

Occlusal traits and orthodontic treatment need in 17–21-year-olds in Estonia

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Abstract

Background: The purpose of this study was to analyse data on occlusal traits and orthodontic treatment need and complexity in 17–21-year-old Estonians, in order to provide solid information about this age groups` occlusal health and expectations.

Methods: Clinical records and plaster casts of 390 young adults (219 female and 171 male, mean age 18.5 years, range 17–21 years) were analysed. Assessed traits included first molar and canine sagittal relationship, overjet, overbite, crowding, midline diastema, crossbite and scissor bite. The Index of Complexity, Outcome and Need (ICON) was used to assess orthodontic treatment need and complexity. Participants` opinions regarding their teeth was determined with a questionnaire.

Results: The most prevalent occlusal traits were Class I sagittal relationship in canines (76%) and molars (70%), crowding (51%), overbite ≥ 3.5 mm (48%), end-to-end sagittal relationship in canines (48%) and overjet ≥ 3.5 mm (47%). According to ICON, 36% of Estonian adolescents needed orthodontic treatment. Treatment complexity was easy in 45%, mild in 30%, moderate in 16%, difficult in 7% and very difficult in 2% of this age group. A total of 44% of the participants wanted orthodontic treatment.

Conclusions: In more than half of participants had crowding, increased overjet and overbite and asymmetric sagittal relationship. The treatment motivation was associated with crowding and increased overjet, and the adolescents` main expectation from orthodontic treatment was improvement in dentofacial aesthetics. Treatment need estimated with ICON was moderate and in line with participants` desire for orthodontic treatment.

Keywords: occlusal traits, dental features, ICON, treatment need

Introduction

In the past, healthy and attractive teeth have not been a spontaneous and inseparable part of social communication among Estonians. Over the last years, interest in dental aesthetics has grown, and consequently, the demand for orthodontic treatment has increased among the population.

Studies on the prevalence of occlusal traits and professionally assessed orthodontic treatment need support the planning and provision of public orthodontic services for those most in need. In addition, epidemiologic studies on the prevalence of occlusal traits in different developmental stages in various population groups provide data on developmental trends and etiology of malocclusions (1,2,3,4,5,6).

This study is the second in a series of investigations analysing the prevalence of occlusal traits in Estonians between the ages of 3 and 21 years.

The aims of this study were

- to evaluate the distribution of occlusal traits in Estonian 17–21-year-olds who have not had orthodontic treatment.
- to evaluate objective and subjective need for orthodontic treatment in this age group.

Subjects and methods

Recruitment of 17–21-year-old young adults was started in November 2009 and completed in January 2011. In the sampling, a multistage stratified cluster design was implemented. All the twelfth grade students from four randomly selected high schools, one in Tallinn (in northern Estonia), two in Tartu (in central Estonia) and one in Pärnu (in southwestern Estonia), were invited to participate in the study. The sample size was determined with the aid of a statistical power calculation. In advance, a 95% confidence interval around an estimate ($\pm 2.5\%$ of the estimate) was specified and the sample size was calculated. The sampling procedure and exclusion of participants are illustrated in Figure 1.

Five occlusal traits were registered clinically by Examiner 1 in centric occlusion, on the left and right sides separately: 1) sagittal relationships in canines and first molars 2) overjet, 3) overbite, 4) crossbite and 5) scissor bite. The examination was carried out in the school's dental office using a dental mirror, probe, pencil (0.3 mm) and millimetre ruler (Dentaurum 042-751 Münchenner Modell). The clinical study was complemented with alginate impressions for plaster casts.

Three more features were verified from the plaster casts by Examiner 1 and Examiner 2 together: 1) end-to-end relationship in canines and first molars, on the left and right sides, 2) crowding and 3) diastemas between central incisors. Registration of the occlusal traits was based on international standards (7,8,9). A detailed description of the criteria has been presented previously (10). Furthermore, orthodontic treatment need and complexity were assessed from the plaster casts using Index of Complexity, Outcome and Need (ICON) (11). A threshold score of more than 43 indicates treatment need. Scores < 29 indicate easy, 29–50 mild, 51–63 moderate, 64–77 difficult and > 77 very difficult treatment complexity.

