Original Article

Acceptability of Dental Appearance in a Group of Finnish 16- to 25-Year-Olds

Anna-Liisa Svedström-Oristo[a]; Terttu Pietilä[b]; Ilpo Pietilä[c]; Tero Vahlberg[d]; Pentti Alanen[e]; Juha Varrela[f]

ABSTRACT

Objective: To define a grade in the Aesthetic Component (AC) of the Index of Orthodontic Treatment Need (IOTN) that would differentiate between esthetically acceptable and unacceptable occlusions and that would also be both subjectively and objectively meaningful.

Materials and Methods: Dental appearance and self-perceived orthodontic treatment need were analyzed in a group of Finnish young adults (171 males, 263 females, age range 16–25 years). Subjective data were gathered using a questionnaire, and the respondents were requested to score their dental appearance on a visual analog type 10-grade scale. Professional assessment of dental appearance was performed by two orthodontists using the AC of the IOTN. The cutoff value between esthetically acceptable and unacceptable occlusions was defined using receiver operating characteristic curves.

Results: Sixty-six percent of orthodontically treated and 74% of the untreated respondents were satisfied with their own dental appearance. Every third respondent reported one or more disturbing traits in their dentition. The most frequently expressed reason for dissatisfaction was crowding; girls expressed dissatisfaction more often than boys did ($P = .005$). A self-perceived treatment need was reported infrequently by 8% of orthodontically treated and 6% of untreated respondents. In the logistic regression analysis, self-perceived need for orthodontic treatment was the only significant factor explaining dissatisfaction with own dental esthetics. On the applied scales, grades 1 and 2 fulfilled the criteria for satisfactory dental esthetics.

Conclusion: The results suggest that the AC grade 3 could serve as a cutoff value between esthetically acceptable and unacceptable occlusions. (*Angle Orthod.* 2009;79:479–483.)

KEY WORDS: Dental appearance; Self-perception; Orthodontic treatment need; Acceptable occlusion

INTRODUCTION

The outcome of orthodontic treatment is generally evaluated in terms of two separate aspects: a professional assessment of occlusion (objective outcome) and the patient's satisfaction with the treatment result (subjective outcome). Ideally, the success of care should be defined by criteria that would be meaningful to both professionals and patients.[1] In general, a wide individual variation in acceptance of occlusal features seems to exist among laypeople.[2,3] They also seem to be less concerned than orthodontists about deviations from the ideal.[4–8] On the other hand, young adults' dissatisfaction with their own dental appearance has been found to be based on a realistic perception of occlusal features when their evaluation has been compared with a professional assessment.[7,9,10]

In a series of investigations, clinical criteria that could be used in the assessment of occlusal acceptability were analysed.[11–14] Consequently, a new index, the Occlusal Morphology and Function Index (OMFI), was developed, based on the assessment of six morphological and four functional criteria.[15,16] The OMFI is intended to be used as a tool eg, in studies monitoring the outcome of orthodontic care at population level.

[a] Associate Professor, Department of Oral Development and Orthodontics, Institute of Dentistry, University of Turku, Turku, Finland.

[b] Chief Orthodontist, Health Centre of Pori, Pori, Finland.

[c] Chief Dental Officer, Health Centre of Pori, Pori, Finland.

[d] Lecturer, Department of Biostatistics, University of Turku, Turku, Finland.

[e] Professor Emeritus, Department of Community Dentistry, Institute of Dentistry, University of Turku, Turku, Finland.

[f] Professor and Department Chair, Department of Oral Development and Orthodontics, University of Turku, Turku, Finland.

Corresponding author: Dr Anna-Liisa Svedström-Oristo, Department of Oral Development and Orthodontics, Institute of Dentistry, University of Turku, Lemminkäisenkatu 2, 20520 Turku, Finland
(e-mail: anlisve@utu.fi)

Accepted: June 2008. Submitted: April 2008.

Table 1. Categories of Esthetically Based Orthodontic Treatment Need According to the Scores of the Aesthetic Component (AC) of the Index of Orthodontic Treatment Need

Category	AC Score
No treatment need	1–4
Borderline need	5–7
Definite treatment need	8–10

Such studies, including both orthodontically treated and untreated individuals, provide data on the ability of the health care system to promote oral health in the population. However, for a comprehensive evaluation of occlusal acceptability, it would be necessary to include an assessment of the esthetic aspects of occlusion and the subject's own opinion on his or her dental appearance. The aim of this study was to identify subjectively and objectively meaningful criteria and cutoff values that would allow a classification into esthetically acceptable and unacceptable occlusions.

