Received: 25 September 2022 | Revised: 30 October 2022 | Accepted: 13 December 2022 | Published online: 30 December 2022

International Journal of Advance in Clinical Science Research, Volume 1, 2022
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# Application of Ricketts Cephalometric in the Establishment of the Clinical Normal Values in Adolescent Population

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**Abstract:** ***OBJECT: this study was to investigate the establishment of the normal values of the Ricketts cephalometric analysis method indicators in the Han nationality adolescents in Zhenjiang, and to compare the gender differences of craniofacial characteristics. METHODS: A randomized survey of individual normal occlusions was performed among Han nationality adolescents aged 10-14 in primary and secondary schools in Zhenjiang City. 120 normal permanent occlusal adolescents who met the inclusion criteria were selected. Men and women, average age (12± 2.0 years old). The face is beautiful and harmonious, the shape and the bite balance, the relationship between the bones and the teeth is normal, the permanent teeth are all present, and there is no history of orthodontic treatment or facial trauma. Using the Ricketts analysis method in Dolphinl 10.0 software, 35 indicators were measured, including 19 line spacing indicators and 16 angles. The t-test was used to compare the standards of male and female Han ethnic groups in Zhenjiang. RESULTS: Several statistically significant gender differences were significant. There were no significant differences in gender differences between the other indicators except the degree of protrusion, maxillary depth, length of mandibular body, and length of anterior skull base (P<0.05). Conclusion: The Ricketts analysis method of Han Chinese adolescents in Zhenjiang showed that there were no statistically significant differences in dental index, tooth-to-bone relationship, and aesthetic factors. A point of protrusion in the bone index; face-to-skull relationship maximal depth angle of the factor index; the length of the mandibular body and the length of the anterior skull base in the internal structural factors of the skull. The measured values are male>female, and the gender difference is statistically significant. Therefore, it should be considered in the diagnosis, design and analysis of clinical orthodontics. Gender differences.***

**Keywords:** Cephalometry; Cephalometrical film; Ricketts analysis; Normal values.

## 1. Introduction

Since its introduction in 1931 by Broadbent [1] and Hofrath [2] differences.in the United States and Germany, respectively, radiographic cephalometry has become one of the most important tools of clinical and orthodontic research. Since Rickettt's diagnostic analysis method has been proposed since 1961, the six factors are related to the relationship between the upper and lower teeth, the relationship between the upper and lower jaws, the relationship between the dentition and the jaw, the aesthetic factors, the relationship between the face and the skull, and the internal structure of the skull[3-5]. Cephalometric norms provide useful guidelines to orthodontists in their diagnosis and evaluation of orthodontic treatment outcomes. Moreover their importance exists to investigate the average values, shapes and variations among any population. Conducting comprehensive research has gradually

become an important biological theoretical basis and an important clinical operational basis for bioprogressive orthodontic techniques [6].

Harmonious facial esthetics and optimal functional occlusion have long been recognized as the most important goals of orthodontic treatment. Orthodontic treatment is best when the facial and cephalometric characteristics of the ethnic background of patients are considered [7-8]. Many studies in the foreign literature have involved research on cephalometric and contour standards [9]. There are few domestic studies on the Ricketts analysis for people of a specific age group in a particular region [10-12]. The purpose of this study was to establish a cephalometric measurement standard for Han Chinese adolescents in Zhenjiang and to study their gender differences.

## 2. Data and Methods

### 2.1 Screening of cases

There were 5,000 primary and middle school students in the Zhenjiang area of Pucha, and 120 normal occlusal subjects with facial symmetry were selected, including 60 males and 60 females, with an average age of 12±2.0. Inclusion criteria: 1) individual normal occlusion (normal anterior teeth coverage, neutral relationship of molar fangs, upper and lower dental arch crowding are less than 2mm, upper and lower dentition gaps are less than 1mm, full mouth occlusal contact is good, no obvious Wear), except for the third molar, complete dentition; 2) facial coordination symmetry; 3) no dental emergency, history of non-traumatic fracture of the teeth; 4) history of orthodontic and/or orthognathic surgery, no history of repair; 5) no night molars or a history of dental disease, no chewing habits; 6) no TMDS, no relevant medical history, no otitis media, no temporomandibular joint trauma and/or surgical history, no chronic systemic diseases affecting the temporomandibular joint (such as rheumatoid joints) Disease); 7) no history of trauma to the neck and neck; 8) healthy, no mental illness; 9) all subjects understand the purpose of the experiment and the process of voluntary participation in the entire experimental process.

### 2.2 Shooting of the lateral position of the skull

When using the Planmeca Promax Digital X-ray machine to capture the lateral position of the skull, the natural head position is obtained by self-balancing. Specific methods: the subject's head and neck muscles relax, naturally stand, the arms are naturally perpendicular to the sides of the body, the heels are close together, and the toes are separated by about 45 degrees. The head makes a pitching motion several times, and gradually reduces the swing amplitude. When the subject feels in a "naturalbalance" state, the head stops swinging, and the eyes naturally look straight ahead. The earplugs are placed without affecting the head position of the subject to adjust the median sagittal plane. When the lateral slice of the skull was photographed, the subject's upper and lower teeth touched the median occlusal position, and the soft tissue of the lips was naturally relaxed. A metal chain is suspended in front of the subject, indicating a true vertical line VER, and a plane perpendicular to the VER is a true horizontal plane HOR. The subject's FH plane is parallel to the ground.

