Malocclusion, facial profile and dental aesthetics in Asian adults
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Document Version
Publisher's PDF, also known as Version of record

Publication date:
2006

Link to publication in University of Groningen/UMCG research database

Citation for published version (APA):
Chapter 1 provides an overview of malocclusion studies that involve the assessment of occlusal traits in relation to the prevalence of malocclusions, orthodontic treatment need and the perception of dentofacial aesthetics. The main aims of this study are introduced. The aims were to establish the malocclusion status and orthodontic treatment need in an orthodontically untreated sample of Asian men and to investigate the perception of dentofacial aesthetics by orthodontists and adults from an Asian community.

The methods of assessing and grading malocclusion are briefly reviewed with emphasis given to the use of occlusal indices namely, the Index of Orthodontic Treatment Need (IOTN) and the Peer Assessment Rating (PAR) index in the assessment of orthodontic treatment need and malocclusion severity respectively.

The complex nature of the perception of dental and facial aesthetics and its relevance to orthodontics is introduced. A brief review of the factors that influenced the perception of dentofacial aesthetics and malocclusion is given.

An overview of the thesis is presented to describe the two main themes of the thesis and summarise the research methodologies employed to establish and explore these themes.

Chapter 2 describes the occlusal status in a sample of 339 orthodontically untreated Asian men from a multiracial community. The sample comprised of 258 Chinese (76%), 60 Malays (18%) and 21 Indians (6%). The mean age of the subjects was 18.8 ± 1.1 years. The occlusal traits examined from study models were incisor relationship, molar relationship, overjet, overbite, crossbite, clinically missing permanent teeth, retained deciduous teeth and incisor crowding. The percentages of incisor Class I, Class II Division 1, Class II Division 2 and Class III relationships were 48.1%, 26.3%, 3.2% and 22.4% respectively. Angle's Class I molar relationship was most prevalent followed by Class II and III. The prevalence of anterior and posterior crossbites was in the range of 13 to 17%. The prevalence of clinically missing permanent teeth was found to be 14%. Ethnic comparison among Chinese, Malay and Indian men found that Indian men were more likely to be associated with Class II Division 1 incisor relationship with overjet greater than 6.5 mm. A higher prevalence of Class III incisor relationship was found in Malay than Chinese men although it was statistically not significant. Indian men were more likely to have clinically missing permanent teeth. No statistically significant differences were found among the three ethnic groups for molar relationship, overbite, crossbite, retained deciduous teeth and incisor crowding. Moderate to severe incisor crowding was manifested in more than half of the total sample. The implications and limitations of the study were discussed.
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Chapter 3 describes the level of orthodontic treatment need in a sample of 339 orthodontically untreated Asian men from a multiracial community. The Index of Orthodontic Treatment Need (IOTN) was used to determine the level of objective treatment need from study models. The IOTN protocol for study model analysis was applied. Subjective treatment need was determined with the use of a questionnaire that investigated the self-perceived dental aesthetics and desire for orthodontic treatment. Half of the Asian men had a definite objective need for treatment with Dental Health Component (DHC) grades 4 and 5. The level of objectively identified definite level of treatment need due to aesthetic impairment accounted for 29% of the sample with Aesthetic Component (AC) grades 8 to 10. There was no statistically significant difference in the level of objective treatment need among the Chinese, Malay and Indian men for both DHC and AC assessments although a higher proportion of Malay men with definite objective treatment need was found. Only a minority of the Asian men perceived themselves to have nice dental aesthetics (19%). Majority of the Asian men did not think that they needed orthodontic treatment (68%) or were unsure of the need (23%). Majority of the Asian men (77%) responded that the perceived benefit of orthodontic treatment was the improvement of dental aesthetics. A poor correlation was found between objective and subjective AC assessments. This study also reflected the level of residual treatment need among young men in an Asian community where orthodontic treatment is readily available.

