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Research Article

Comparison of the Subjective Need for Orthodontic Treatment with its Affecting Factors between Local Students and Foreign Students in Nanjing

Niroj Raj Neupane[1]*, Guifeng Li[2], Jilin Zhao[3] and Huang Li[4]

[1]*Consultant Orthodontist, Department of Orthodontics, Suzhou Dental Hospital, Suzhou, China*

[2]*Senior Orthodontist, Department of Orthodontics, Nanjing Stomatological Hospital, Affiliated Hospital of Nanjing University, Nanjing, China*

[3]*Associate Professor, Department of Orthodontics, Jinlin Dental Hospital, Nanjing, China*

[4]*Professor, Department of Orthodontics, Nanjing Stomatological Hospital, Affiliated Hospital of Nanjing University, Nanjing, China*

***Corresponding Author:** Niroj Raj Neupane, Consultant Orthodontist, Department of Orthodontics, Suzhou Dental Hospital, Suzhou, China.

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Abstract

Objective: To compare the need for orthodontic treatment between local students and foreign students in Nanjing and analyze it's affecting factors.

Materials and Methods: A total of 210 students (105 foreign students, 105 local students) studying in Nanjing University and Southeast University of Nanjing were selected for the study. Data were collected with the questionnaire, which included the desire for orthodontic treatment, satisfaction with their dental appearance, importance of well-aligned teeth, awareness of others teeth and self-perception of psychosocial impact of malocclusion and clinical examination was done by a trained and calibrated orthodontist to assess the ICON index. The independent variables which were statistically significant were screened using logistic regression analysis with the method of forward stepwise and regarded as factors affecting the subjective need for orthodontic treatment. The p value was taken as $p < 0.05$.

Results: 54.3% (57/105) local students were satisfied with their teeth whereas this number was 71.5% (75/105) in the foreign students group ($p = 0.01$). The prevalence of the desire for orthodontic treatment was 18% (19/105) in local students and 38% (40/105) in foreign students. Aesthetic component ($P = 0.01$), upper arch crowding ($P = 0.00$), crossbite ($P = 0.00$) and incisor overbite ($P = 0.00$) of the ICON components had a great significance and were associated with the desire and plan for undergoing orthodontic treatment in both groups. 52.4% (55/105) local students and 56.2% (55/105) foreign students were found to have an ICON index of < 29 ($p = 0.1$).

Conclusions: The importance of well aligned teeth and the self-perception of the psychosocial impact of malocclusion were the main two factors influencing the subjective orthodontic treatment need in both the groups. Some cultural differences existed between the two groups. The local students gave greater importance to aesthetics for undergoing orthodontic treatment whereas improving chewing function was of greater importance in the foreign students' category. Less number of local students was satisfied with their teeth indicating a greater treatment need in this group. The cutoff point to 29 for ICON index had more sensitivity and specificity in both the groups in the present study.

Keywords: *Orthodontic; Malocclusion; Desire; Motivation; Foreign Students; Local Students*

Introduction

The impact of malocclusion on quality of life has been the object of study in different populations [1-6], especially between local residents and foreigners. The subjective need for orthodontic treatment between the local residents will be different from that of the foreigners because of the differences in culture and the level of education. Compared with Caucasian race, Asians are not at a disadvantage in getting orthodontic treatment and they have higher needs for orthodontic treatment than Caucasians and differences of culture background do exist between Asians and Caucasians [2,3]. However, few studies have investigated the influence of factors affecting orthodontic treatment between local students and foreign students.

The factors affecting the demand for orthodontic treatment include the satisfaction on the teeth and jaw, expectations for maxillofacial beauty, gain of confidence, gender and so on. The satisfaction on dental situation has strong correlation with subjective needs for orthodontic treatment. People who express dissatisfaction with their teeth may have some psychological problems which may impact their social behavior [4-6]. Also, gender and ethnic aspects should be taken into consideration when planning orthodontic treatment [7-9]. When considering evaluating the subjective need for orthodontic treatment, a new index [10] was developed which incorporates outcome, need, and complexity of treatment - the Index of Complexity, Outcome and Need (ICON).

Aim of the Study

The aim of this study is to compare the subjective needs for orthodontic treatment between local students and foreign students in Nanjing and analyze the affecting factors by using the questionnaire and ICON index. This will have important significance and will guide us for the treatment of patients with different cultural backgrounds.

Materials and Methods

Subjects and Study Design

This study was a comparative study regarding the subjective need for orthodontic treatment and its influencing factors among local students and foreign students in Nanjing, China. The investigation received approval from the Human Research Ethics Committee of Nanjing University. The students participating in the research signed a statement of informed consent.

The sample consisted of 105 foreign students and the same number of local students of Nanjing. Two universities were selected for research purpose: Nanjing University and Southeast University. Inclusion criteria were age between 18 and 35 years and no history of orthodontic treatment. The survey was done with the help of a questionnaire and ICON was determined by oral examination and using the standard photographs of the aesthetic component of the index for orthodontic treatment needs (IOTN). The age groups of the participants were divided into two groups, 18 - 24 years excluding those who were 24 years old and 24 - 35 years including 24 years group.

The calculation of the sample size was based on a source population of about 1500 foreign students in each university, an estimated 30% prevalence rate of malocclusion, a 95% confidence level, an 80% power, and a 10% margin of error. These parameters determined a minimum sample of 100 foreign students.

