



## **MASTEROPPGAVE**

**Malalignment of anterior teeth in relation to orthodontic  
treatment experience and satisfaction with dental  
appearance in a group of adolescents in Norway**

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## Abstract:

The purpose of this study was to compare the relationship between some of the most common traits of malocclusion in Norway, overjet and anterior displacement, to satisfaction with dental appearance and treatment experience. Prevalence of malocclusions was studied in a sample of 55 adolescents, aged 14-15 years, from the city of Fauske in Northern Norway. Overjet and displacement were recorded on dental casts, and satisfaction with dental appearance was evaluated from a questionnaire.

Subjects with lower anterior displacement of 4 mm or more were significantly more dissatisfied with their dental appearance as compared to subjects who had mandibular dental displacement less than 4 mm. No significant association was found between displacement in the maxilla and satisfaction. Almost all subjects (94,5%) with displacement of 4 mm or more in the maxilla had not received orthodontic treatment, and the orthodontically treated adolescents showed significantly less often anterior dental displacement in the maxilla compared to the non-treated subjects.

In general, severe malocclusions were rare among our subjects, but moderate displacement of anterior teeth seems to be more common among non-treated than in treated individuals. It seems that mandibular anterior dental displacement may negatively affect one's satisfaction with the dental appearance.

## Main message

- Significant association was found between treatment experience and anterior displacement in maxilla and mandible
- Significant association between mandibular anterior dental displacement and satisfaction was found

- The findings in this study must be seen in relation to the relative low number of participants of this investigation.

## INTRODUCTION

### **Organization of orthodontic care in Norway**

Approximately 30% of children and adolescents in Norway receive orthodontic treatment.

The proportion of child population receiving orthodontic treatment is relatively equal in all Scandinavian countries; in average 30 % of an age group. There are only slow changes in this proportion, and the rate has been around one third the last 15 years. (1) (2). Most orthodontic treatment is provided by orthodontists in Norway. According to membership numbers from 2007, NKF (Norwegian association of Orthodontists) had 160 working orthodontists under the retirement age of 67. In addition to the 160 there are several orthodontists above the retirement age who still practice their profession. (3). According to a preliminary report on the need of orthodontists in the future by the Social- and Health department in Norway, there will be a reduction of 57 orthodontists in 2020 if the same educational policy as nowadays is followed (4).

In Norway there is free dental care up to the age of 18. Orthodontic treatment for children and adolescents under the age of 18 is funded by the government (social security) based on treatment need. The social security covers 40-100% of the patients' costs, depending on the severity of the malocclusion. The prerequisite is that the treatment is performed by a specialist in orthodontics. The government's refunds for orthodontic treatment have increased from approximately 255 million Norwegian crowns in 2002 to 355 million crowns in 2006 (1). The private orthodontic sector, which comprises the main part of the Norwegian orthodontic service, has generally higher fees than the public sector. Refunding of treatment cost is

dependent on the occlusal diagnosis, according to the Need for Orthodontic Treatment Index (NOTI), assessed by the orthodontist. The index scores different morphological occlusal traits into four categories (A-D) according to their severity. Category A represents normative need labelled “very great need”, category B “great need” and C “obvious need”, the refund will respectively be 100%, 60% and 40%. It is the most severe malocclusion trait, which determines the category.

A lack of space of 3 mm or more in the anterior area of the upper- or lower jaw was the most frequent single obliging discrepancy reported by orthodontists to the Department of Social Security in Norway in the period 01.01.98-31.03.98. Increased horizontal or vertical overbite were registered in 40 % of the individuals. The most frequent combination of discrepancies was anterior crowding in both the upper- and lower jaw. (2).

Esthetic components or subjective need for treatment are not included in the NOTI, only the morphological recordings (1) (2). The final treatment decision is also influenced by various factors such as socio-economic circumstances of the child and the parent, personal treatment experiences of the parents, general trust in the profession and personally perceived need, as well as self-esteem of the person. (5) (6)

A report from the Norwegian government in 2007 established an imbalance in the distribution of specialists in Norway. Orthodontics is the profession which is best distributed over the country (1). On a national level the number of 12-years old per orthodontist is 370, and there is relatively little variation between geographic areas. An average waiting time for treatment on a national level has been 4.7 months, but differences in treatment frequency exist between regions (3). It has been shown that a low treatment uptake in one region is accompanied by an increased frequency of residual malocclusion (7). The main challenge in the years to come

is mainly to achieve a decent distribution of the newly educated specialists (3). There is a tendency towards most of the applicants to the specialist education to come from the vicinity of the two main institutions for education, and settle down nearby afterwards (1). With the new dental education and specialist education in orthodontic in the northern part of Norway, in the city of Tromsø, the politicians hope to improve the distribution of orthodontists and dentists in Norway.

