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ORIGINAL ARTICLE

Occlusal traits, orthodontic treatment need and treatment complexity among untreated 17–21-year-olds in Estonia

Hettel Sepp[a], Mare Saag[a], Timo Peltomäki[b,c,d], Heli Vinkka-Puhakka[e] and Anna-Liisa Svedström-Oristo[e]

[a]Department of Stomatology, University of Tartu, Tartu, Estonia; [b]Oral and Maxillofacial Unit, Tampere University Hospital, Tampere, Finland; [c]Faculty of Medicine and Life Sciences, University of Tampere, Tampere, Finland; [d]Faculty of Health Sciences, Institute of Dentistry, University of Eastern Finland, Kuopio, Finland; [e]Department of Oral Development and Orthodontics, Institute of Dentistry, University of Turku, Turku, Finland

ABSTRACT

Objective: To analyze data on occlusal traits, orthodontic treatment need and treatment complexity in orthodontically untreated 17–21-year-old Estonians.

Materials and methods: Clinical records and plaster casts of 390 untreated young adults (219 females and 171 males, mean age 18.5 years, range 17–21 years) were analyzed. Assessed occlusal 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 were determined with a questionnaire.

Results: The most prevalent occlusal traits were Class I sagittal relationship in canines (76%) and molars (70%), crowding (51%), overbite $\geq$3.5 mm (48%), the end-to-end sagittal relationship in canines (48%) and overjet $\geq$3.5 mm (47%). Antero-posterior asymmetry was common both in canines (39%) and molars (37%). According to ICON, 36% of participants had orthodontic treatment need.

Conclusions: Desire for orthodontic treatment was associated with crowding and increased overjet, and with no gender difference, participants' main expectation of treatment was an improvement in dentofacial aesthetics. Treatment needs determined with ICON was moderate and in line with the participants' desire for orthodontic treatment.

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ICON; occlusal features; questionnaire; self-perception

Introduction

In the past, healthy and attractive teeth were not considered an obvious or inseparable aspect 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. An assessment of self-perceived treatment need has also become an important part of the screening process, and clinicians' sensitivity towards patient expectations influence the mutual interaction [1–3].

Studies on the prevalence of occlusal traits, and professionally assessed and self-perceived 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 at different developmental stages and within various population groups provide data on developmental trends and aetiology of malocclusions [4–9]. This study is the second in a series of investigations analyzing 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 17–21-year-olds with no history of orthodontic treatment
- to evaluate objective and subjective treatment need and complexity of orthodontic treatment in this age group.

Subjects and methods

Recruitment of 17–21-year-old young adults was begun in November 2009 and completed in January 2011. In the sampling, a multistage stratified cluster design was implemented. All twelfth-grade students from four randomly selected high schools – one in northern Estonia, two in central Estonia and one in Southwestern Estonia – were invited to participate in the study. The initial number of young adults invited to take part was 548. Young adults who were not in school on the examination day were offered a second-time point for examination. The sampling procedure and exclusion of participants are illustrated in Figure 1. Among the excluded young adults, 150 (27%) had previous or currently ongoing orthodontic treatment.

Six occlusal traits were registered clinically by Examiner 1 in centric occlusion, on the left and right sides separately: 1) sagittal relationships in canines and 2) first molars 3) overjet, 4) overbite, 5) crossbite and 6) scissor bite. The examination was carried out in the school's dental office using a dental

CONTACT Hettel Sepp hettelsepp@gmail.com Department of Stomatology, University of Tartu, Raekoja pl. 6, EE51003 Tartu, Estonia