MATERIALS AND METHODS

The subjects comprised three groups of voluntary participants from a project focusing on the development of clinical criteria for acceptable permanent occlusion.[13,15] Group I consisted of subjects from three secondary schools and one vocational school in central Finland (n = 116) aged between 16 and 25 years. Group II comprised 15- to 18-year-old subjects from the catchment area of one municipal health center in eastern Finland (n = 192), and Group III comprised 16-year-old adolescents from a rural municipality in southwest Finland (n = 126).

A semistructured questionnaire was used to gather data on satisfaction with one's own dental appearance. In the case of dissatisfaction, the respondents were asked to give reasons for their dissatisfaction. Moreover, each respondent was requested to assess his or her own dental appearance on a visual analog type 10-grade scale. The scale was anchored at both ends with a colored photograph (1 = *good, attractive occlusion* and 10 = *definite treatment need*) from the Aesthetic Component (AC) of the Index of Orthodontic Treatment Need (IOTN).[17] The subjects were asked to give their assessment as a whole number. The questionnaire also included questions concerning the respondent's currently perceived orthodontic treatment need and previous orthodontic care.

Two orthodontists participated in the assessments of dental esthetics using the AC of the IOTN.[17] Occlusions were compared with the scale of 10 dental photographs and given the number of the matching photograph as suggested by Richmond et al.[18] The AC scores were further categorized into three categories defining orthodontic treatment need (Table 1).[18] Group I was assessed by one orthodontist, group II by two orthodontists, and group III by one orthodontist. The research protocol was approved by the local authorities, and informed consent was obtained from all the participants.

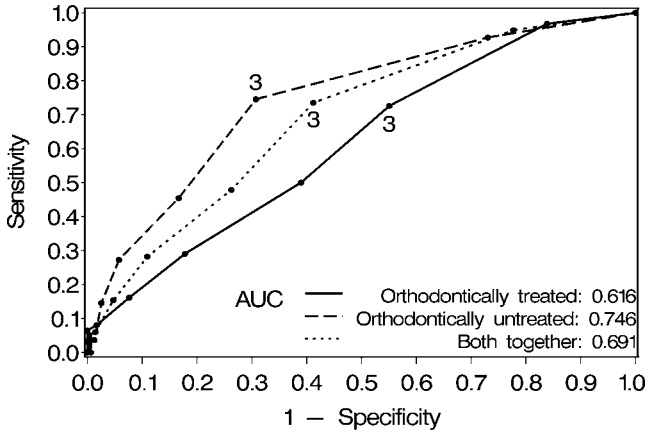

Figure 1. The respondent's dissatisfaction with his or her dental appearance as predicted with the professional assessment using the Aesthetic Component (AC) of the Index of Orthodontic Treatment Need (IOTN) in orthodontically treated (n = 180) and untreated (n = 211) respondents and in both groups together (n = 391). Number 3 in the Figure refers to AC grade 3. The area under the receiver operating characteristic curve (AUC) varies from 61.6% to 74.6%.

Statistical Analyses

Associations between categorical variables were analyzed using a chi-square test or Fisher exact test, when appropriate. The difference between two orthodontists' ratings was tested with the McNemar test. The interexaminer agreement in the assessment of group II was analyzed using the Kappa statistic.[19] The impact of various personal factors (age, gender, previous treatment history, perceived dental status, and self-perceived orthodontic treatment need) on satisfaction with dental appearance was analyzed with logistic regression in univariate and in multivariate modeling. Interpretation was made using odds ratios (OR) with 95% confidence limits (CL). The OR describes how much the odds changed when a continuous predictor changes by one unit. Among categorical predictors, the OR shows how great the odds are in one group compared with another (reference) group.

