Soft-tissue Esthetic Evaluation in Chinese Adults with Well-balance Profile

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Abstract: **Objective:** The aim of this study was to make soft-tissue esthetic evaluation in Chinese adults with well-balance profiles by Holdaway analysis and compare them with other ethnic population. **Methods**: Cephalometric radiographs of 100 selected Chinese adults with normal occlusion were analyzed; and with double selection by orthodontist and the public, a sample with 56 subjects of esthetically pleasing subjects was selected. All of them analyzed by the Holdaway cephalometrics conducted statistical test with SPSS program. **Results**: The Chinese esthetically pleasing subjects showed significant differences by gender in soft tissue subnasale to H line; significant statistical differences existed in most of measurements compared with Japanese, Yemeni and the Whites. Find out the correlational relationship in Holdaway cephalometric measurments and regression relationship of between the relevant hard and soft tissue. **Conclusions**: Holdaway norms in Chinese adults with well-balance profile were established. The regression relationships between the relevant hard and soft tissue were found out. Chinese had more convex profiles than the Yemeni and the Whites which were similar with Japanese, and showed the most markedly lip protrusion among the four ethnic population. These racial differences had to be considered in orthodontic treatment and orthognathic surgery planning.

1. Introduction

Cephalometric analysis play so important part in orthodontic diagnosis and treatment .The cephalometric norms in specific age and ethnic groups is crucial[1]. However, in China numerous studies had published, most of them were limited to hard tissue analysis[1,2],several studies used the Ricketts' esthetic plane and Holdaway analysis which are only included growing population or patients in their samples[3,4]. The aims of this study were to develop Holdaway soft-tissue norms that can assist in diagnosis and treatment planning for Chinese adults.

2. Materials and methods

Lateral cephalometric radiographs were taken of subjects who were students at Hebei Medical University, and the Shijiazhuang University of Economics. For the first step of the selection process, clinical examinations and interviews determined their occlusal status according to the following criteria: Chinese with Chinese ancestry; ideal or near ideal occlusion; no craniofacial deformity or

trauma or history of orthodontic treatment; well-balanced profile (assessed by 8 investigator in step 2). After step 1, from 5500 students , 50 men and 50 women satisfied the selection criteria in step 1.

All cephalometric lateral skull radiographs were taken in a natural head position. All radiographs were traced and digitized by writer and reviewed twice for accurate landmark identification. One-way analysis of variance, used to test the equality of means for the cephalometric measurements, suggested that it was done consistently.

After the lateral cephalograms, soft-tissue outlines were traced on 0.003mm matte acetate papers and then scanned. A software program (Adobe Photoshop, CS5.0; Adobe Systems, San Jose, Calif) was used to darken and trim the scanned profiles to obtain black soft-tissue profiles on white backgrounds to trace and process these profiles(Fig 2).

Chinese lay judges evaluated each of the sujects' profiles after step 1. Each profile was evaluated as very pleasant (5 points), pleasant (4 points), average (3 points), below average (2 points), and unpleasant (1 point). Subjects who were unanimously rated as pleasing (3 or 4 points) by the judges were included as the sample. After this procedure, the sample included 56 profiles (25 male, 31 female). When all the Holdaway analysis were done, the results were subjected to a Student T test using the SPSS program. The level of significance was set at 0.05. The correlational relationship in Holdaway analysis were established by the SPSS program with stepwise method.
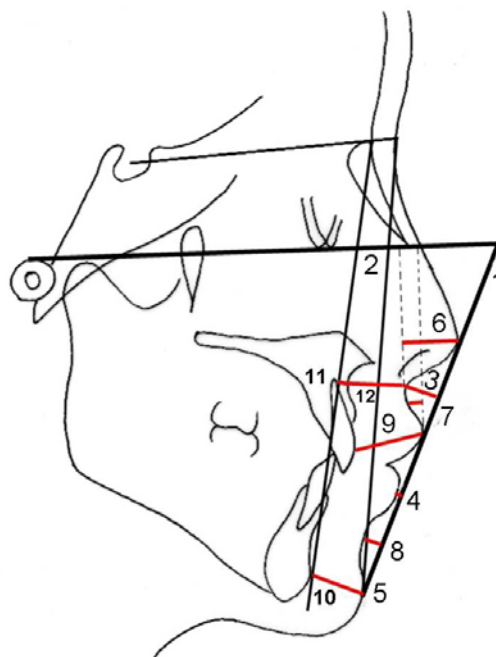
3. Results

Fig 1 Holdaway analysis

1. H line drawing(ls-pg')2. Soft tissue facial angle(FH-n'pg')3. Soft tissue subnasale to H line(Sn-H) 4. Lower lip to H line (li-H) 5.H angle (H-n'pg') 6.Nose prominence (prn-Sn) 7.Upper lip sulcus depth (ss'-ls) 8.Inferior sulcus to the H line (lower lip sulcus depth)(si-H) 9.Upper lip thickness (U1-ls) 10.Soft tissue chin thickness: the distance between the hard and soft tissue facial planes at the level of suprapogonion. 11.Skeletal profile convexity (A-NPG) 12. Basic upper lip thickness(A-Sn) 13. Upper lip strain measurement: the difference between basic upper lip thickness and upper lip thickness