### 2.3 Depiction and measurement of the lateral position of the skull

All subjects' head-positioned lateral slices were sampled and fixed-point measurement Ricketts analysis using manual method and Dolphin software 17.0 (Patterson, USA) measurement method. The specific operation of the manual method: using the HB pencil on the reader to fix, draw and measure on the sulfuric acid paper, the time interval is 1 week, then repeat the measurement for 3 consecutive times, and finally find the average value; Dolphin software 10.0 measurement method: Within 1 month, the Dolphin software was used to locate and measure the head position of each subject on the computer. Each item was fixed and measured 3 times, and the average value was obtained to obtain all the indicators of the Ricketts analysis method.

### 2.4 Measurement indicators

The lateral position of the Ricketts analysis consists of 35 indicators, namely: molar relationship.The relationship between the fangs. Incisor coverage. Incisor lamination.

Lower incisor height distance. The angle between the incisors. Burst distance. Below the height angle. The position of the maxillary molars. Lower arch depth. The degree of Mandibular incisor. The maxillary incisor is a sudden distance. Mandibular incisor axis inclination. The maxillary incisor axis inclination. Plane-mandibular ascending distance. The plane inclination. Lip protrusion distance. Upper lip length. The dot-to-plane distance. Facial depth angle. Face axis angle. Facial tilt. Maxilary depth angle, Upper jaw height angle plane angle. Mandibular plane angle. Skull tilt The length of the front of the skull. Back height, Fully high. Angle of Ba-Na-A. The angle of the mandible ascending axis. The position of the ear point. The angle of curvature of the mandible. The length of the mandible, Figure 1 and Figure 2.

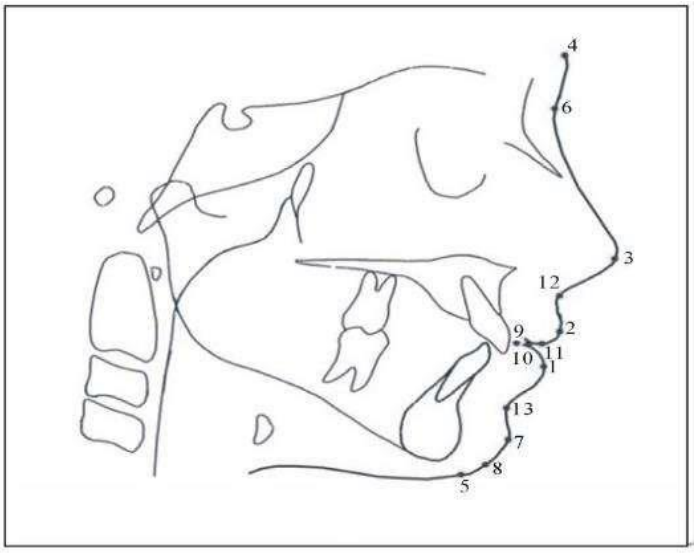


**Figure 1:** Cephalometric reference points, hard tissue landmarks

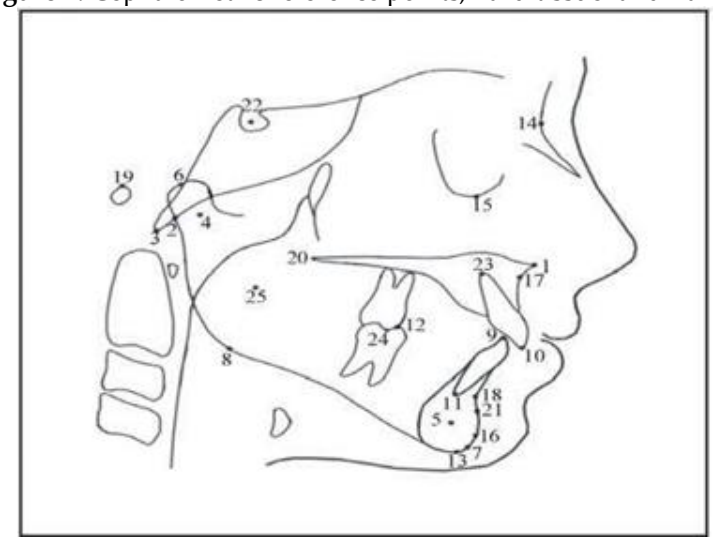


**Figure 2:** Cephalometric reference points, soft tissue land-marks

**2.5 Statistical analysis**

According to the Ricketts indexes were selected, and female groups we mean±standard deviation.between male and female $P<0.05$. It is statistically significant was assisted by the computer Package nalysis method, 32 measurement he clinical normal values of male determined by means of The difference of normal values groups was compared by t test, nificant. All statistical processinger SPSS 13.0 statistical software

## 3. Results

The normal range of Ricketts analysis methods for Han Chinese adolescents in Zhenjiang area is shown in Table 1 for the normal range of all indicators and the differences between male and female.