### **Objective and subjective need for and demand of orthodontic treatment in Norway**

Espeland and Stenvik (7) studied subjective and objective orthodontic treatment need in a group of untreated 16-20-year-olds in areas in Norway with different treatment rates. They found that the satisfaction with dental arrangement is higher in areas with higher treatment rates. Dissatisfaction was completely eliminated among individuals from the high treatment rate area (treatment rate 63%), and well-aligned teeth seemed to be taken for granted among individuals from the area with a high treatment rate. There were significant decrease in occurrence of normative need and reported dissatisfaction in samples representing increasing treatment rates (7).

There is evidence that certain malocclusions such as excess overjet and posterior crossbite with shift can negatively affect dental health and occlusal development (8) (9). Increased overjet exposes a child to an increased risk of dental trauma during growth. Posterior crossbite has some association with temporomandibular disorders and can cause skeletal, dental and muscle adaptation which may lead to facial asymmetry.

The most common reason for looking for orthodontic treatment is dentofacial appearance (10). The psychosocial benefit of better looks is often the main motivation for initiating

orthodontic treatment, instead of improved dental health and function (11) (12) (13). In a longitudinal study on 359 Norwegian children and their parents, aesthetics was found to be the most frequent reason for seeking orthodontic treatment. Well-aligned teeth were considered important for the overall facial appearance (13).

Several studies have shown that dental arrangement has a significant influence on the perceived beauty and success of a person (14) (15). There seems to be a general agreement that ideal occlusion is also aesthetically the most pleasing one and will also have a positive effect on the expectations of teachers and employers (16). A study on Norwegian lay attitudes to dental appearance reported a low degree of acceptance of malocclusion in general. The subjects were shown 10 photographs according to the Aesthetic Component of the IOTN (Index of Orthodontic Treatment Need). The majority of the subjects (80-100%) rated the five photographs on the unattractive end of the scale to be in need of treatment. (14) In a study done by Kerosuo et al. four different dental arrangements were manipulated on photographs of six test faces and shown to 1007 Finnish students. Test faces with incisal crowding and broad medial diastema were ranked as significantly less intelligent, beautiful and sexually attractive, and judged to belong to a lower social class than the faces with ideal occlusion (15). It was concluded that incisal crowding or spacing may represent a social disadvantage compared to normal or protruded incisors in this study (15). In another study children with poorer aesthetic anterior tooth arrangement, as recorded by the examiner, perceived themselves as worse off and in need of orthodontic treatment compared to those with more ideal occlusion (17). This is in accordance with Norwegian studies by Stenvik and Birkeland. Birkeland found that most children (83%) and parents (87%) were of the opinion that well-aligned teeth were important for the overall facial appearance (5) and that both children and

parents rate pleasing aesthetics as an important factor for psychosocial well being (13) (14) (7) (5).

Also, a Norwegian investigation on 130 young orthodontic treated and non-treated young adults showed that satisfaction corresponded to their anterior dental arrangement. Almost all the subjects (98%) with near-ideal occlusion or minor deviations expressed satisfaction (18).

Anterior traits of occlusion seem to be a determinant of how pleased an individual is with his/her own dentofacial appearance. There are only few studies done among the Norwegian population on the kind and severity of anterior malocclusion that affect satisfaction with dental arrangement.

The aim of this investigation was to study the association of overjet and anterior tooth displacement with orthodontic treatment experience and satisfaction with one's dental appearance. Our hypothesis was that there is an association between malalignment of the anterior teeth and satisfaction with dental appearance, as well as between orthodontic treatment experience and anterior malocclusion traits.

## SUBJECTS

The data from this study is part of an ongoing larger study by DDS, PhD student Anette Haseid on orthodontic treatment need and orthodontic treatment experience in the north of Norway. The sample in our study consisted of all 14- and 15-year olds living in Fauske (N=114). Fauske is a small municipality in the middle of Norway with about 9500 inhabitants. The town has no orthodontists and the distance to the nearest orthodontist is 60 kilometers. The subjects were introduced to the study and invited to participate by a letter.



The final number of participants was 69, with a mean age of 14.9 years. The participation rate was 61 %.