Associations between the AC grades/self-assessment grades and satisfaction with own dental appearance were analyzed separately and together for groups of orthodontically treated and untreated, as well as for subjects with self-perceived need and no self-perceived need of treatment. Receiver operating characteristic (ROC) curves were applied to determine cutoff values on the AC/self-assessment scale that would allow classification into esthetically acceptable and unacceptable occlusions. In a perfect discrimina-

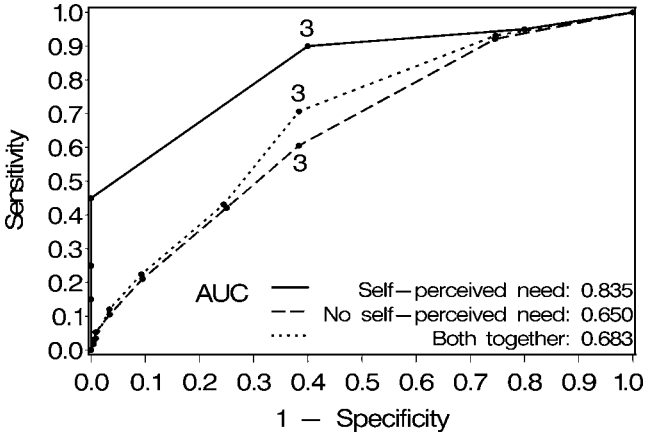

Figure 2. The respondent's dissatisfaction with his or her own dental appearance as predicted with the professional assessment using the Aesthetic Component (AC) of the Index of Orthodontic Treatment Need (IOTN) in respondents with self-perceived treatment need (n = 25), with no self-perceived treatment need (n = 270), and in both groups together (n = 295). Number 3 in the figure refers to AC grade 3. The area under the receiver operating characteristic curve (AUC) varies from 65.0% to 83.5%.

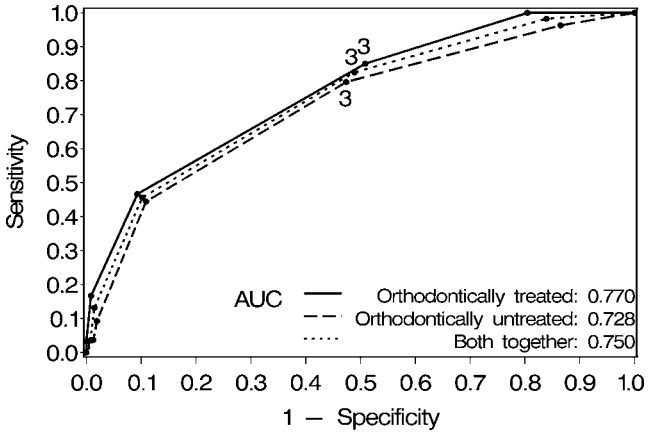

Figure 3. The respondent's dissatisfaction with his or her own dental appearance as predicted with the visual analog type 10-grade scale in orthodontically treated (n = 178) and untreated (n = 210) respondents and in both groups together (n = 388). Number 3 in the figure refers to grade 3. The area under the receiver operating characteristic curve (AUC) varies from 72.8% to 77.0%.

tion into acceptable and unacceptable occlusions, the area under the ROC curve (AUC) would cover 100%; coverage of 50% would mean that the discrimination of the test equals that of flipping a coin. The optimal cutoff value was defined as a point on the curve closest to the top of the left hand corner. The cutoff value illustrates a compromise between high sensitivity (ie, the test's ability to detect the unsatisfied respondents) and high specificity (ie, inclusion of no or only a small number of satisfied respondents).

RESULTS

Of the 434 subjects, 171 were male (39%) and 263 were female (61%). Eight subjects did not answer the question about previous orthodontic treatment; of the remaining 426 subjects, 42% were orthodontically treated, 4% were still wearing appliances, 50% had not had orthodontic treatment, and 3% could not recall their treatment history. There was no statistically significant difference between the proportions of orthodontically treated girls and boys (χ^2 test, $P = .135$). Those with unknown treatment history and those with ongoing treatment were excluded from further analyses.