Questionnaires

The questionnaire included demographic data such as country, gender, age, educational background, self-satisfaction with the teeth, the importance of well-aligned teeth, awareness of others teeth, motives of seeking orthodontic treatment and self-perception of psychosocial impact of malocclusion. Other items included in the questionnaire were visiting a dentist before, history of orthodontic treatment and importance of good looking face. This questionnaire employed a two point rating scale (yes or no). Motives of undergoing orthodontic treatment was assessed on a three point rating scale (improve chewing function, improve facial appearance or get community appraisal). The students also answered a question that corresponded to the outcome of the study: "If you plan to undergo orthodontic treatment, what would you think it would be for?" To calculate the examiner reliability, 10 local students and 10 foreign students were randomly

selected for oral examination and given the same questionnaire after an interval of one month. Kappa value was used for the analysis of reliability. Their initial answers were included in the study. The foreign students answered the questionnaire in English, and the local students answered in Chinese. To avoid the difference, this questionnaire was evaluated by native orthodontic experts.

Clinical Exam

The clinical exam was performed by an experienced orthodontist using a mouth mirror, and regarding whether orthodontic treatment was required for the participant or not was determined by using the ICON score for the participant. The Index of Complexity, Outcome and Need (ICON) consists of five occlusal traits which are the aesthetic component of the index of orthodontic treatment need (IOTN), upper arch crowding/spacing, crossbite, anterior vertical relationship and sagittal relationship of the buccal segment. The scoring range is 1 - 10, 0 - 5, 0 - 1, 0 - 4 and 0 - 2 respectively and the weightage is 7, 5, 5, 4 and 3 respectively. Each component is scored on their respective scale, then multiplied by their weightage and summed up to get the ICON score. The international cutoff point for treatment need is 43. A cutoff point of 31 is taken for the treatment outcome.

Statistical Analysis

Simple random sampling of the data was done. The data input was done using Epidata 3.0 and processing was done by SPSS 13.0. The reliability test was calculated by Kappa value. The "subjective needs for orthodontic treatment" was regarded as the dependent variable and other variables such as "gender, age, satisfaction on teeth and jaw" were regarded as independent variables. Statistically significant independent variables were screened by using chi-square test. The independent variables which were statistically significant were screened using logistic regression analysis with the method of forward stepwise and regarded as factors affecting the subjective need for orthodontic treatment. The P value was taken as $P < 0.05$.

Results

The final sample consisted 210 participants, who completed the survey which included half local students and half foreign students. Figure 1 shows the flowchart study. Among the foreign students, 20% (21/105) were Asians, 72% (76/105) were Europeans and the remaining 8% (8/105) were from other countries (Figure 2). 75% of the local students (79/105) and 85% (89/105) of the foreign students were graduate or post-graduate students whereas 25% (26/105) of the local students and 15% (16/105) of foreign students were undergraduate students. The participants included a lesser number of female participants in both the groups. Only 37.1% (39/105) of the foreign students were females whereas in local students group, their number was 47.6% (50/105). Regarding age, 76.2% (80/105) of the foreign students were in the age group of 18 - 24 years whereas 74.3% (78/105) of local students were in this category. 24 - 35 years category had a lesser percentage of participants, 23.8% (25/105) foreign students and 25.7% (27/105) local students respectively.

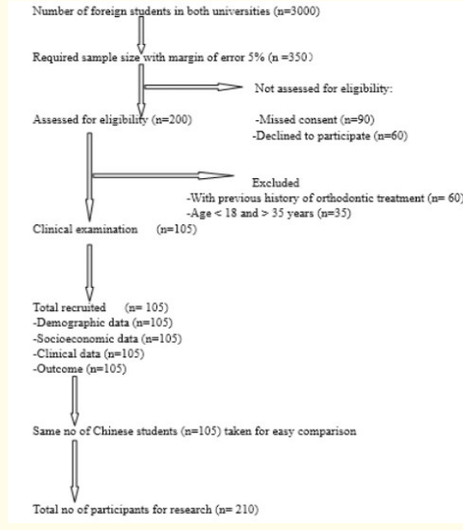

Figure 1: *Flow diagram at each stage of recruiting study participants.*

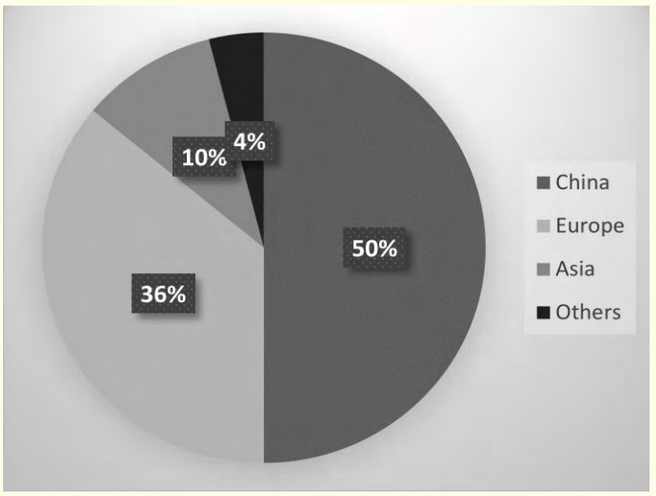

Figure 2: *Distribution of participants in our research. Half of the participants were from China whereas the remaining half in decreasing order were from Europe, Asia and other countries respectively.*

Regarding satisfaction with their teeth, 54.3% (57/105) of local students were satisfied with the current conditions of their teeth whereas 71.5% (75/105) of foreign students had satisfaction with their teeth as shown in figure 3. 95.2% (100/105) of the local students thought that straight teeth were important to them whereas 87.6% (92/105) of the foreign students thought so (Figure 4). 77.1% (81/105) of local students thought that if teeth were irregular, orthodontic treatment would be helpful in correcting them whereas 81.9% (86/105) of the foreign students thought so. Both the local students and the foreign students were very much aware of the fact that irregular teeth had an impact on the psychosocial development of an individual as 63.8% (67/105) local students and 61.9% (65/105) foreign students thought so (Figure 5).