Those who agreed to participate were given an appointment at the dental office for a clinical orthodontic examination, impression taking for study casts and a questionnaire. Fourteen of the 69 individuals were excluded from our study because of ongoing treatment with fixed appliances. Thus the final study sample consisted of 55 individuals, 27 boys and 28 girls,

## METHODS

Impressions for study casts, with the bite registered in centric relation, were taken in the dental office. The participants were given a questionnaire concerning satisfaction about their own dental arrangement. The question sound was: “Are you satisfied with the arrangement of your teeth?”, and the answer options were divided as following: Very satisfied, satisfied, dissatisfied, very dissatisfied. The answers were later dichotomized in two categories: 1. very satisfied and satisfied, 2. dissatisfied and very dissatisfied.

Overjet and displacement in the maxilla and the mandible were assessed on study casts.

Overjet was measured in millimeters as the distance from the labio-incisal edge of the most prominent upper central incisor to the labial surface of the corresponding lower incisor parallel to the occlusal plane.

Displacement was measured in the anterior segment, including the canines. Both the maxilla and the mandible were assessed separately. The distance of single anterior teeth being out of normal arch alignment and /or rotated from the normal arch was measured, in millimeters.

The individual measurements of displacement were then added together in each jaw.

## Data analysis

The data was inserted and analyzed in a statistical program, SPSS 17.0. Chi-square and Fisher's exact test were used to test differences in the occlusal traits between the treated and not-treated groups, and in regard to satisfaction with dental appearance. For the inter- and intra examiner agreement kappa values were calculated.

### Method error

After training to the method (under the guidance of) by an experienced supervisor, the student investigators (A.E. and L.P.) carried out all the measurements independently. Inter- and intra-calibrations were then performed on 19 and 15 study casts, respectively. The inter-examiner kappa values ranged from 0.57-1.00. The kappa value regarding the displacement was 0.57 in the maxilla and 0.77 in the mandible, corresponding for moderate agreement and substantial agreement, respectively. (20) For the overjet the kappa was 1.00, corresponding for full agreement. The intra-examiner agreement for different measurements ranged from substantial to full agreement (kappa values from 0.762-1.00).

## RESULTS

In the study group, 31% of the participants had received orthodontic treatment and the majority of the individuals (83 %) were satisfied with their own dental arrangement independent of the treatment experience. Three individuals did not respond to the questionnaire concerning satisfaction, and were excluded from this analysis.

11.0% of the individuals had an overjet of 5 mm or more, and all of them belonged to the non-treated group of adolescents. The relationship between treatment experience and overjet was not significant (Table I).

84.5% of the participants with an overjet of 0-4 mm, in comparison with 66.5% of those who had an overjet of 5 mm or more, were satisfied with their dental arrangement, but this difference was not statistically significant (Table II).

All except one subject (94.5% ) who had anterior dental displacement 4 mm or more in the maxilla belonged to the non- treatment group. There was a significant negative association between treatment experience and displacement in the maxilla (Table III). 88% of the participants with 0-3 mm displacement in maxilla were satisfied with their dental appearance, in comparison to 72 % of those with displacement of 4 mm or more. The relationship between displacement in maxilla and satisfaction was not significant (Table IV).

In the non-treated group of adolescents, 68.5% had displacement of 0-3 mm in mandible. All the 17 participants (31%) who had received orthodontic treatment were in the category of 0-3 mm displacement in mandible. Significant association between displacement in mandible and treatment experience was observed (Table V). In the group of individuals with 4 mm or more displacement in the mandible, 50% were satisfied with their dental arrangement, while 92.5% of those with 0-3 mm displacement in the mandible were satisfied. Significant association between displacement in mandible and satisfaction was found (Table VI)

Table I. Distribution of overjet (mm) among the participants with and without a history of orthodontic treatment

Overjet	Orthodontic treatment experience		
	yes	no	Total
	n (%)	n (%)	N (%)
0-4mm	17 (100)	31(84)	48(89)
>4 mm (5mm or	0(0)	6(16)	6(11)

more)

Total 17(100) 37(100) 54(100)

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$p > 0.05$  N.S. (not significant)

Table II. Satisfaction with dental appearance in relation to overjet among the participants

Overjet	Satisfaction		
	yes	no	Total
	n (%)	n (%)	n (%)
0-4mm	38(84.5)	7(15.5)	45(100)
>4 mm (5 mm or more)	4(66.5)	2(33.5)	6(100)
Total	42(82)	9(18)	51(100)

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$p > 0.05$  N.S.