Participants' opinions regarding their dental health, alignment of teeth, dental appearance and orthodontic treatment need were gathered with a questionnaire (12).

Prior to the study, a written description of the study protocol was given to all participants. All participants signed an informed consent form indicating that their participation was voluntary. The study protocol was approved by the Ethics Review Committee on Human Research of the University of Tartu (Protocol No. 186T-24).

Reliability and statistical analyses

Twenty-two students were re-examined clinically by Examiner 1 after a one-week interval before the study. The 92 plaster casts were re-examined after a one-month interval by Examiner 1 and 2 in consensus. The intra-examiner reliability was good ($r > 0.98$ and $r > 0.97$, respectively). To evaluate the ICON assessments, 39 (10%) randomly selected plaster casts were analysed twice by Examiner 1 and by an ICON-calibrated Examiner 3. The inter-examiner reliability was good ($r > 0.72$).

Chi-square test was used to compare the frequencies of specific traits. Exploring gender differences, logistic regression was used (IBM SPSS v.20 software for Windows). P-values of less than 0.05 were considered statistically significant. The test-retest was calculated using Pearson's correlations ($r = 0.72$, $P < 0.001$).

Results

The most prevalent occlusal traits were Class I sagittal relationship in canines (76%) and molars (70%), crowding (52%), overbite ≥ 3.5 mm (48%), end-to-end sagittal relationship in canines (48%) and overjet ≥ 3.5 mm (47%). The detailed distribution of occlusal traits in 17–21-year-olds is presented in Table 1. Compared to males, females had 1.7 times greater odds of having canine end-to-end relationship ($P = 0.01$).

The overjet ranged from -5.5 mm to 10 mm (mean 3.2 mm, SD 1.6). The overbite ranged from -3 mm to 8 mm (mean 3.1 mm, SD 1.6). Posterior crossbite was observed in 17% on the right side, in 19% on the left side and in 8% on both sides. Scissor bite was observed in 10 adolescents on the right side, in 30 adolescents on the left side and in 1 adolescent on both sides. No gender difference was detected ($P > 0.05$). The midline diastema ranged from 0.5 mm to 2 mm. Crowding ranged from 1 mm to 9 mm in the maxillary and from 1 mm to 8 mm in the mandibular arch. The most frequent was 1 mm of crowding in the mandibular (23%) and 1 mm of crowding in the maxillary (20%) arch.

More than half of examinees had an asymmetrical canine and molar sagittal relationship. An asymmetrical Class II in molars was associated with crowding [$\chi^2 = 4.27$ df = 1, $P = 0.041$] and with scissor bite [$\chi^2 = 21.87$ df = 1, $P = 0.000$]. Satisfied participants had less crowding in the lower arch compared to those who were dissatisfied [0.72 vs 1.1, $t(366) = -2.57$, $P = 0.011$], and the value of crowding in the upper arch was substantially less than among dissatisfied participants [0.32 vs 0.73, $t(366) = -2.87$, $P = 0.005$]. Dissatisfied students had more overjet than satisfied ones [$T(366) = -4.46$, $P < 0.001$]. An overjet of 4.0 mm was the threshold for significantly increased dissatisfaction.

According to ICON, 36% of Estonian 17–21-year-olds needed orthodontic treatment. The scores ranged from 7 to 87 (median 31). There was no gender difference in treatment need as assessed with ICON [$\chi^2 = 0.96$, df = 1, $P = 0.333$]. Distribution of treatment complexity is presented in Table 2. A statistically significant association was found between participants' desire to get their teeth straightened and orthodontic treatment need assessed by ICON [$\chi^2(3) = 19.33$, $P = 0.000$].

Opinions regarding orthodontic treatment need did not differ between genders [$\chi^2(3) = 3.76$, $P = 0.288$]. The reasons for wanting orthodontic treatment included the desire to improve dental appearance (37%), reduce the amount of caries (9%), improve function (5%) and ease of teeth cleaning (3%).