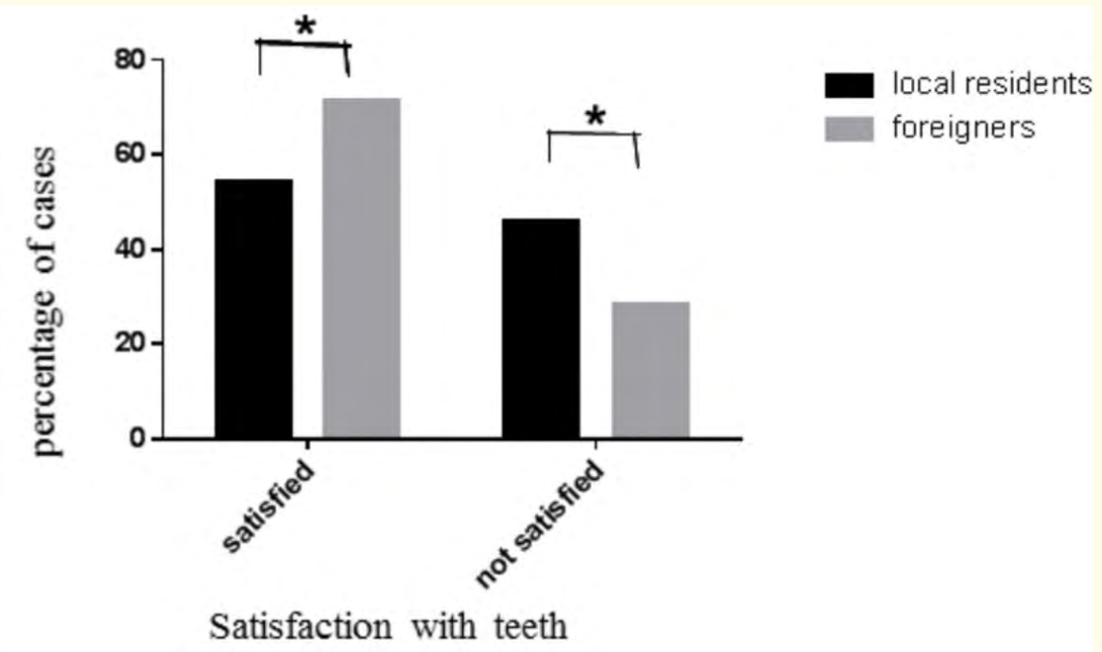

Figure 3: *Distribution of participants according to satisfaction with teeth. Left side shows the percentage of participants satisfied with their teeth and right side shows the percentage of participants not satisfied with their teeth. (P = 0.01).*

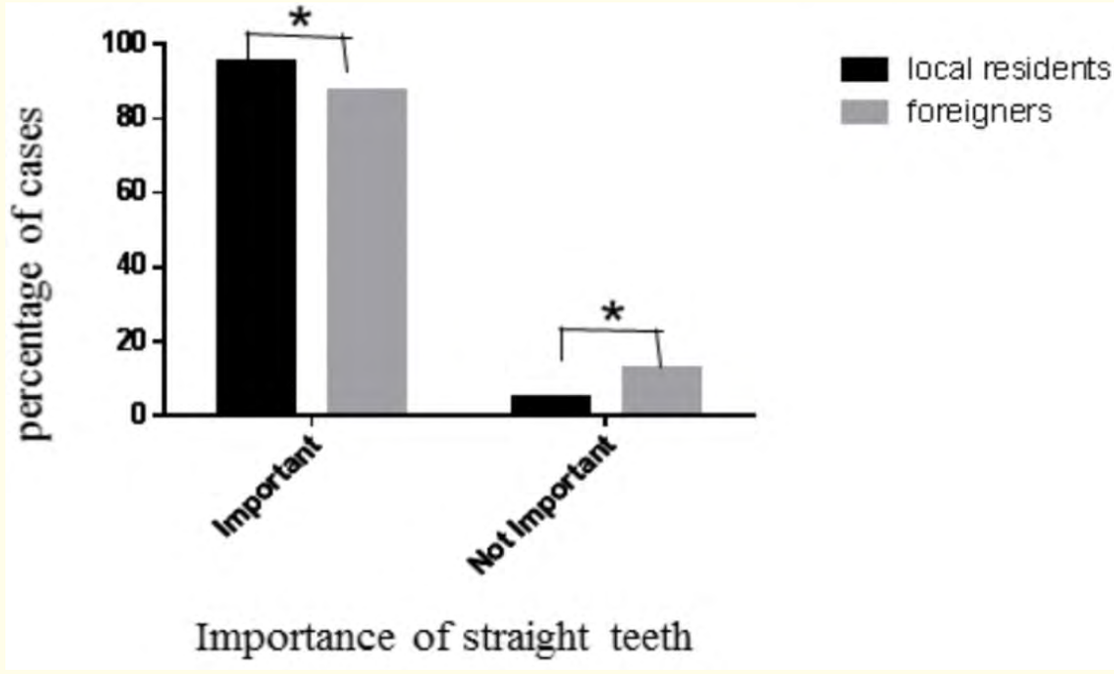

Figure 4: *Distribution of participants according to their view regarding the importance of straight teeth. Left side is the percentage of participants thinking that straight teeth are important and right side is the percentage who think that straight teeth are not important. (P = 0.00).*