Table III. Distribution of displacement in maxilla among the participants with and without orthodontic treatment experience

Displacement maxilla	Orthodontic treatment experience		
	yes	no	Total
	n (%)	n (%)	n (%)
0-3mm	16(43)	21(57)	37(100)
>3mm (4mm or more)	1(5.5)	17(94.5)	18(100)
Total	17(31.0)	38(69.0)	55(100)

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$p < 0.05$  significant(\*) (Fisher's exact test)

Table IV. Satisfaction with dental appearance in relation to displacement in the maxilla

Displacement maxilla	Satisfaction		
	yes	no	Total
	n (%)	n (%)	N (%)
0-3mm	30(88)	4(12)	34(100)
>3mm (4mm or more)	13(72)	5(28)	18(100)
Total	43(82.5)	9(17.5)	52(100)

$p > 0.05$  N.S

Table V. Distribution of displacement in mandible among the participants with and without orthodontic treatment experience

Displacement mandible	Treatment experience		
	Yes	no	Total
	n (%)	n (%)	n (%)
0-3mm	17(100)	26(68.5)	43(78)
>3mm (4mm or more)	0(0)	12(31.5)	12(22)
Total	17(100)	38(100)	55(100)

$p < 0.05$  \*

Table VI. Satisfaction with dental appearance in relation to displacement in mandible

Displacement mandible	Satisfaction		
	Yes	no	Total

	n (%)	n (%)	N (%)
0-3mm	37(92.5)	3(7.5)	40(100)
>3mm (4mm or more)	6(50)	6(50)	12(100)
Total	43(82.5)	9(17.5)	52(100)

*p*<0.05 \*

## DISCUSSION

The findings in this study must be regarded in relation to the relative low number of participants attending. We also had to exclude 11% of the participants because of ongoing treatment with fixed appliances, which decreased the proportion of treated subjects in comparison to the non-treated in this study. The number of severe anterior malalignments was low in this particular sample indicating that those with severe malocclusions had received orthodontic treatment or was in treatment. The low number of severe anterior malalignment might also explain the high degree of satisfaction among the individuals. It is difficult to compare the result concerning satisfaction with dental appearance with other studies, because previous studies have used other methods to measure satisfaction, i.e The Aesthetic Component. Therefore, it should be kept in mind that our findings may not allow inferences, and are not representative for the Norwegian population.

The only significant relationship between satisfaction with dental arrangement and malocclusion traits was found in the displacement in the mandible, but not in the maxilla. This is somewhat surprising. One should think that displacement in maxilla would play a larger role to the individual satisfaction with dental arrangement than displacement in mandible, because the upper anterior segment is more visible. One explanation for this could

be that the same amount of displacement in mm seems more marked in mandible because of the smaller size of the lower incisors in relation to the upper incisors. The amount of displacement in mm in the mandible and maxilla in the group that had 4 mm or more cannot explain these results, since four individuals had 10-14 mm of displacement in the maxilla, whereas the largest displacement in mandible was 6 mm.

Another explanation could be that the dichotomization of the four categories collected from the questionnaire into two categories: satisfied and not satisfied, can have been misleading, if the majority of the participants placed themselves in the borderline between satisfied and not satisfied, i.e. satisfied and dissatisfied. A closer study of the data collected from our study group shows us that this may have been true.

In this study we have chosen the most common traits of malocclusion in Norway (2). These malocclusions are often visible for the patients and can therefore affect their satisfaction. The authors of this article are of the opinion that there are other factors than malocclusion traits that may affect satisfaction with dental appearance such as tooth form, color and dental caries, these factors must be kept in mind when the reader consider the results on satisfaction. It has also been reported that some children are dissatisfied with an aesthetically pleasing dentition and others are satisfied despite of severe aesthetic problems (19). The conclusion is that a satisfied/not satisfied answer to the questionnaire in this study could at least partially have another background not dealt with in this report.

Comparing the results from this study to other studies done on the same subjects is difficult because previous studies have used the IOTN score (5) (7) (13) (19), and displacement and overjet are not dealt with separately in relation to satisfaction and orthodontic treatment experience.

## CONCLUSIONS

Conclusions: In general, severe malocclusions were rare among our subjects, but moderate displacement of anterior teeth seems to be more common among non-treated than in treated individuals. Also, it seems that mandibular anterior dental displacement may negatively affect one's satisfaction with the dental appearance.

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