Discussion

There were only 10 adolescents (3%, 6 females and 4 males) with symmetrical first molar Class I, canine Class I, overjet 1–3 mm and overbite 1–3 mm, who had no crowding, scissor bite, crossbite or negative overbite. Of these, nine were satisfied with their teeth (one didn't answer this question), and three wanted orthodontic treatment.

The number of young adults in the present study ($n = 390$) represents 1% of Estonians in the age cohort of 17–21-year-olds. The included subjects had not had orthodontic treatment in

earlier years, because 27% of the invited adolescents were excluded due to some orthodontic treatment before permanent dentition. In addition, subject with Grouzon syndrome was excluded. Hence, the occlusal traits and orthodontic treatment need presented in this study are more likely to underestimate than overestimate the deviations in these age groups. All invited young adults participated in the questionnaire study, and all except eight participated in the clinical study. Based on this, it seems unlikely that socioeconomic status and/or parents' health behavior influenced participation.

An asymmetrical canine and molar sagittal relationship were found in more than half of 17–21-year-old Estonian young adults. The prevalence of crowding was ten per cent lower than in neighboring Finland (13). It may indicate Estonians' early extractions due to caries and crowding. Estonian young adults had a higher frequency of molar Class III relationships than Finnish students (13) and were more likely to have crossbite (27%) and scissor bite (11%) than Finnish adolescents of 47 years earlier (8% and 2%, respectively) (13).

Similarly to Danes (14), satisfied Estonian adolescents had less crowding and overjet than dissatisfied ones. And similarly to Norwegian 18-year-olds (15) Estonian young adults were aware of anterior traits.

Estonian students were more critical towards overjet as compared to international treatment need indices applying a threshold value of more than 6 mm (16). Unlike the opinion of Finnish orthodontists, who accepted an overjet of 0–5 mm (17), the threshold of dissatisfaction among Estonian young adults was 4 mm overjet.

A higher percentage (36%) of 17–21-year-old Estonians were in need of orthodontic treatment compared to 15–16-year-olds in Finland (20%) (12). Half of young adults answered that they did not need orthodontic treatment, but many (28%) indicated several reasons for why they would nevertheless like to have orthodontic treatment. The process of participating in the survey may have made them aware of the possibility of doing something. In line with other studies the most prevalent reason for orthodontic treatment was enhancement of appearance (12,18). The distribution of answers regarding dental appearance, ease of cleaning and lower risk of caries were in line with those of Finnish 15–16-year-olds; however, improvement of jaw function was not highlighted among Estonians. There was no gender difference in Estonia like reported in Finland (12).

In the future, it would be interesting to study how much parents' socioeconomic status and health behavior influence 17–21-year-olds' oral health behaviors and demand for orthodontic treatment.

Conclusions

The present results indicate that

- The most prevalent occlusal traits were Class I sagittal relationship in canines and molars, crowding, end-to-end sagittal relationship in canines and increased overbite and overjet.
- More than half of 17–21-year-old Estonians had an asymmetrical canine and molar sagittal relationship.
- According to ICON, 36% of Estonian 17–21-year-olds needed orthodontic treatment.
- The participants' main expectation from orthodontic treatment was improvement in dentofacial aesthetics.
- Participants' opinions did not differ according to gender.
- A statistically significant association was found between participants' desire to get their teeth straightened and the treatment need assessed using ICON.