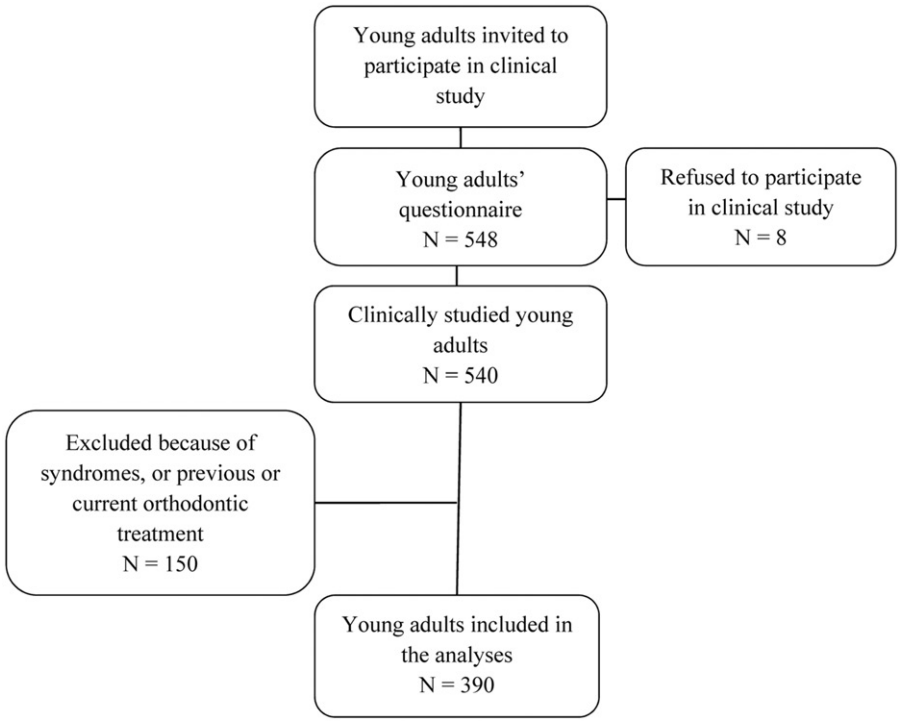

Figure 1. Selection of the final study sample.

mirror, probe, pencil (0.3 mm) and millimetre ruler (Dentaurum 042-751 Münchner Modell). The clinical study was complemented with alginate impressions for plaster casts.

Four more features were verified from the plaster casts jointly by Examiner 1 and Examiner 2: 1) an end-to-end relationship in canines and 2) first molars, on the left and right sides, 3) crowding and 4) diastemas between central incisors. Registration of the occlusal traits was based on international standards [10–12]. A detailed description of the criteria has been presented previously [13]. Orthodontic treatment need and complexity were assessed from the plaster casts using the Index of Complexity, Outcome and Need [14]. 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 collected with a questionnaire [15].

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 in this study 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

A 95% confidence interval around an estimate (±2.5% of the estimate) was specified for sample size calculation. Before the study, 22 volunteer students were examined clinically and re-examined after a one-week interval by Examiner 1. Furthermore, the four features verified from the 22 plaster casts were re-assessed after a one-month interval by Examiners 1 and 2 for 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 analyzed twice by Examiner 1 and by an ICON-calibrated Examiner 3. The inter-examiner reliability was good ($r > 0.72$).

The Chi-square test was used to compare the frequencies of occlusal traits. Exploring gender differences, logistic regression was used (IBM SPSS v.20 for Windows (IBM Corp, Armonk, NY, USA)). p Values of less than .05 were considered statistically significant. The test–retest was calculated using Pearson's correlations ($r = 0.72$, $p < .001$).

Results

The most prevalent occlusal traits were Class I sagittal relationship in canines (76%) and molars (70%), crowding (52%), overbite $\geq$3.5 mm (48%), an end-to-end sagittal relationship in canines (48%) and overjet $\geq$3.5 mm (47%). Compared with males, females had 1.7 times greater odds of having an end-to-end relationship in canines ($p = .011$). The detailed distribution of occlusal traits is presented in Table 1.

