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Orthodontic treatment need in Latvia

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SUMMARY Measuring the prevalence of malocclusion and treatment need in a population is useful for the planning of orthodontic services. In addition, knowledge concerning the attitudes of patients to malocclusion is becoming increasingly important in orthodontics. Without a satisfactory estimate of the need and demand for treatment it is difficult to develop and organize a meaningful service. The aims of this investigation were to estimate the need for orthodontic treatment in 12–13-year-old school children in urban and rural schools in Latvia. Five hundred and four school children aged 12–13 years were examined using the Index of Complexity, Outcome and Need (ICON). The children were invited to complete a questionnaire about treatment need and their appearance. The survey was carried out in four urban and five rural school settings.

There were no statistically significant differences in treatment need between rural and urban settings or between boys and girls. However, there was a difference in ICON scores between Riga and Daugavpils, with a greater need for treatment in Daugavpils. Individual responses to questionnaires illustrated a correlation between individuals who expressed dissatisfaction with the arrangement of their teeth and treatment need according to the ICON score.

The overall prevalence of individuals needing orthodontic treatment in Latvia was 35.3 per cent, but this figure masked considerable variation between schools. For example, a greater need was found in Daugavpils than in Riga. This difference is not fully explained but could be due to genetics, the individuals in Daugavpils being mainly of Russian origin. The individuals' perception of the arrangement of teeth and the need for treatment correlated significantly with the ICON score.

Introduction

Measuring and recording the prevalence of malocclusion and treatment need in a population is useful for the planning of orthodontic services. In addition, knowledge about the attitude of patients to malocclusion is becoming increasingly important in orthodontics. Without a satisfactory estimate of the need and demand for treatment it is difficult to develop and organize a meaningful orthodontic service.

Occlusal indices (Index of Orthodontic Treatment Need, IOTN; Peer Assessment Rating, PAR; Norwegian Orthodontic Treatment Index, NOTI) have been used successfully in many countries around the world and have provided useful information on treatment need and provision of orthodontic services (Espeland *et al*., 1992; Richmond, 1993; Richmond and Andrews, 1993; Birkeland *et al*., 1996).

Orthodontic treatment is often carried out to improve the patient's dental appearance, hence the individual's attitude to their own malocclusion is an important factor in determining treatment need (Shaw *et al*., 1991). The main factors influencing the decision for treatment are aesthetic improvement and psychological aspects, although the patient's perception of malocclusion is often not in agreement with objective measurements. Orthodontists tend to recommend 10–12 per cent more treatment than lay persons (Vally, 1997). Malocclusion is a continuum ranging from an ideal occlusion to considerable deviation from normal. Assessing cut-off points for those needing and not needing treatment is problematic. Factors such as the severity of malocclusion, the appliance type to be employed, the skill of the operator, and the patient's co-operation have to be taken into account. The level of need varies widely and depends on the criteria employed: age, gender, type of population studied, and the cut-off levels for severity of malocclusion. Orthodontic treatment need estimates range from 27.5 to 76.7 per cent, although the demand for treatment is reported to be much lower, ranging from 2 to 47 per cent (Richmond, 2000). Nevertheless, occlusal indices have enabled quantification of need. They are not always comparable (Banack *et al*., 1972; Albino *et al*., 1978; Järvinen and Väätäjä, 1987). Very few occlusal indices have been developed for international use. The Index of Complexity, Outcome and Need (ICON) has been developed (Daniels and Richmond, 2000) based on the average opinion of 97 practising specialist orthodontists from nine countries (Richmond and Daniels, 1998a,b). It is a single assessment method to quantify orthodontic treatment complexity, outcome and need. The ICON consists of five components: the Aesthetic Component (AC), upper

and lower crowding/spacing assessment, presence of a crossbite, degree of incisor open bite/overbite, and fit of the teeth in the buccal segment in terms of the anterior-posterior relationship. Each component can be measured on study casts as well as on patients. The practical application of the index is simple and takes approximately one minute for each case.