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Tables and Figures

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Table 3. Adolescents' satisfaction with their dental health, the alignment of their teeth, and their opinion regarding treatment need as compared to an assessment using ICON (17–21-year-old Estonian adolescents; n=390)

Figure 1. Selection of the final study sample

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Table 1. Prevalence of occlusal traits in 17–21-year-old Estonian adolescents (N = 390)

	Occlusal trait	Prevalence (%)
Canine relationship	Class I	75.6
	Class II	6.7
	End-to-end	47.7
	Class III	3.3
	Symmetric	61.8
	Asymmetric	38.2
Molar relationship	Class I	69.7
	Class II	21.3
	End-to-end	29.2
	Class III	12.6
	Symmetric	62.8
	Asymmetric	37.2
Horizontal relationship	Overjet ≥ 3.5 mm	46.9
	Negative overjet	0.5
Vertical relationship	Overbite ≥ 3.5 mm	48.2
Transversal relationship	Posterior crossbite	27.4
	Scissor bite	10.5
Spacing	Midline diastema	7.2
	maxillary	4.9
	mandibular	1.3
Crowding	Upper and lower arch	51.3
	maxillary	29.2
	mandibular	22.1

Table 2. Distribution of orthodontic treatment complexity in 17–21-year-old Estonian adolescents determined with ICON

ICON		Girls		Boys		Total	
Complexity grade	Score range	N	%	N	%	N	%
Easy or Mild	< 50	168	76.7	122	71.4	290	74.4
Moderate	51–63	36	16.4	27	15.8	63	16.1
Difficult	64–77	12	5.5	17	9.9	29	7.4
Very difficult	> 77	3	1.4	5	2.9	8	2.1
Total		219	100.0	171	100.0	390	100.0

Table 3. Adolescents' satisfaction with their dental health, the alignment of their teeth, and their opinion regarding treatment need as compared to an assessment using ICON (17–21-year-old Estonian adolescents; n=390)

	Treatment need		Total	
	ICON \leq 43 (N)	ICON $>$ 43 (N)	N	%
Satisfaction with dental health				
Very satisfied	32	7	39	10.0
Satisfied	156	81	237	60.8
I do not care	14	9	23	5.9
Dissatisfied	42	38	80	20.5
Not satisfied at all	2	1	3	0.8
I don't know	4	3	7	1.8
No answer	0	1	1	0.2
Total	250	140	390	100.0
Satisfaction with the alignment and appearance of teeth				
Very satisfied	44	10	54	13.8
Satisfied	151	74	225	57.7
Dissatisfied	40	45	85	21.8
Unhappy	2	2	4	1.0
I don't know	12	9	21	5.4
No answer	1	0	1	0.3
Total	250	140	390	100.0
Desire for orthodontic treatment				
Definitely not	20	5	25	6.4
No, I don't think so	138	52	190	48.7
Yes, I think so	75	71	146	37.5
Yes, definitely	16	11	27	6.9
No answer	1	1	2	0.5
Total	250	140	390	100.0

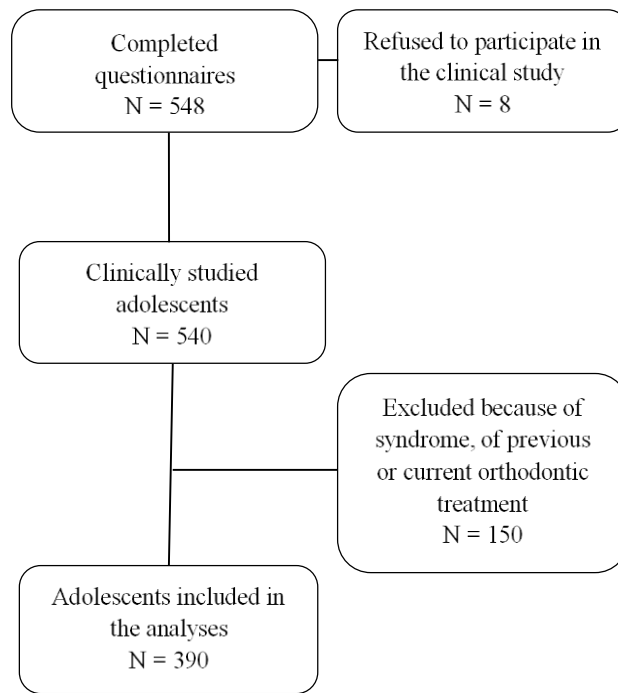


Figure 1. Selection of the final study sample