Antero-posteriorly asymmetrical canine and molar sagittal relationship was found in 39% and 37% of participants, respectively. An asymmetrical Class II in molars was associated with crowding [$\chi^2 = 4.27$, df $=1$, $p = .041$] and with scissor bite [$\chi^2 = 21.87$, df $=1$, $p = .000$]. Satisfied participants had less crowding in the lower arch compared with those who were dissatisfied [0.72 vs 1.1, $t(366) = -2.57$, $p = .011$]; also crowding in the upper arch was substantially less than among dissatisfied participants [0.32 vs 0.73, $t(366) = -2{,}87$, $p = .005$]. Dissatisfied participants had larger overjet than

Table 1. Prevalence of occlusal traits in Estonian 17–21-year-olds ($n = 390$).

	Occlusal trait	Prevalence ($N = 390$) %
Canine relationship	Class I	76
	Class II	7
	End-to-end	48
	Class III	3
	Symmetric	62
	Asymmetric	38
Molar relationship	Class I	70
	Class II	21
	End-to-end	29
	Class III	13
	Symmetric	63
	Asymmetric	37
Horizontal relationship	Overjet ≥3.5 mm	47
	Negative overjet	1
Vertical relationship	Overbite ≥3.5 mm	48
Transversal relationship	Posterior crossbite	27
	Scissor bite	11
Spacing	Midline diastema	7
	• maxillary	5
	• mandibular	1
Crowding	Upper and lower arch	51
	• maxillary	30
	• mandibular	22

Table 2. Distribution of orthodontic treatment complexity in Estonian 17–21-year-olds ($n = 390$) determined with ICON.

ICON		Girls		Boys		Total	
Complexity grade	Score range	N	%	N	%	N	%
Easy/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

satisfied ones [T (366) = –4.46, $p < .001$]. For overjet, 4.0 mm was the threshold for significantly increased dissatisfaction.

The ICON scores ranged from 7 to 87 (median 31). According to ICON, 36% of 17–21-year-olds were in need of orthodontic treatment; no gender difference was found [$\chi^2 = 0.96$, df =1, $p = .333$]. Distribution of treatment complexity is presented in Table 2. In this age group, treatment complexity was easy in 45%, mild in 30%, moderate in 16%, difficult in 7% and very difficult in 2%. A total of 44% of the participants wanted orthodontic treatment. A statistically significant positive association was found between participants' desire to get their teeth straightened and orthodontic treatment needs determined with ICON [χ^2 (3) = 19.33, $p = .000$]. Self-perceived orthodontic treatment need did not differ between genders [χ^2 (3) = 3.76, $p = .288$] (Table 3). Participants wanted orthodontic treatment to improve their dental appearance (37%), diminish their risk for caries (9%), improve function (5%) and facilitate teeth cleaning (3%).

Discussion

The aim of this study was to analyze the distribution of occlusal traits and to evaluate objective and subjective orthodontic treatment need among untreated 17–21-year-olds. As expected, the most frequent occlusal traits were Class I in canines and molars. Interestingly, asymmetrical sagittal canine and the molar relationship was found in more than one in three participants. This finding is in line with those of other recent studies focusing on antero-posterior asymmetries at various stages of dental development [16–18].

The prevalence of crowding was 10% lower than in neighbouring Finland [19]. This, and the higher frequency of molar rather than canine Class III relationships may indicate higher rates of early extractions of deciduous molars, presumably due to caries or crowding. The prevalence of crossbite and scissor bite was also higher than expected.

The final sample represents 71% of the originally invited 17–21-year-olds who had not had availability of orthodontic services or the possibility of treatment. It is also plausible that some of them were not interested in treatment, or their malocclusion had not been severe enough to fulfil the selection criteria. The sample covers 1% of the target cohorts in Estonia. Thus, the results give an estimate of the allocation of orthodontic care; this estimate is more likely to underestimate rather than overestimate occlusal deviations and treatment need.

All participants filled in the questionnaire and all except eight participated in the clinical study. Hence, unlike those seeking orthodontic treatment in North America [1], the socioeconomic status and/or parents' health behaviour did not seem to influence participation.

Similarly to Norwegians [20], young Estonian adults paid attention to anterior occlusal traits. In line with Danes [21], those who were satisfied with their teeth had less crowding and overjet than those who were dissatisfied.

