evaluated models exhibited a curve of Spee with a depth of less than 2.5 mm and demonstrated that the 6th occlusion key was having highest prevalence (100%) in the sample. A similar study showing 100% prevalence rate of VIth key was reported by Ubaydi and Mothaffar [8] wheras Brangeli [9] found that this key was satisfactory in 74% of cases. It is interesting to note that the crown inclinations described in the 3rd occlusion key presented a prevalence of 90.25% with very few models having positive inclination. In contrast to this study, study done by Maltagliati et al.[7], showed a prevalence of only 34.4%, with many models having positive inclination of the lower incisors being observed, which seems to reflect the more convex Brazilian facial pattern. In a similar study by Ubaydi and Mothaffar [8] this key was present in 41% of cases. On examining crown angulations, a prevalence of 84.71% was found in the present study. However, study done by Maltagliati et al. [7] and Ubaydi and Mothaffar [8] showed a prevalence of 27.9% and 67% respectively. In both previous studies, as reported, many models showed negative angulations particularly of lower lateral incisors which was the main reason of lower prevalence rate in these studies.

It is acceptable not to achieve all the objectives of the six keys in all cases, but it is unacceptable to stop when they are possibly achievable. Therefore, the six keys to optimal occlusion are excellent parameters for diagnosis and to guide us in the search for quality in the treatment of our patients. However, the absence of one or more of these factors should not be seen rigidly as failure, since the concomitant occurrence of these characteristics is very rare in the population. It is also worth highlighting that these objectives can only be expected in individuals with a good relationship between the maxilla and mandible, since in those individuals with skeletal discrepancy, who will be treated compensatorily, the parameters of normality will be altered, guided in the sense of seeking the best possible aesthetics and function for the case. It seems clear to us that the functionality established in the interocclusal relationship is the most important factor for occlusion, regardless of which teeth are establishing this relationship, if it allows for a balanced distribution of forces duringchewing and mandibular excursions.

CONCLUSION

The evaluation of the prevalence of Andrews' norms in the Bihar population revealed significant adherence to these orthodontic standards. The findings showed a 96% prevalence of the curve of Spee within the normative range, highlighting its consistency across the population. Similarly, crown inclination exhibited a prevalence of 90.25%, indicating a high level of alignment with Andrews' norms. Crown angulation, observed in 84.71% of the population, also demonstrated substantial conformity. These results suggest that most of the Bihar population naturally adheres to Andrews' six keys to normal occlusion, with slight variations, providing valuable insights for orthodontic diagnosis and treatment planning in this demographic.

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GRAPH 1

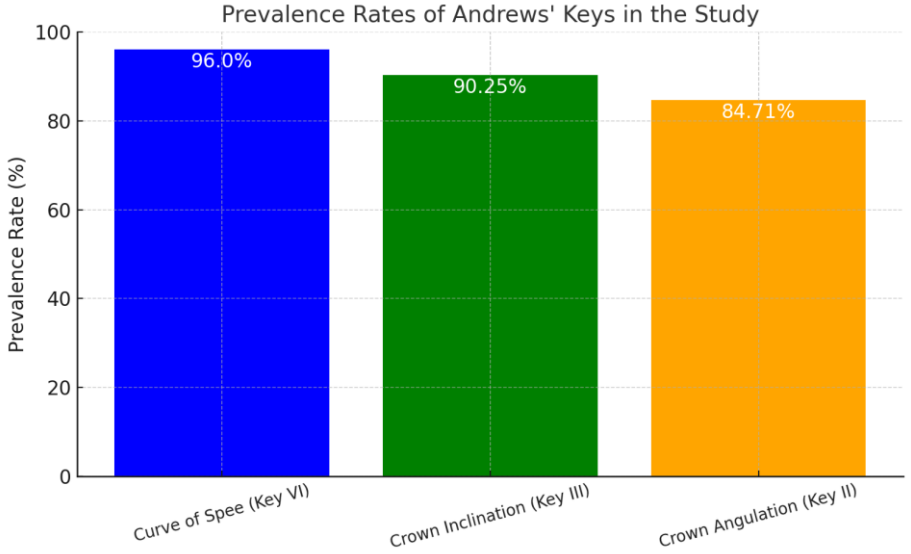

Table 1: Number of Satisfactory and Non-Satisfactory values of crown angulations in Bihar population.

Maxillary crown angulations		
Tooth number	**Satisfactory**	**Non satisfactory**
1	162	38
2	192	8
3	187	13
4	134	66
5	160	40
6	175	25
7	189	11
Mandibular Crown Angulations		
Tooth Number		
1	185	15
2	179	21
3	189	11
4	137	63
5	172	28
6	139	61
7	172	28

Table 2: Number of Satisfactory and Non-Satisfactory values of crown inclinations in Bihar population.

Maxillary crown Inclinations		
Tooth number	**Satisfactory**	**Non satisfactory**
1	130	70
2	190	10
3	185	15
4	178	22
5	181	19
6	178	22
7	182	18
Mandibular crown inclinations		
Tooth number		
1	200	0
2	190	10

3	178	22
4	167	33
5	185	15
6	192	8
7	191	9

Table 3: Number of Satisfactory and Non-Satisfactory values of Curve of Spee values in Bihar population.

	Satisfactory	**Non-Satisfactory**
Curve of Spee	96	4

FIGURES

Figure 1: Crown angulation (a) Figure 2: Crown Inclination (b) Figure 3: Curve of Spee (c)