Chapter 4 describes the patient factors associated with the lack of orthodontic treatment uptake in young men with ages between 17 to 22 years. A questionnaire-type of survey was conducted on a sample of 170 orthodontically untreated Singaporean men who were objectively identified to be in the definite treatment need category defined by Dental Health Component (DHC) grades 4 and 5 based on study model analysis. The two most common reasons cited for the lack of orthodontic treatment uptake were self-satisfaction with dental appearance and treatment cost. The study also found that about a third of the study sample was unaware of their orthodontic treatment need status while about 10% was unsure of the benefits of orthodontic treatment. Less than a third of the sample cited pain associated with treatment as a deterrent factor. About 37% of the sample felt that wearing fixed orthodontic appliances would be unsightly and embarrassing. Perceived embarrassment associated with the wearing of braces and parental objection to treatment were deterrent factors more commonly associated with non-Chinese than Chinese adults. The results of the study emphasize the importance of orthodontic counseling and timely dental education to promote a greater awareness toward malocclusion and orthodontic status within the public community.
Chapter 5 describes the relationship between malocclusion type, orthodontic treatment need and malocclusion severity. The Peer Assessment Rating (PAR) index and the Index of Orthodontic Treatment Need (IOTN) were used to determine the severity of malocclusions and level of orthodontic treatment need from 339 study models of Asian men with no history of orthodontic treatment respectively. Type of malocclusion was defined as Class I, Class II Division 1, Class II Division 2 and Class III according to the incisor relationship. The highest mean PAR score was associated with Class II Division 2 malocclusions. In general, Class II malocclusions were found to be more severe than Class I and III malocclusions. PAR scores were significantly correlated with Dental Health Component and Aesthetic Component grades. An increase in 1 unit PAR score increased the likelihood of treatment need for dental health reasons and aesthetic reason by 1.17 and 1.25 times respectively. Receiver Operator Characteristics (ROC) analysis was used to identify the optimal cut-off PAR scores in relation to orthodontic treatment need. An optimum cut-off PAR score of 17 was found to be indicative of orthodontic treatment need for dental health reasons while a PAR score of 20 was indicative of treatment for aesthetic reasons. The PAR index was found to be more predictive for aesthetic treatment need than dental health needs. Although the PAR index was originally developed with the intention of assessing malocclusion severity in relation to treatment outcome, the findings of this study suggest that the PAR index could be reflective of the orthodontic treatment need status within the limitations discussed in the paper.

Chapter 6 compares the perception of Chinese facial profile aesthetics among dental professionals, dental students and laypersons. The sample consisted of 31 dental professionals (20 orthodontists, 11 oral surgeons), 92 dental students and 152 laypersons (37 males, 115 females) in an Asian community. The facial profile photographs and lateral cephalometric radiographs of an adult Chinese man and woman with normal Class I incisor and skeletal base relationships were digitized and matched using CASSOS (Computer-Assisted Simulation System for Orthognathic Surgery), a commercial software programme used for treatment planning of orthodontic-surgical cases. The digitized facial profile image was used as the template to generate 6 other profile images by altering the normative hard tissue cephalometric values by at least 2 standard deviations. The 7 profiles used of assessment were: (1) bimaxillary protrusion, (2) protractive mandible, (3) retrusive mandible, (4) normal profile (Class I incisor with Class I skeletal pattern), (5) retrusive maxilla, (6) protractive maxilla and (7) bimaxillary retrusion. Normal and bimaxillary retrusion male and female profiles were perceived to be the most attractive by dental professionals, dental students and laypersons. Male and female profiles were both perceived to be the most attractive by the three groups. However, the most attractive profile was different for the male and female groups. Male and female profiles were perceived to be the most attractive by dental professionals, dental students and laypersons. Male and
Chapter 3. Facial profile attractiveness assessment

Female orthodontic treatment need was assessed using the Dental Health Unit PAR (Patient Assessment Rating) score. The relationship between malocclusions and aesthetic preferences was examined. Class II division 2 malocclusions were more than Class I and Class II division 1. The Dental Health Unit PAR score was used to assess treatment need. The PAR index showed a higher correlation among the dental professionals, dental students, and laypersons when compared to their perception of the male profile. The three groups were significantly correlated for their perception of female profile aesthetics. The perception of male profile aesthetics was significantly correlated only between dental students and laypersons.