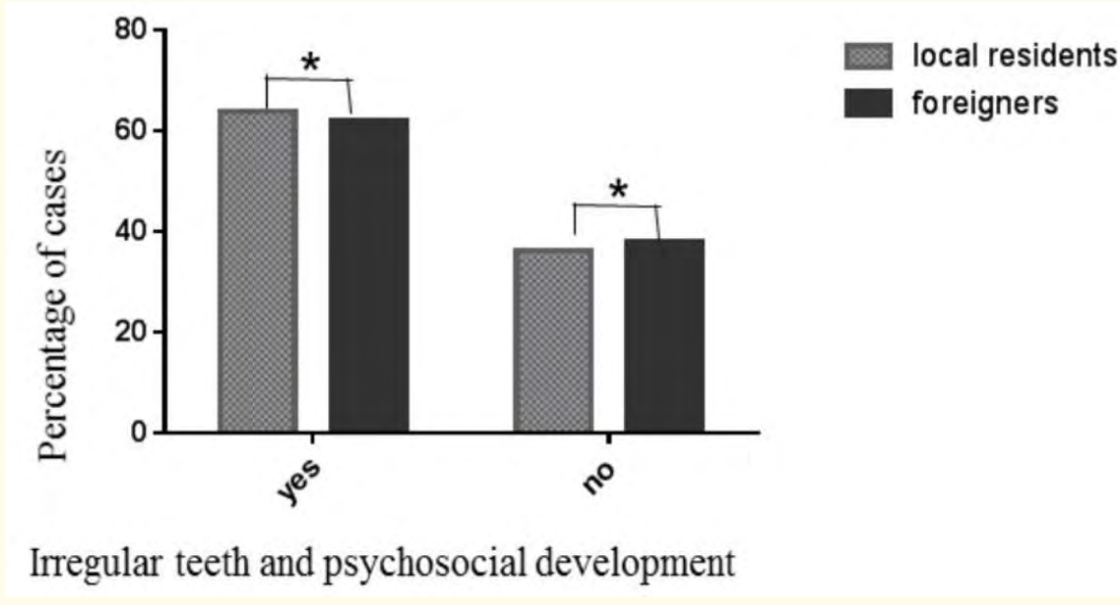

Figure 5: *Distribution of participants according to their view regarding the influence of irregular teeth on psychosocial development. Left side is the percentage of participants who say yes and the right side is those who say no. (P = 0.04).*

As far as visiting dentist was concerned, 55.2% (58/105) local students had been to a dentist before whereas 93.3% (98/105) foreign students had. The local students were seen to be more aware of others teeth as compared to their foreign counterparts. Results showed that 81.9% (86/105) of the local students had awareness of others teeth whereas only 74.3% (78/105) of the foreign students had such awareness. Both the local students and the foreign students thought that good looking face gives a good impression during social interaction. The results were surprisingly the same, 93.3% (98/105) in both the groups. 84.8% (89/105) of local students had no history of orthodontic treatment and never plan to do so whereas 68.3% (72/105) of foreign students fell in this category. 68.3% (71/105) local students and 55.2% (58/105) foreign students had friends undergoing or planning orthodontic treatment. We asked the participants about their motives for orthodontic treatment if they plan to do so. 30.5% (32/105) of the local students thought that it would be to improve chewing function, 68.6% (72/105) to improve facial appearance and 0.9% (1/105) to get community appraisal or praise whereas in the foreign students category, these were 50% (52/105), 46.2% (48/105) and 3.8% (5/105) respectively (Figure 6).