| Measure Progress | Male(n=61) | Female(n=59) | t | P |
|---|---|---|---|---|
| Canine distance | -2.19±1.14 | -1.90±1.09 | -1.180 | 0.241 |
| Incisor coverage | -3.32±0.67 | -3.10±0.69 | -1.198 | 0.236 |
| Incisor closure | 2.81±0.65 | 2.01±0.75 | -1.710 | 0.089 |
| Height distance of lower incisor | 1.83±0.80 | 1.91±0.54 | -0.886 | 0.378 |
| Angle of intersection of incisors | 1.62±1.00 | 1.90±0.95 | -0.785 | 0.426 |
| Outburst distance | 120.33±10.04 | 126.89±8.29 | -2.01 | 0.471 |
| Lower height angle | 2.65±1.98 | 1.79±1.01 | 2.176 | 0.036* |
| Position distance of maxillary molars | 42.87±5.13 | 43.41±5.11 | -0.410 | 0.691 |
| Protrusion distanc e of mandibular incisor | 18.10±2.43 | 16.81 ± 3.19 | 1.90 | 0.087 |
| Protrusion distance of maxillary incisor | 3.82±2.41 | 3.49 ± 1.81 | 0.672 | 0.514 |
| Axial inclination of mandibular incisor | 6.59±2.40 | 6.79±1.60 | -0.440 | 0.670 |
| Axial inclination of maxillary incisors | 28.09±4.15 | 26.08±4.05 | 1.961 | 0.062 |
| Occlusal plane mandibular ramus | 29.46±5.84 | 30.71±5.34 | -0.930 | 0.361 |
| Inclination of syncretic plane | 2.91±2.89 | 2.39±3.09 | 0.531 | 0.588 |
| Lip distance | 22.46±2.80 | 22.50±1.79 | 1.269 | 0.211 |
| Length distance of upper lip | 2.69±2.67 | -0.15±2.44 | 3.29 | 0.735 |
| Distance between opening point and closing plane | 27.96±2.90 | 24.99±2.20 | 4.691 | 1.531 |
| Facial depth angle | -3.31±4.19 | -2.50±1.89 | -1.260 | 0.239 |
| Facial axis angle | 86.87±2.69 | 86.59±2.80 | 1.889 | 0.069 |
| Face inclination | 87.89±2.91 | 86.51±3.09 | 1.980 | 0.055 |
| Angle of maxillary depth | 67.33±4.20 | 67.09±3.09 | 0.010 | 0.898 |
| Height angle of maxilla | 90.21±2.69 | 88.44±3.01 | 2.160 | 0.034* |
| Palatal plane angle | 61.02±2.98 | 61.98±2.90 | -1.389 | 0.171 |
| Plane angle of mandible | -3.96±2.51 | -2.61±3.49 | -1.819 | 0.081 |
| Skull inclination | 22.20±4.41 | 23.89±4.40 | -1.679 | 0.102 |
| Anterior length of skull | 25.15±1.63 | 25.01±1.80 | 0.279 | 0.801 |
| Rear height | 55.89±3.02 | 53.09±2.19 | 4.039 | 0.003* |
| Axial angle of mandibular ramus | 69.11±4.19 | 66.01±3.70 | 6.271 | 3.654 |

| | | | | |
|---|---|---|---|---|
| Distance between ear points | 67.40±5.03 | 65.61±6.14 | 1.308 | 0.201 |
| Angle of curvature of mandible | -38.50±3.01 | -37.70±3.18 | -1.069 | 0.291 |
| Length of mandible | 34.12±6.71 | 32.90±7.09 | 0.698 | 0.502 |
| Canine distance | 70.47±3.50 | 68.31±4.11 | 2.243 | 0.031* |

## 4. Conclusion

This study established the reference range of the clinical normal values of the measured indicators of the normal occlusal Ricketts analysis method of the Han nationality in Zhenjiang area, supplemented the deficiency of the existing Ricketts analysis method in Zhenjiang area, and reached the following conclusions: the dental factor index There was no statistically significant difference in the relationship between the teeth and bone and the gender difference in the aesthetic factors. The sudden distance between the bone factors (t=2.176, P=0.036), the gender difference was statistically significant, and the male mean was greater than the female. It is suggested that the development of male maxilla is greater than that of female in adolescence; the index of facial relationship relative to skull: maxillary depth angle (t=2.160, P=0.034), gender difference is statistically significant, male mean is greater than female, suggesting adolescence, The mandibular male was more prominent than the female; the internal structure of the skull was indexed by the length of the mandible (t=2.243, P=0.031). The gender difference was statistically significant. The male was larger than the female, suggesting that the male mandible was slightly longer than the female. The length of the anterior skull base (t=4.039, P=0003), the gender difference was statistically significant, the mean male was larger than the female, suggesting male The anterior length of the skull is greater than that of women. Clinically, the corresponding correction analysis, diagnosis and post-correction evaluation can be carried out according to gender differences, so that the correction results are more perfect, the success rate is improved, and the recurrence rate is reduced.

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