# Anomalies of Occlusion Predisposing to Occlusal Interference in Children

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***A statistical evaluation of relationships between occlusal interferences and common malocclusions shows significant positive relationships with crossbites and open bite, and a negative relationship with deep overbite.***

Different types of occlusal interferences have been shown to be partly responsible for symptoms of mandibular dysfunction in children (Egermark-Eriksson, Ingervall & Carlsson 1981). Age, sex and psychological characteristics are also important factors.

Occlusal anomalies *per se* were not found to be essential variables for explaining symptoms of mandibular dysfunction, so it is important to find out which types of morphological malocclusions might contribute to occlusal interference and thereby indirectly to possible mandibular dysfunction.

The purpose of this study was to seek any relationship between occlusal anomalies and occlusal interference in children that may be revealed by stepwise multiple regression.

## SUBJECTS AND METHODS

Occlusal anomalies and interferences were recorded clinically in 402 children in three age groups (17, 11 and 15 years old), with equal sex distribution. The sample and details of measurement procedures have been previously described in detail by Egermark-Eriksson (1981).

The following types of occlusal anomalies were recorded:

- Postnormal occlusion, grade 1 (½ cusp width)
- Postnormal occlusion, grade 2 (≧ 1 cusp width)
- Prenormal occlusion (≧ ½ cusp width)
- Extreme maxillary overjet (≧ 6 mm)
- Incisor crossbite
- Cuspid-bicuspid crossbite
- Molar crossbite
- Bicuspid-molar segment lingual crossbite
- Lateral (buccal) open bite
- Anterior open bite (overbite < 0)
- Deep bite (overbite ≧ 5 mm)

In addition, the overjet and overbite were recorded in millimeters. The criteria for the recording as well as the prevalence of the different types of occlusal anomalies have been published by Egermark-Eriksson (1981).

The following types of occlusal interferences were recorded as described by Egermark-Eriksson, Carlsson & Ingervall (1981).

- Unilateral contact in Retruded mandibular Position (RP)
- Large antero-posterior distance (≧ 1.5 mm) between RP and IP (Intercuspal mandibular Position)
- Lateral deviation ≧ 0.5 mm between RP and IP
- Functional nonworking side interference with a lateral movement ≦ 3 mm
- Nonworking side interference anywhere during the course of full lateral excursion.

A compound variable called "severe occlusal interference" was formed to include those cases fulfilling one or more of the following criteria:

- Antero-posterior RP-IP distance ≧ 1.5 mm
- Lateral deviation between RP and IP ≧ 1.0 mm
- Functional nonworking side interference.

*Statistical methods*

The different types of occlusal interferences were correlated individually with the occlusal anomalies (including overjet and overbite), using Spearman rank correlation (Siegel 1956). To examine the influence of combinations of occlusal anomalies on occlusal interferences, the anomalies were used as independent variables in stepwise multiple regression analyses with the different types of occlusal interference as dependent variables.

Because most of the variables were dichotomous, the results of the regression analyses were checked with non-parametric methods. This was done by calculation of the partial correlation between the dependent variable and any one of the independent variables in the outcome of the regressions with the other variables given (Pitman permutation test, Bradley 1968). Only variables that were significantly correlated both individually and partially with the dependent variable in the non-parametric tests are included in the results of the regression analyses.

The number of observations in the regression analyses was limited by missing data to 340.

The levels of significance used were $P<.05$ and $P<.01$.

## Results

The significant single correlations between the occlusal anomalies and occlusal interferences according to Spearman rank correlation are given in Table 1.