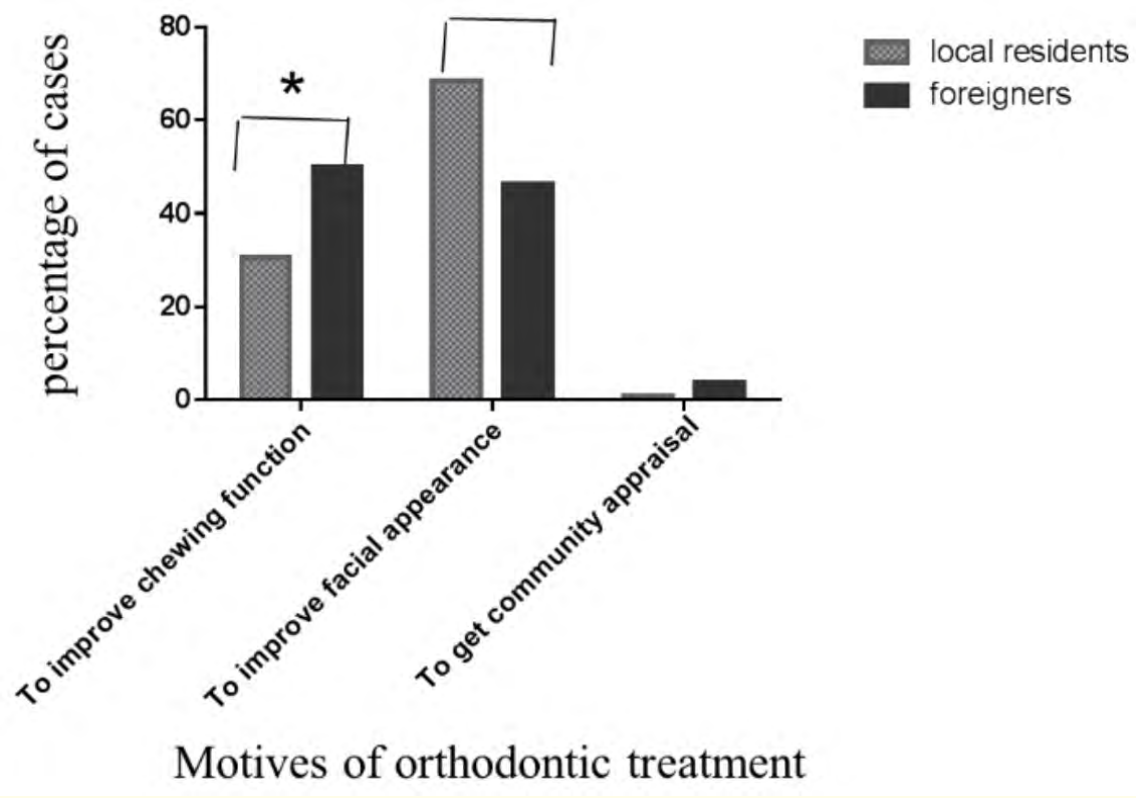

Figure 6: *Distribution of participants according to their view regarding the motives of orthodontic treatment. Left side is the percentage of participants who think orthodontic treatment is to improve chewing function, the middle one to improve facial appearance and the right side to get community appraisal. (P < 0.05).*

52.4% (55/105) local students and 56.2% (59/105) foreign students were found to have an ICON index less than 29, 29.8% (31/105) local students and 33.3% (35/105) foreign students greater than 29 but less than or equal to 50, 11.4% (12/105) local students and 6.7% (7/105) foreign students in the range of 51 - 63, 3.8% (4/105) local students and 1.9% (2/105) foreign students had ICON index rang-

ing from 64 - 77 and 2.6% (3/105) local students and 1.9% (2/105) foreign students had ICON index greater than 77. The ICON results are shown in figure 7. According to doctor's opinion, 56.2% (59/105) local students and 45.7% (48/105) foreign students fall into the category of needing orthodontic treatment as shown in figure 8.

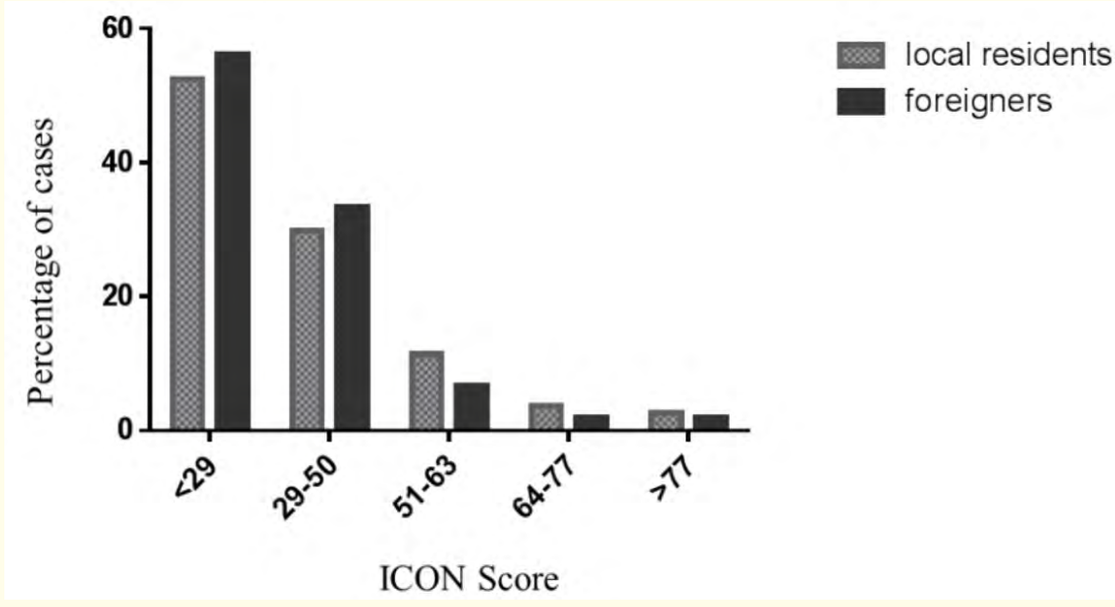

Figure 7: *Distribution of participants according to their ICON index score. First one shows the percentage of participants having ICON score < 29, second one having scores 29 - 50, third one having scores 51 - 63, the fourth one having scores 64 - 77 and the last one having scores > 77.*