Chapter 7 compares and contrasts the perception of Chinese facial profile attractiveness between Asian orthodontists (n = 20) and oral surgeons (n = 11). Clinician's age, sex, clinical specialty, and the number of years in clinical practice were evaluated as possible predictive factors influencing the profile assessment. The 7 profiles used for the assessment were the same as those described in Chapter 6. There was a strong correlation in profile assessment trend between orthodontists and oral surgeons. Male profile with bimaxillary retrusion was perceived to be the most attractive by the orthodontists. In contrast, oral surgeons perceived male normal Chinese profile to be the most attractive. Female profile with bimaxillary retrusion was ranked as most attractive by both orthodontists and oral surgeons. Male and female profiles with mandibular protrusion were perceived to be the least attractive.

Chapter 8 evaluates the perception of Chinese facial profile attractiveness by Asian laypersons (n = 149) and the effect of age, gender and ethnicity on their perception. The sample comprised of 65.1% Chinese, 21.5% Malay and 13.4% Indian adults inclusive of 112 females (75.2%) who participated in the study. The mean age of the subjects was 24.6 ± 4.4 years. The 7 profiles used for the assessment were the same as those described in Chapters 6 and 7. Female normal and bimaxillary retrusive profiles were perceived to be the most attractive. Age, sex and ethnicity of the laypersons were non-significant predictors in the selection.
of the most attractive female profile. Male normal profile was perceived to be the most attractive. Sex and ethnicity were non-significant predictors. However, older laypersons were less likely to choose male normal profile to be the most attractive. Female or male profile with protrusive mandible was perceived to be the least attractive. Bimaxillary protrusive male and female profiles were ranked in the less attractive end of the scale despite the fact that these profiles are typical of Chinese faces. A male profile with protrusive maxilla and retrusive mandible was ranked the second and third most attractive profile respectively. This is an interesting finding as facial profiles associated with skeletal Class II patterns were perceived to be unattractive in White communities.

Chapter 9 describes the perception of dental aesthetics between 21 orthodontists and 158 laypersons from an Asian community. Fifty pairs of photographic prints of dental malocclusions at maximum intercuspation observed from the frontal and right buccal view were used to assess dental aesthetics. Visual analogue scale (VAS) was used for the rating of dental aesthetics. The anterior occlusal traits evaluated were anterior dental crowding, overjet, overbite, dental spacing and type of incisal malocclusion. Objective measurements of these occlusal traits were performed. The VAS scores of layperson were significantly correlated with increased overjet greater than 6 mm and severe maxillary dental crowding greater than 8 mm. The VAS scores of orthodontists were significantly correlated with reversed overjet. Class III incisal malocclusions were perceived to be the least aesthetic by the orthodontists. Overbite and dental spacing were non-significant occlusal traits in the assessment of dental aesthetics. The major occlusal trait that governed the perceived dental aesthetics of laypersons and orthodontists appears to be the degree of incisor overjet.

Chapter 10 discusses the key issues and implications of the research findings from this series of studies. Several recommendations on the future directions of research in the areas of malocclusion status, orthodontic treatment need and dentofacial aesthetics are proposed. These proposals include the assessment of malocclusion status and orthodontic treatment need-demand in Asian woman and adolescents, the level of orthodontic awareness in Asian woman and adolescents, the perception of dentofacial aesthetics in Asian orthodontic patients and the development of a dental aesthetic index to better reflect the perception of dental aesthetics of the Asian community.