Table 2. The Subjects' Responses to Satisfaction With Own Dental Appearance and Self-perceived Treatment Need According to the Previous Orthodontic History

	Orthodontically Treated, n (%)	Orthodontically Untreated, n (%)	*P*
Satisfaction with own dental appearance			.067
Satisfied	118 (66)	157 (74)	
Unsatisfied	62 (34)	55 (26)	
Self-perceived treatment need			.119
Yes	15 (12)	12 (7)	
No	109 (88)	163 (93)	

Satisfaction With Own Dental Appearance

Using the dichotomy of satisfied (those replying *very satisfied* or *satisfied*) and dissatisfied respondents (those replying *will do* or *dissatisfied*), 66% of orthodontically treated and 74% of untreated respondents expressed satisfaction with their own dental appearance. Thirty-seven percent of the treated and 27% of the untreated subjects listed one or several disturbing traits in

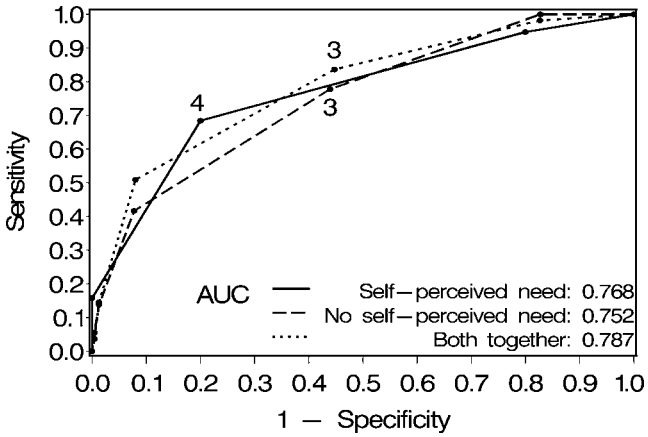

Figure 4. The respondent's dissatisfaction with his or her own dental appearance as predicted with the visual analog type 10-grade scale in respondents with self-perceived treatment need (n = 24), with no self-perceived treatment need (n = 268), and in both groups together (n = 292). Numbers 3 and 4 in the figure refer to grades 3 and 4. The area under the receiver operating characteristic curve (AUC) varies from 75.2% to 78.7.0%.

their occlusion. Of the traits causing dissatisfaction, incisor crowding/rotation was the most common, followed by diastemata. Of the treated subjects who were dissatisfied, 24% expressed dissatisfaction with lower incisors, 24% with upper incisors, and 20% with diastemata. The respective percentages among the untreated subjects were 37%, 19%, and 22%. Girls more often expressed dissatisfaction with their dental appearance than boys did (Fisher exact test, $P = .005$). Significant associations were found first between the orthodontist's rating with the AC scale and the respondent's satisfaction with his or her own dental appearance (χ^2 test $P < .001$) and second between the respondent's rating with the self-assessment scale and satisfaction with his or her own dental appearance (χ^2 test, $P < .001$).

Self-perceived Treatment Need

A self-perceived need of orthodontic treatment was reported by 12% of treated and 7% of untreated respondents, while 88% of the treated and 93% of the untreated reported no treatment need. No statistically significant difference was found in self-perceived treatment need with respect to orthodontic treatment history (Table 2).

Subjects with no self-perceived treatment need were significantly more often satisfied with their own dental appearance than those who had treatment need (OR = 24.5, 95% CL = 8.7–69.3, $P < .0001$). Girls more often expressed dissatisfaction than boys did (OR = 1.9, 95% CL = 1.2–3.1, $P = .006$), and a similar tendency was found when orthodontically treated respondents were compared with respondents without orthodontic treatment history (OR = 1.5, 95% CL = 1.0–2.3, $P = .068$). In multivariate modeling, self-perceived treatment need was the only significant factor explaining dissatisfaction (OR = 23.7, 95% CL = 8.3–67.9, $P < .001$). Interaction between gender and self-perceived treatment need was significant ($P = .034$). Among respondents with self-perceived treatment need, girls were significantly more often dissatisfied than boys were (OR = 13.5, 95% CL = 1.3–136.0, $P = .027$), while among respondents with no self-perceived treatment need, the gender difference was not significant ($P = .996$).

Professional Assessment With the AC

Orthodontists' ratings with the AC showed a statistically significant association with the respondent's gender, with boys more often having a need for orthodontic treatment (Fisher exact test, $P = .030$). The interexaminer agreement in the assessment of group II was moderate (Kappa = .57), with 85% of all grades ending up within the same category. No apparent level difference was found between the orthodontists (McNemar test, $P = .564$). Applying the three different treatment need categories of the AC (Table 1), 84% of the respondents were rated as having no treatment need, 15% had a borderline need, and 2% of occlusions were rated as definitely needing treatment.