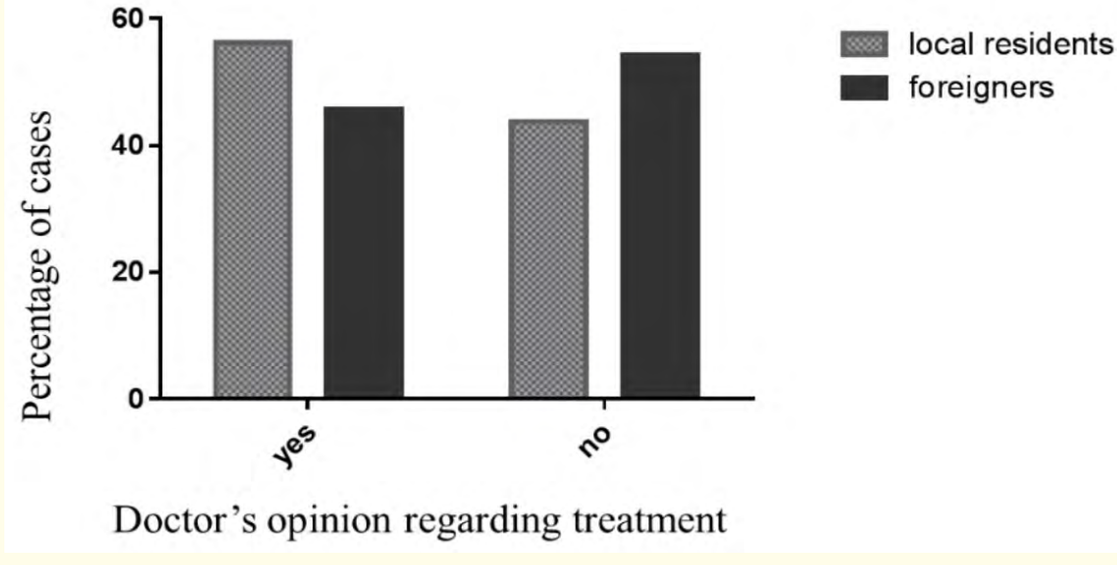

Figure 8: *Distribution of the percentage of participants according to investigating doctor's opinion of needing or not needing orthodontic treatment. Left hand side is the ones who the doctor believes need orthodontic treatment and the right side is the ones who the doctor believes do not need orthodontic treatment.*

Factors influencing subjective orthodontic treatment

Subjective orthodontic treatment need was considered as one dependent variable in the questionnaire. Other eleven variables such as age, gender, educational background, satisfaction with teeth, importance of straight teeth, awareness of others teeth, visited dentist before, plan orthodontic treatment, motives of orthodontic treatment, self-perception of psychosocial impact of malocclusion and friends undergoing orthodontic treatment were considered as independent variables (Table 1). The independent variables were screened using Chi-square test to find their association with the dependent variable.

	Total N=210		Percentage (%)	
Variables	**Local students**	**Foreign students**	**Local students/Foreign students**	**P**
Satisfaction with teeth	57/105	75/105	54.3/71.5	0.01
Importance of straight teeth	100/105	92/105	95.2/87.6	0.00
Awareness of others teeth	86/105	78/105	81.9/74.3	0.00
Visited dentist before	58/105	98/105	55.2/93.3	0.00
Importance of orthodontic treatment for irregular teeth	81/105	86/105	77.1/81.9	0.00
Friends of participants undergoing orthodontic treatment	71/105	58/105	68.3/55.2	0.002
Plan orthodontic treatment to improve chewing function	32/105	52/105	30.5/50	0.009
Irregular teeth influence psychological development	67/105	65/105	63.8/61.9	0.04
Good looking face gives good impression	98/105	98/105	93.3/93.3	0
Orthodontic treatment required in doctor's view	59/105	48/105	56.2/45.7	0.11
ICON < 29	55/105	59/105	52.4/56.2	0.1

Table 1*: Summary of questionnaire.*

In both the groups, it was found that importance of straight teeth, awareness of others teeth and the self-perception of the psychosocial impact of malocclusion was the only three independent variables that had statistical significance (Table 2). Rest of the independent variables was not found to be associated with our dependent variable: subjective orthodontic treatment need. Forward stepwise logistic analysis was subsequently used to select the main influential factors among these three statistically significant variables. This analysis showed that the importance of well-aligned teeth and self-perception of psychosocial impact of malocclusion were the two main factors influencing subjective orthodontic treatment need ($P < 0.05$) in both the local students and foreign students in Nanjing.

Variables	Foreign students (P value)	Local students (P value)
Importance of Straight teeth	0.001	0.001
Awareness of others teeth	0.051	0.002
Self-perception of the Psychosocial impact of malocclusion	0.007	0.000

Table 2: *Chi square test.*

The importance of well aligned teeth and the self-perception of the psychosocial impact of malocclusion were significant ($p < 0.05$) and the others were not significant ($p > 0.05$).

Exit criteria P=0.05

The difference of subjective orthodontic treatment plan between the two groups

18% (19/105) of the local students planned to undergo orthodontic treatment later whereas 38% (40/105) of foreign students had such plans. Chi-square test between these two groups showed that this had a statistical significance ($P < 0.05$). It was found that aesthetic component ($P = 0.01$), upper arch crowding ($P = 0.00$), crossbite ($P = 0.00$) and incisor overbite ($P = 0.00$) of the ICON components had great significance and were associated with the desire and plan for undergoing orthodontic treatment in both the local students and foreign students. The desire and plan for orthodontic treatment with ICON components like upper arch spacing ($P = 0.2$), incisor open bite ($P = 0.16$) and buccal segment relationships ($P = 0.49$) was insignificant as these variables lost their statistical significance (Table 3). Less number of local students had plans to undergo orthodontic treatment later even though the malocclusion factor was higher in them as compared to the foreign students.