The aim of this investigation was to estimate the need for orthodontic treatment in 12–13-year-old school children in urban and rural schools in Latvia.

Subjects and methods

Five hundred and five school children aged 12–13 years were examined using the ICON index (Appendix 1). The children were also invited to complete a questionnaire about treatment need and their appearance (Appendix 2). The survey was carried out in four urban schools (Riga ×2, Daugavpils, Ventspils) and five rural schools (Saldus, Madona, Limbaži, Jelgava, Valmiera) according to the World Health Organisation ICS II criteria (World Health Organisation, 1993).

One orthodontist (AL) screened all the children using the ICON in a dental setting in the schools. The need for orthodontic treatment was defined as having an ICON score of 44 and greater.

Statistical analyses

The proportions of children in different schools needing treatment, as defined by having an ICON score of at least 44, were compared using a Chi-square test. ICON scores between the schools and settings were compared using one-way analysis of variance, having tested the scores for normality. Tukey's multiple comparison method was used to make pairwise comparisons.

The differences in the responses to the questionnaires in the schools and settings were tested using Levene's test for equality of variances, *t*-test for equality of means, and Mann–Whitney tests. Correlations were also undertaken and a forward variable logistic regression analysis was employed to explore questions in relation to those individuals needing and not needing treatment.

Results

The examiner was calibrated in the use of the ICON using 30 dental casts. The mean difference from the gold standard was less than 5 ICON points and the root mean square less than 9 ICON points. There was a 100 per cent response rate for the study. The prevalence of malocclusion for the eight schools is shown in Figure 1. The need for treatment, according to an ICON score of at least 44, ranged from 27.5 to 58.3 per cent. The differences between these percentages were statistically significant ($P < 0.01$). There were no significant differences between urban and rural areas, with 34 per cent of subjects in rural areas and 37 per cent in cities needing treatment. Thirty-two per cent of boys needed treatment, compared with 37 per cent of girls, but this difference was not significant.

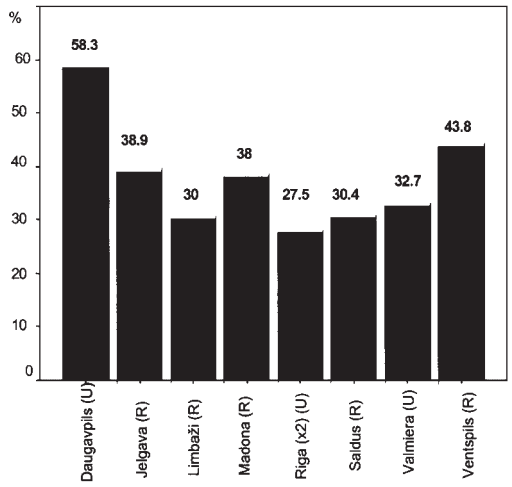

Figure 1 Percentage need for orthodontic treatment in nine urban (U) and rural (R) settings in Latvia using the ICON.

The actual ICON score contains more information than simply whether the score is at least 44. The box plot (Figure 2) shows the distribution of scores in the various schools. Analysis of variance confirmed that there were no differences between urban/rural areas and/or between boys and girls. However, it did show that there were significant differences between schools; the multiple comparison tests indicated that the difference between Riga, with a mean of 35.6, and Daugavpils, with a mean of 48.5, was significant ($P < 0.001$).