Cutoff for Acceptable/Unacceptable Occlusions

The AUC for the AC scale varied from 61.6% to 74.6% (orthodontically treated/untreated and both groups together) and from 65.0% to 83.5% (self-perceived treatment need/no need/both groups together). The graphically determined cutoff value for unacceptability was found to be the AC grade ≥ 3 (Figures 1 and 2). The AUC for the self-assessment scale varied from 72.8% to 77.0% (orthodontically treated/untreated and both groups together) and from 75.2% to 78.7% (self-perceived treatment need/no need/both groups together). On the self-assessment scale, the optimal cutoff value was located on grade ≥ 3 for all groups except for the group of respondents indicating treatment need (Figures 3 and 4). For that group (n = 24), the cutoff value was determined to be grade ≥ 4.

DISCUSSION

In this study, satisfaction with one's own dental appearance was lower among orthodontically treated than untreated respondents. The same level of satisfaction (74%) that was found among the present untreated respondents has also been reported among 15- to 16-year-olds by Pietilä and Pietilä[10] and Sheats et al.[20] In older age groups, satisfaction has been higher, between 89% and 94%.[7,21,22] The low satisfaction among the treated subjects in our study may be related to the fact that the Finnish publicly funded orthodontic care gives priority to functional aspects instead of esthetics.[12]

Compared with the rather low satisfaction level, only a few of the respondents expressed a need for orthodontic treatment. However, more than every fifth respondent could not decide whether treatment was needed. In contrast, one-third of eighth graders were found to consider themselves in need of treatment,[20] while 20% of orthodontically treated and 11% of untreated university applicants indicated a subjective treatment need.[23] Nevertheless, our results corroborate the previous findings suggesting that those who perceive a treatment need are more often dissatisfied with their dental appearance than those who do not.[23,24]

Although the range for acceptable esthetics (ie, AC grades 1 and 2) might be considered narrow, it is in line with other recent findings. Grzywacz[24] suggested that the ''no treatment need'' category of the AC should include only the AC grades 1 and 2 instead of the originally selected grades 1 to 4, while the AC grades 3 and 4 would represent slight treatment need.

On the other hand, the AC grades 1 to 3 have been found to represent customers' current opinion on "no aesthetically based treatment need" among both adolescents and their parents, as well as among university students.[25,26] However, it was somewhat surprising that the small group expressing treatment need tolerated a wider range of acceptability (ie, grades 1–3) than those without treatment need. This might partly be explained by the fact that although crowded or rotated lower incisors weaken dental appearance, they are not especially visible in early adulthood.

In the standardization of subjective assessments, such as that of dental appearance, a simple method is of great value. The AC of the IOTN has proved to be an applicable tool for dental professionals.[27] However, schoolchildren and young adults have been reported to have problems in applying the scale in the evaluation of dental appearance.[9,24,28] To facilitate the rating in this study, a self-assessment scale anchored only at both ends was used. Even then, the distribution of the grades was identical to the results obtained with the original AC among young Finnish adults.[21]

CONCLUSIONS

- On the applied AC and the visual analog type 10-grade scale, grades 1 and 2 fulfilled the criteria for satisfactory dental esthetics.
- The results suggest that the AC grade 3 could serve as a cutoff value between esthetically acceptable and unacceptable occlusions.

ACKNOWLEDGMENTS

The authors wish to thank Ms Hanna Pärssinen and Mr Heikki Hiekkanen for statistical assistance.