Plan orthodontic treatment							
Icon Components	**Local students**	**Foreign students**	**% (local/foreign)**	**Local students**	**Foreign students**	**% (local/foreign)**	**p[a]**
Aesthetic Component							
1 - 3	80	20	76.1/85.7	16	34	20/37.7	0 .010
4 - 7	90	12	19.2/11.4	7	5	35/41.6	
8 - 10	5	3	4.7/2.9	1	2	20/66.6	
Upper arch crowding							
< 2 mm	41	52	39/49.5	9	15	21.9/28.8	0.000
2.1 - 5 mm	30	43	28.5/40.9	6	13	20/30.2	
5.1 - 9 mm	13	3	12.3/2.85	3	1	23/33.3	
9.1 - 13 mm	7	1	6.66/0.95	2	1	28.5/100	
13.1 - 17 mm	3	1	2.85/0.95	1	1	33.3/100	
> 17 mm	2	0	1.9/0	1	0	50/0	
Upper arch spacing							
< 2mm	0	2	0/1.9	0	0	0	0.200[b]
2.1 - 5 mm	3	3	2.85/2.85	0	1	0/33.3	
5.1 - 9 mm	3	1	2.85/0.95	1	1	33.3/100	
> 9 mm	1	0	0.95/0	0	0	0/0	
Impacted teeth	2	0	1.9/0	1	0	50/0	
Crossbite							
Present	9	2	8.6/1.9	1	2	11.1/100	0.000[b]
Absent	96	103	91.4/98.1	15	30	15.6/29.1	
Incisor open Bite							
Edge to edge	0	0	0	0	0	0	0.160
< 1 mm	3	2	2.85/1.95	0	0	0	
1.1 - 2 mm	0	0	0	0	0	0	
2.1 - 4 mm	4	1	3.8/0.95	1	1	25/100	
> 4 mm	0	0	0	0	0	0	
Incisor over bite							
< 1/3 incisal coverage	62	80	59/76.2	16	23	25.8/28.7	0.000
1/3 - 2/3 incisal coverage	22	17	20.9/16.2	7	9	31.8/52.9	
2/3 upto full coverage	11	4	10.5/3.8	2	2	18.1/50	
Fully covered	3	1	2.85/0.95	2	1	66.6/100	
Buccal segment relationship							
Cusp to embrasure only	83	95	79/90.5	14	19	16.8/20	0.499
Upto cusp, not cusp to cusp	16	7	15.2/6.7	5	3	31.2/42.8	
Cusp to cusp	6	3	5.8/2.8	1	1	16.6/33.3	

Table 3: *Plan for orthodontic treatment according to ICON components.*

a: Chi square test

b: Fisher exact test

Discussion

The subjective needs for orthodontic treatment were affected by different factors, especially the culture and background. Josefsson., *et al.* [1] investigated the subjective needs for orthodontic treatment of children from different Swiss families and found that their own people have higher needs for orthodontic treatment than children in immigrant families. In our survey, the main finding is that the subjective needs for orthodontic treatment between the local and foreign students had some similarities and differences.

In the present study, we found that both the local students and foreign students equally agreed that irregular teeth had a great influence on the psychosocial development of an individual. The importance given to well-aligned teeth by both the groups clearly shows that the aesthetics of dental appearance are receiving more and more attention. The two important factors affecting the subjective orthodontic treatment need in the two groups are the importance of well aligned teeth and the self-perception of the psychosocial impact of malocclusion ($P < 0.05$). Cash., *et al.* and Onyeaso., *et al.* [6,20] found that people who express dissatisfaction with their teeth may have some psychological problems. Linder-Aronson., *et al*. [21] support this view. Our finding also proves this fact as an equally high number of local students and foreign students thought that good looking face gives a good impression during social interaction.

On the other hand, our results showed that difference existed in the two groups. A larger number of local students were dissatisfied with their teeth as compared to foreign students. And the local students stressed on the motives of orthodontic treatment to improve facial appearance followed by improving chewing function, whereas the foreign students gave more importance to chewing function. The local students gave more importance to straight teeth as compared to the foreign students. Moreover, lesser number of local students had been to a dentist before as compared to the foreign students. The reason for these findings may be the malocclusion which is more prevalent in Nanjing as compared to Europe where the majority of our foreign students came from. Another reason may be the socioeconomic status which plays a great role in deciding orthodontic treatment need. Badran., *et al.* [16] concluded that subjects of low socioeconomic status (SES) exhibited greater normative and perceived treatment needs than subjects of higher SES. They were less satisfied with their dental appearance and visited a dentist less frequently. This finding can be correlated with our research. The socioeconomic status in the foreign students may be considered to be better than that of local students. So, even if malocclusion was more prevalent in our local students group but their visiting a dentist was much less as compared to the foreign students who pay a lot of attention on their dental health.