With regard to the questionnaire, the responses were compared between those individuals needing and those

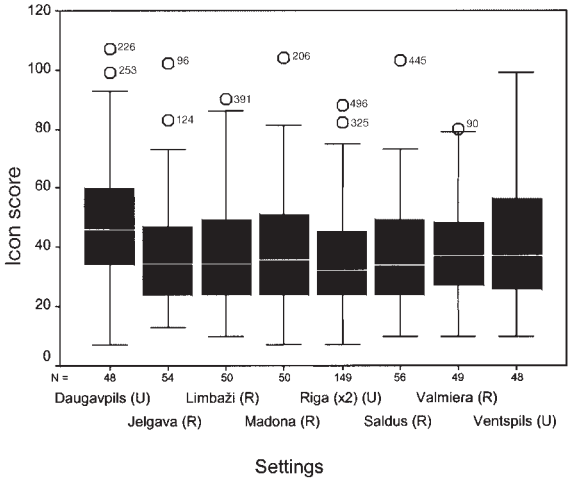

Figure 2 Distribution of ICON scores (box plots) for the nine urban (U) and rural (R) settings in Latvia. (The box shows the 25th to 75th percentile with the black line the mean score. The whisker represents the smallest and largest outlying values. The circles and numbers represent the outliers.)

not needing treatment according to the ICON. Statistically significant differences (using non-parametric Mann–Whitney tests) occurred with respect to questions 1, 2, and 7. These were also the only questions in which the scores were correlated with the ICON score. For question 1 those dissatisfied with the arrangement of their teeth were more likely to require treatment according to the ICON; similarly for question 2 those who wanted their teeth to be straightened were more likely to have a clinical need according to the ICON. For question 7, 49 per cent of those who thought they needed treatment did so; 26 per cent of those who were unsure needed treatment, and 26 per cent of those who said they did not need treatment were judged to need it. There were differences between boys and girls for questions 1, 2, 4, and 7. There was a consistent pattern: girls were more likely than boys to be dissatisfied and judge that they needed treatment.

Statistically significant differences between schools, taking gender into account, occurred only for question 4. Children in Ventspils were more likely to be dissatisfied with their dental health—over 42 per cent recorded dissatisfaction compared with an overall figure of 18 per cent. The largest negative correlation was between questions 1 and 2, i.e. that the individuals were dissatisfied with the appearance of their teeth and wanted them straightened.

A logistic regression was undertaken dichotomizing on the need for treatment based on the ICON scores. Questions 2 and 7 were selected using a forward variable selection method. Using these to predict need led to 69 per cent sensitivity with 53 per cent specificity. Thus, while the questions have some predictive power for assessing need, they are far from perfect.

Regarding treatment complexity (Table 1), the degree of difficulty did not vary significantly between schools (Very difficult ranging 1.3–10.4%). Only 10 per cent were considered 'Difficult or Very Difficult'.

Discussion

The ICON is a relatively new index and is just beginning to be used more widely. It has been shown to be a reliable and valid index (Koochek *et al.*, 2001; Firestone *et al.*, 2002) for assessing orthodontic treatment need. The mean level of treatment need of 35.3 per cent across all settings is similar to other studies in England and Wales (Brook and Shaw, 1989; Burden and Holmes, 1994; Office for Population Censuses and Surveys, 1994).

The results show considerable variation in the percentage of children in need of orthodontic treatment particularly between Riga and Daugavpils (27.5 per cent compared with 58.3 per cent, respectively). The reason for this is not understood, although the individuals making up the Daugavpils sample were 100 per cent of Russian origin compared with 12 per cent Russian and 88 per cent Latvian origins in Riga (determined by name). The ethnic difference warrants further investigation, as there is little information on the prevalence of malocclusion in Russia. As the same calibrated examiner obtained the data collected, bias was eliminated.

For question 1, 63 per cent of school children in Riga were either satisfied or very satisfied with the arrangement of their teeth compared with 67 per cent in Daugavpils. With regard to question 2, 63 per cent of school children in Riga wanted their teeth straightened compared with 70 per cent in Daugavpils. There were no statistically significant differences for either question 1 or 2 for the two schools.

Interestingly, the need for orthodontic treatment determined by the ICON score is related to the individual's subjective assessments of satisfaction of appearance and the perception of need to straighten their teeth. The needs of boys and girls were not found to be different but their self-perceived needs were different, with girls feeling more in need of treatment than boys.