With regard to overjet, Estonian young adults' threshold for dissatisfaction was in line with that of Finnish orthodontists, who regard an overjet of up to 5 mm as acceptable [22]. However, the threshold value is less than the generally applied threshold in selection for orthodontic treatment [23,24].

Although one in four of the participating young adults had had or was currently undergoing orthodontic treatment, one in three of the untreated participants had a need for treatment as per ICON. This share is higher than that of untreated 15–16-year-olds in Finland (18%) [15]. Exclusion of those with previous or current orthodontic treatment, and possible tooth extractions may have reduced the treatment complexity because fewer than 10% of the cases were categorized as difficult or very difficult. The corresponding percentages among 7–10-year-old Estonian children were 26 and 51, respectively [13]. Orthodontic or other dental treatment during the development of occlusion seems to have resulted in a reduction of deviated occlusal traits. This residual treatment need may also be a consequence of lack of patient compliance, or lack of available treatment options or manpower. Moreover, a borderline treatment need might also have been rather difficult to diagnose [25].

More than two in three young adults were satisfied or very satisfied with their dental health and the arrangement of their teeth. Although half of the participants responded that they did not need orthodontic treatment, one in three indicated several reasons for why they would desire it.

Table 3. Satisfaction with dental health, alignment of own teeth and self-perceived orthodontic treatment need compared with an ICON assessment of Estonian 17–21-year-olds ($n = 390$).

	Treatment need		Total	
	ICON ≤43 (*N*)	ICON >43 (*N*)	*N*	%
Satisfaction with dental health				
Very satisfied	32	7	39	10
Satisfied	156	81	237	61
I do not care	14	9	23	6
Dissatisfied	42	38	80	21
Not satisfied at all	2	1	3	0
I don't know	4	3	7	2
No answer	0	1	1	0
Total	250	140	390	100.0
	Treatment need		Total	
	ICON ≤43 (*N*)	ICON >43 (*N*)	*N*	%
Satisfaction with alignment and appearance of teeth				
Very satisfied	44	10	54	14
Satisfied	151	74	225	58
Dissatisfied	40	45	85	22
Unhappy	2	2	4	1
I don't know	12	9	21	5
No answer	1	0	1	0
Total	250	140	390	100.0
	Treatment need		Total	
	ICON ≤43 (*N*)	ICON >43 (*N*)	*N*	%
Desire for orthodontic treatment				
Definitely not	20	5	25	6
No, I don't think so	138	52	190	49
Yes, I think so	75	71	146	38
Yes, definitely	16	11	27	7
No answer	1	1	2	0
Total	250	140	390	100.0

In line with other studies [15,26], the most frequent reason for orthodontic treatment was an improvement in dental appearance. The distribution of answers regarding dental appearance, ease of cleaning and lower risk for caries were in line with the responses of Finnish 15–16-year-olds; however, improvement of jaw function was not highlighted among Estonians. Further, in contrast to the Finnish results [15], there was no gender difference in Estonia.

Future studies should focus on several aspects raised in this study. The share of orthodontically treated young adults seemed to be in line with international levels, but more research is needed to evaluate the allocation of orthodontic care with consideration for various occlusal deviations. Furthermore, although objective and subjective perceptions of orthodontic treatment need were rather consistent, there were inconsistencies with regard to desire for treatment.

Conclusions

The present results indicate that

- The most prevalent occlusal traits were Class I sagittal relationship in canines and molars, crowding, the end-to-end sagittal relationship in canines, and increased overbite and overjet. More than one in three had an antero-posteriorly asymmetrical canine and molar sagittal relationship.
- According to ICON, one in three untreated Estonian 17–21-year-olds had orthodontic treatment need. In most cases, the treatment complexity was moderate or mild.
- A statistically significant positive association was found between participants' desire to get their teeth straightened and orthodontic treatment need to be assessed using ICON. Both female and male participants' main expectation was an improvement in dental appearance.

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Disclosure statement

No potential conflict of interest was reported by the authors.

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