In addition, the ideal cut-off point of ICON index was the main concern in the present study. TJ Louwerse., *et al.* [15] found that the international cut-off value of 43 for the ICON did not appear to be useful in Netherlands and a higher cut-off point of 52 was found to be suitable for that population. Torkan S., *et al.* [13] found that the cut-off point of ICON index in the Iranian population should be adjusted to 35 in lieu of 43 where the highest level of sensitivity and specificity can be obtained for their society. Moreover, ZY Liao., *et al.* [14] concluded that the international cutoff point (43) had poor sensitivity and specificity compared to the experts rating in southern China. In the present study, the cut-off point of 43 was not suitable to either the local students or the foreign students in Nanjing. Cut off point of 29 for ICON was found to be much reliable in our research where more sensitivity and specificity was obtained. Furthermore, a larger sample could be more helpful in finding out the subjective orthodontic treatment needs and factors influencing it in the further studies.

Conclusion

The factors influencing the subjective orthodontic treatment need were the same in both the groups: importance of well aligned teeth and the self-perception of the psychosocial impact of malocclusion. Regarding psychological development, both the groups equally agreed that irregular teeth influenced it. However, some cultural differences existed, for example the local students gave greater importance to aesthetics for undergoing orthodontic treatment whereas improving chewing function was of greater importance in the foreign students' category. Less number of local students was satisfied with their teeth indicating a greater treatment need in this group. The cutoff point to 29 for ICON index had more sensitivity and specificity in the both groups in the present study.

Bibliography

1. Josefsson E., *et al*. "Self-perceived orthodontic treatment need and culturally related differences among adolescents in Sweden". *European Journal of Orthodontics* 27.2 (2005): 140-147.

2. Mandall NA., *et al*. "Perceived aesthetic impact of malocclusion and oral self-perceptions in 14-15-year-old Asian and Caucasian children in greater Manchester". *European Journal of Orthodontics* 22.2 (2000): 175-183.

3. Lew KK. "Attitudes and perceptions of adults towards orthodontic treatment in an Asian community". *Community Dentistry and Oral Epidemiology* 21.1 (1993): 31-35.

4. Burden DJ. "The influence of social class, gender and peers on the uptake of orthodontic treatment". *European Journal of Orthodontics* 17.3 (1995): 199-203.

5. Annemieke B., *et al*. "Expectation of treatment and satisfaction with dentofacial appearance in orthodontic patients". *American Journal of Orthodontics and Dentofacial Orthopedics* 123.2 (2003): 127-132.

6. Cash TF and Fleming EC. "Body image issues and social relations/Cash TF ed". Body image: a handbook of theory, research and clinical practice New York: Guilford (2002): 277-286.

7. DU Hui., *et al*. "An investigation of the knowledge about malocclusions and orthodontic treatment in Beijing area". *Beijing Journal of Stomatology* 16.6 (2008): 329-331.

8. WANG Xiao-rong., *et al*. "The influential factors to the motivation of orthodontic treatment in Chinese adolescent". *Stomatology Edu Journal* 14.3 (1998): 214-216.

9. Christopherson EA., *et al*. "Objective, subjective, and self-assessment of preadolescent orthodontic treatment need--a function of age, gender, and ethnic/racial background". *Journal of Public Health Dentistry* 69.1 (2009): 9-17.

10. Daniels CP and Richmond S. "The development of an index of complexity, outcome and need (ICON)". *Journal of Orthodontics* 27.2 (2000): 149-162.

11. Xiao-ting Li., *et al*. "Factors Influencing Subjective Orthodontic Treatment Need and Culture-related Differences among Chinese Natives and Foreign Inhabitants". *International Journal of Oral Science* 2.3 (2010): 149-157.

12. Rodrigo Norremose Costa., *et al*. "Validity of two occlusal indices for determining orthodontic treatment needs of patients treated in a public university in Belo Horizonte, Minas Gerais State, Brazil". *Cadernos de Saúde Pública* 27.3 (2011): 581-590.

13. Sepide Torkan., *et al*. "An Analytical Study on an Orthodontic Index: Index of Complexity, Outcome and Need (ICON)". *Journal of Dentistry, Shiraz University of Medical Sciences* 16.3 (2015): 149-155.

14. Zheng-YuLiao., *et al*. "Validity assessment and determination of the cutoff value for the Index of Complexity, Outcome and Need among 12 - 13 year-olds in Southern Chinese". *International Journal of Oral Science* 4.2 (2012): 88-93.

15. TJ Louwerse., *et al*. "The reliability and validity of the Index of Complexity, Outcome and Need for determining treatment need in Dutch orthodontic practice". *European Journal of Orthodontics* 28.1 (2006): 58-64.

16. Serene A Badran., *et al*. "Effect of socioeconomic status on normative and perceived orthodontic treatment need". *Angle Orthodontist* 84.4 (2014): 588-593.

17. Tuominen ML., *et al*. "Subjective orthodontic treatment need and perceived dental appearance among young Finnish adults with and without previous orthodontic treatment". *Community Dental Health Journal* 11.1 (1994): 29-33.

18. Shaw WC., *et al*. "Quality control in orthodontics: factors influencing the receipt of orthodontic treatment". *British Dental Journal* 170.2 (1991): 66-68.

19. Riedmann T., *et al*. "Adult patient's view of orthodontic treatment outcome compared to professional assessment". *Journal of Orofacial Orthopedics* 60.5 (1999): 308-320.

20. Onyeaso CO and Sanu OO. "Perception of personal dental appearance in Nigerian adolescents". *American Journal of Orthodontics and Dentofacial Orthopedics* 127.6 (2005): 700-706.

21. Linder-Aronson S., *et al*. "Objective and subjective need for orthodontic treatment in Sto ckholm County". *Swedish Dental Journal* 26.1 (2002): 31-40.

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