The level of dental health as reported by children in Ventspils was poorer than in other schools but there were no significant differences between urban and rural settings.

The percentage of school children who had worn an orthodontic appliance was 18 per cent, which is approximately half that reported for 11–12 year olds in England and Wales (Office of Population Censuses and Surveys, 1994).

The ICON seems to be of use in assessing treatment need in a population and appears to be sensitive in

Table 1 Distribution of orthodontic treatment complexity between the urban (U) and rural (R) settings using ICON.

Settings	Easy	Mild	Moderate	Difficult	Very difficult	Total number (*n*)
Daugavpils (U)	22.9	35.4	18.8	12.5	10.4	48
Riga (×2) (U)	36.9	44.3	14.8	2.7	1.3	149
Ventspils (U)	29.2	39.6	14.6	14.6	2.1	48
Jelgava (R)	33.3	48.1	9.3	5.6	3.7	54
Limbaži (R)	48.0	40.0	12.0	4.0	6.0	50
Madona (R)	40.0	34.0	16.0	4.0	6.0	50
Saldus (R)	37.5	39.3	14.3	7.1	1.9	56
Valmiera (R)	30.6	46.9	12.2	6.1	4.1	49
Overall (%)	34.3	41.7	14.1	6.2	3.8	

identifying differences in populations. The assessment of need and complexity can be used to plan orthodontic provision in a developing country such as Latvia.

Conclusions

The overall prevalence of individuals needing orthodontic treatment in Latvia was 35.3 per cent, but this figure masks considerable variation between schools. For example, a greater need was found in Daugavpils than in Riga. This difference is not fully explained but could be genetic: the individuals in Daugavpils being mainly of Russian origin. The individuals' perception of the arrangement of teeth and the need for treatment correlated significantly with the ICON score.

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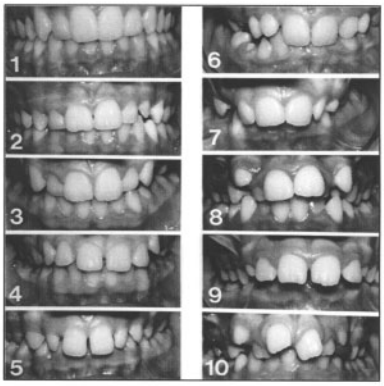
Appendix 1 Index of Complexity, Outcome and Need (ICON) scoring criteria

ICON

Index of Complexity, Outcome and Need

- Based on expert opinion of 97 practising specialist orthodontists from Germany, Greece, Hungary, Italy, Netherlands, Norway, Spain, United Kingdom and the USA
- For use on patients or dental casts
- A single assessment method to record complexity, outcome and need
- For use in clinical governance, audit, research and decision making
- 5 components, taking about one minute to measure



Component 1 Aesthetic Assessment

The Aesthetic Component was originally described as "SCAN"
Evans R and Shaw WC 1987 A preliminary evaluation of an illustrated scale for rating dental attractiveness European Journal of Orthodontics 9:314-318.

b) Possess less than or equal to 4mm of space between the adjacent permanent teeth. Use average canine and premolar widths to estimate the potential crowding in the mixed dentition, namely, 7mm for pre-molars, lower canine, and 8mm for upper canine

- Spacing in one part of the arch will cancel out crowding elsewhere
- Retained deciduous teeth (without permanent successor) and erupted supernumerary teeth score as space (unless they are to be retained to obviate the need for prosthesis)
- Lost teeth due to trauma or extraction should be counted as space (unless space is maintained for a prosthetic replacement).