Table1 Holdaway analysis norms for Chinese adults by gender

Holdaway analysis		Male		Female		P-value
		Mean	SD	Mean	SD	
Soft tissue facial angle	dg	90.31	2.35	89.85	2.48	0.566
Soft tissue subnasale to H line	mm	8.72	1.83	6.99	1.56	0.004**
Lower lip to H line	mm	1.59	0.9	1.22	.66	0.149
H angle	dg	16.93	2.94	15.44	2.42	0.064
Nose prominence	mm	13.64	1.45	12.88	1.35	0.121
Upper lip sulcus depth	mm	3.52	1.12	2.91	.72	0.063
lower lip sulcus depth	mm	3.95	0.79	3.54	1.11	0.217
Upper lip thickness	mm	12.77	1.65	11.89	1.62	0.118
Soft tissue chin thickness	mm	13.25	1.41	12.47	1.39	0.155
Skeletal profile convexity	mm	3.1	1.61	2.80	1.40	0.568
Basic upper lip thickness	mm	13.08	1.19	12.78	1.33	0.536
Upper lip strain measurement	mm	0.91	1.79	0.89	1.43	0.305

*P<0.05; ** P<0.01

Table 2 The correlational analysis between H angle and other measurements of Holdaway analysis

	H angle/°	
	R	P
Soft tissue facial angle/°	-0.31	0.013*
Soft tissue subnasale to H line/mm	1.427	0.000**
Lower lip to H line/mm	0.057	0.553
Nose prominence/mm	-0.645	0.000**
Upper lip sulcus depth/mm	-0.882	0.020**
lower lip sulcus depth/mm	-0.155	0.117
Upper lip thickness/mm	-0.014	0.902
Soft tissue chin thickness/mm	-0.181	0.051
Skeletal profile convexity/mm	0.184	0.109
Basic upper lip thickness/mm	0.384	0.038*
Upper lip strain measurement/mm	0.015	0.902

$Y=1.427X_1$(soft tissue subnasale to H line)$-0.882X_2$(upper lip sulcus depth)$-0.645X_3$(nose prominence)$-0.31 X_4$(soft tissue facial angle)$+0.384 X_5$(basic upper lip thickness)$+39.298$

*P<0.05; ** P<0.01

Fig 2 Lateral facial well-balance profiles for Chinese adults

4. Discussion

Patients usually paid more attention on their faces than the oral function when they came to clinic for consulting. As a result, orthodontists should conduct a comprehensive and rational view to their problems for patients. Holdaway analysis directs focus at the soft-tissue profile which was used widely in the world. Many countries had established their adult norms of Holdaway analysis[5-8]. However, this method was used limitedly in China. Ye huiying[3] used the Holdaway analysis to research on children instead of adults; Wen xingtao[4] chose this method for adults in Chongqing region who were selected without aesthetic evaluation by public. Therefore, to establish Chinese adult norms of Holdaway analysis has great significance.

4.1 Difference by gender

Significant statistical differences existed between male and female in soft tissue subnasale to H line (Tab 1) which means the male had more stereoscopic profiles than the female.

4.2 Comparison with Japanese[9]

The results showed that Japanese have as convex faces as Chinese have. especially at mandibular position. However, there were also many differences between Chinese and Japanese. Chinese had bigger lip convexity than Japanese. And mental profiles of Chinese were more plimmed. In the other way, one third of midface of Chinese lessly highlighted than Japanese because Japanese had anterior nose and posterior upper lip.

4.3 Comparison with Yemeni [10]

The results showed that both ethnic population were similar upper lip sulcus depth. However, Chinese had bigger lip and profile convexity than Yemeni. In the other way, one third of midface, one third of lower face of Chinese lessly highlighted than Yemeni who had more stereoscopic profiles .

4.4 Comparison with Whites[11]

The results showed that both ethnic population had obviously different skeletal and soft-tissue profile. Chinese with more lip protrusion had more convex profiles than Whites whose nose and mental point were markedly anterior. Therefore, It suggested that there were distinct difference in aesthetic evaluation between the east and the west.

4.5 Correlational analysis of Holdaway cephalometric measurments

H line is the reference plane in Holdaway analysis (Fig 1) to evaluate facial esthetic. The correlation coefficients are shown in Tab 2. Soft tissue subnasale to H line showed the highest coefficient followed by upper lip sulcus depth, nose prominence, soft tissue facial angle and basic upper lip thickness at last. Basic upper lip thickness and soft tissue subnasale to H line showed positive correlation with H angle which indicated H angle would get larger with the increase of the two indexs. Upper lip sulcus depth, nose prominence and soft tissue facial angle showed negative correlation with H angle which indicated H angle would get larger with the decrease of the these indexs. Therefore, to rebuilt the well-balance profiles for patients, orthodontists should cast about for effective ways to change the six indexs in order to improve the H angle (Tab 2).

5. Conclussion

Holdaway norms in Chinese adults with well-balance profile were established. Chinese had specific skeletal and soft-tissue characteristic which showed significant difference when compared with other ethnic population in other countries. Find out the correlational relationship in Holdaway cephalometric measurments and regression relationship of between the relevant hard and soft tissue.

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