REFERENCES

1. Vig KWL, Weyant R, O'Brien K, Bennet E. Developing outcome measures in orthodontics that reflect patient and provider values. *Semin Orthod.* 1999;5:543–553.
2. Gosney MBE. An investigation into some of the factors influencing the desire for orthodontic treatment. *Br J Orthod.* 1986;13:87–94.
3. Brown DF, Spencer AJ, Tolliday PD. Social and psychological factors associated with the adolescents' self-acceptance of occlusal condition. *Community Dent Oral Epidemiol.* 1987;15:70–73.
4. Peck H, Peck S. A concept of facial esthetics. *Angle Orthod.* 1970;40:284–317.
5. Prahl-Andersen B, Boersma H, van der Linden FP, Moore AW. Perceptions of dentofacial morphology by laypersons, general dentists, and orthodontists. *J Am Dent Assoc.* 1979; 98:209–212.
6. Shaw WC. Factors influencing the desire for orthodontic treatment. *Eur J Orthod.* 1981;3:151–162.
7. Espeland LV, Stenvik A. Perception of personal dental appearance in young adults: relationship between occlusion, awareness and satisfaction. *Am J Orthod Dentofacial Orthop.* 1991;100:234–241.
8. Kokich VO, Kiyak HA, Shapiro PA. Comparing the perception of dentists and lay people to altered dental esthetics. *J Esthet Dent.* 1999;11:311–324.
9. Burden DJ, Pine CM. Self-perception of malocclusion among adolescents. *Community Dent Health.* 1995;12:89–92.
10. Pietilä T, Pietilä I. Dental appearance and orthodontic services assessed by 15–16-year-old adolescents in Eastern Finland. *Community Dent Health.* 1996;13:139–144.
11. Svedström-Oristo A-L, Pietilä T, Pietilä I, Alanen P, Varrela J. Outlining the morphological characteristics of acceptable occlusion. *Community Dent Oral Epidemiol.* 2000;28:35–41.
12. Svedström-Oristo A-L, Pietilä T, Pietilä I, Alanen P, Varrela J. Morphological, functional and aesthetic criteria of acceptable mature occlusion. *Eur J Orthod.* 2001;23:373–381.
13. Svedström-Oristo A-L, Pietilä T, Pietilä I, Helenius H, Alanen P, Varrela J. Selection of criteria for assessment of occlusal acceptability. *Acta Odontol Scand.* 2002;60:160–166.
14. Svedström-Oristo A-L, Pietilä T, Pietilä I, Helenius H, Alanen P, Varrela J. Reproducibility of characteristics assessing the occlusion in young adults. *Angle Orthod.* 2002;72:310–315.
15. Svedström-Oristo A-L, Pietilä T, Pietilä I, Alanen P, Varrela J. Occlusal status in orthodontically treated and untreated adolescents. *Acta Odontol Scand.* 2003;61:123–128.
16. Svedström-Oristo A-L. Morphological and functional analysis of occlusion in permanent dentition [thesis]. Annales Universitatis Turkuensis: Sarja - Ser. D, Osa - Tom. 594, Medica-Odontologica. Turku, 2004.
17. Brook PH, Shaw WC. The development of an index of orthodontic treatment priority. *Eur J Orthod.* 1989;11:309–320.
18. Richmond S, O'Brien K, Buchanan I, Burden D. *An Introduction to Occlusal Indices.* Manchester, UK: Mandent Press; 1992:4–13.
19. Fleiss JL. *The Design and Analysis of Clinical Experiments.* New York: John Wiley and Sons; 1986:1–32.
20. Sheats RD, McGorray SP, Keeling SD, Wheeler TT, King GJ. Occlusal traits and perception of orthodontic need in eighth grade students. *Angle Orthod.* 1998;68:107–114.
21. Kerosuo H, Kerosuo E, Niemi M, Simola H. The need for treatment and satisfaction with dental appearance among young Finnish adults with and without a history of orthodontic treatment. *J Orofac Orthop.* 2000;61:330–340.
22. Lilja-Karlander E, Kurol J, Josefsson E. Attitudes and satisfaction with dental appearance in young adults with and without malocclusion. *Swed Dent J.* 2003;27:143–150.
23. Tuominen ML, Tuominen R. Factors associated with subjective need for orthodontic treatment among Finnish university applicants. *Acta Odontol Scand.* 1994;52:106–110.
24. Grzywacz I. The value of the aesthetic component of the Index of Orthodontic Treatment Need in the assessment of subjective orthodontic treatment need. *Eur J Orthod.* 2003;25:57–63.
25. Hamdan AM, Al-Omari IK, Al-Bitar ZB. Ranking dental aesthetics and thresholds of treatment need: a comparison between patients, parents and dentists. *Eur J Orthod.* 2007; 29:366–371.
26. Hunt O, Hepper P, Johnston C, Stevenson M, Burden D. The aesthetic component of the Index of Orthodontic Treatment Need validated against lay opinion. *Eur J Orthod.* 2002;24:53–59.
27. Burden DJ. The ranking of dental aesthetics. *Br J Orthod.* 1995;22:259–261.
28. Flores-Mir C, Major BW, Salazar FR. Self-perceived orthodontic treatment need evaluated through 3 scales in a university population. *J Orthod.* 2004;31:329–334.