COMPONENT 3 CROSSBITE

- Anterior and posterior transverse discrepancies of cusp to cusp or greater in intercuspal position

COMPONENT 4 INCISOR OPEN BITE / OVERBITE

- Open bite (except developmental conditions) is measured to the mid-incisal edges
- Deep bite is measured to deepest part of overbite
- If both traits are present only the highest score is counted

COMPONENT 5 BUCCAL SEGMENT ANTERO-POSTERIOR

- Quality of buccal segment interdigitation is measured (not Angles classification)
- Both sides are scored then added together

B. ICON SCORING PROTOCOL

- Measure all 5 traits according to the protocol above to obtain a set of scores
- Multiply the scores by their respective weights
- The sum of the weighted scores is the ICON score for the case
- Pre-treatment scores give the treatment need and complexity grades
- End of treatment scores gives the acceptability
- Pre-treatment - 4 x post treatment scores gives the degree of improvement

A. ICON SCORING METHOD

	SCORE						
COMPONENT	0	1	2	3	4	5	Weigh t
1 Aesthetic assessment	Score 1 to 10						7
2 Upper arch crowding	< 2mm	2.1 to 5mm	5.1 to 9mm	9.1 to 13mm	13.1 to 17mm	> 17mm	5
Upper spacing	< 2mm	2.1 to 5mm	5.1 to 9mm	>9mm		Impacte d teeth	5
3 Crossbite	No crossbite	crossbite present					5
4 Incisor open bite	Edge to edge	< 1mm	1.1 to 2mm	2.1 to 4mm	>4mm		4
Incisor overbite	< 1/3 lower incisor coverage	1/3 to 2/3 coverage	2/3 up to fully covered	Fully covered			4
5 Buccal segment antero-posterior	Cusp to embrasure only. Class I, II or III	Any cusp relation up to but not including cusp to cusp	Cusp to cusp				3

COMPONENT 1 AESTHETIC ASSESSMENT

Ten pictures ranking dental attractiveness

COMPONENT 2 UPPER ARCH CROWDING / SPACING

- The difference between the sum of the mesio-distal tooth diameters and the available arch circumference in the upper arch reduced to a 5 point score
- Impacted teeth in either arch immediately score 5

Impacted teeth must be unerupted and either:

a) Ectopic or impacted against an adjacent tooth (excluding third molars but including supernumerary teeth)

C. INTERPRETATION OF ICON SCORES

NEED AND ACCEPTABILITY	THRESHOLD
Pre-treatment need	> 43 treatment need
End treatment acceptability	< 31 acceptable

COMPLEXITY GRADE (PRE-TREATMENT)	SCORE RANGE
Easy	< 29
Mild	29 to 50
Moderate	51 to 63
Difficult	64 to 77
Very difficult	> 77

IMPROVEMENT GRADE (PRE-TREATMENT SCORE - 4 x POST-TREATMENT SCORE)	SCORE RANGE
Greatly improved	> -1
Substantially improved	-25 to -1
Moderately improved	-53 to -26
Minimally improved	-85 to -54
Not improved or worse	< -85

Appendix 2 Questionnaire

1. Are you satisfied with the arrangement of your teeth?

Very satisfied	Satisfied	I do not care	Dissatisfied	Very dissatisfied
1	2	3	4	5

2. Do you want your teeth straightened?

Yes, definitely	yes, probably	no, probably not	no, definitely not
1	2	3	4

3. Do you consider well aligned teeth important for overall facial appearance?

Very important	rather important	not important	not important at all
1	2	3	4

4. How satisfied are you with your dental health?

Very satisfied	Satisfied	Dissatisfied	I do not care	I do not know
1	2	3	4	5

5. How often do you brush your teeth?

Several times a day	Once a day	At least once a week	Less than once a week
1	2	3	4

6. Have you ever worn an orthodontic appliance?

Yes	No	I do not know
1	2	3

If yes who suggested treatment?

Myself	My parents	Dentist	Friend	I do not know
1	2	3	4	5

7. Have you ever thought you are in need of treatment?

Yes	No	I do not know
1	2	3

If yes, please give the main reason for your concern?

Appearance of teeth is unsatisfactory	Function of the dentition is unsatisfactory	Cleaning of teeth is difficult	Some other reason	I do not know
1	2	3	4	5