TABLE 1

Significant Rank Correlations between Occlusal Interferences and Occlusal Anomalies. + or − Denote Significant Positive or Negative Correlation at the Level $P < .01$ and (+) or (−) at the Level $P < .05$. N = 402

| | *Unilateral contact in RP* | *Large RP-IP distance* | *Lateral deviation RP-IP* | *Functional non-working side interf.* | *Non-working side interf.* | *Severe occlusal interf.* |
|---|---|---|---|---|---|---|
| Postnormal occlusion grade 1 | | + | | | | (+) |
| Postnormal occlusion grade 2 | | | | + | | |
| Postnormal occlusion (grade 1 or 2) | | (+) | | | | (+) |
| Incisor crossbite | (+) | + | | + | + | + |
| Crossbite cuspid-bicuspid segment | | | + | + | + | + |
| Crossbite molar segment | | + | + | + | + | + |
| Crossbite (cuspid-bicuspid or molar segment) | | | + | + | + | + |
| Lateral open bite | | | | (+) | | |
| Frontal open bite* | | | | + | + | |
| Deep bite* | | | | | − | |
| Overjet (mm)* | | | (+) | (−) | − | |
| Overbite (mm)* | + | | | − | − | |

* 32 children with incisors not fully erupted excluded.

Crossbites were positively correlated with almost all types of occlusal interference examined. Prenormal occlusion, extreme maxillary overjet and lingual crossbite in the buccal segments were not significantly correlated to any type of occlusal interference, and deep bite was negatively correlated with non-working side interference.

Stepwise multiple regression analysis with unilateral contact in RP as the dependent variable did not yield any additional information.

Regression analysis with large antero-posterior RP-IP distance as the dependent variable showed that incisor crossbite and post-normal occlusion, as the most strongly related occlusal anomalies, accounted for less than 10% of the variance of RP-IP (Table 2).

With incisor crossbite and postnormal occlusion as variables, no more of the variation of large RP-IP distance could be explained by crossbite in the molar segment, which in the simple correlation analysis was found to be positively correlated with large antero-posterior RP-IP distance (Table 1).

Lateral deviation between RP and IP was weakly dependent on crossbite and overjet, with an explained variance below 10% (Table 3).

Three types of occlusal anomalies, with crossbite as the most important, could explain about 20% of the vari-

ance of functional nonworking side interference as a dependent variable (Table 4). The relationship between the four variables is illustrated in Fig. 1.

Crossbite could again explain part of the variation of nonworking side interference, but there was a strong negative relationship with overbite (Table 5 and Fig. 2). The two independent variables explained only about 20% of nonworking side interference.

Three types of occlusal anomalies, with incisor crossbite as the most important, together explained slightly more than 10% of the variation of the compound variable "severe occlusal interference" (Table 6, Fig. 3).

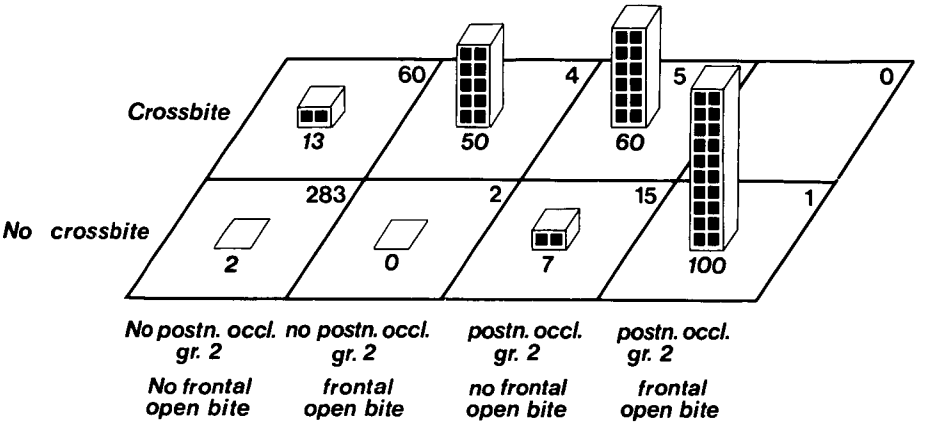


Fig. 1 Relationship between crossbite, Grade 2 postnormal occlusion, frontal open bite and functional nonworking side interference. The number of children is shown in each square, and the percentage with functional nonworking side interference is shown at the base of each column.

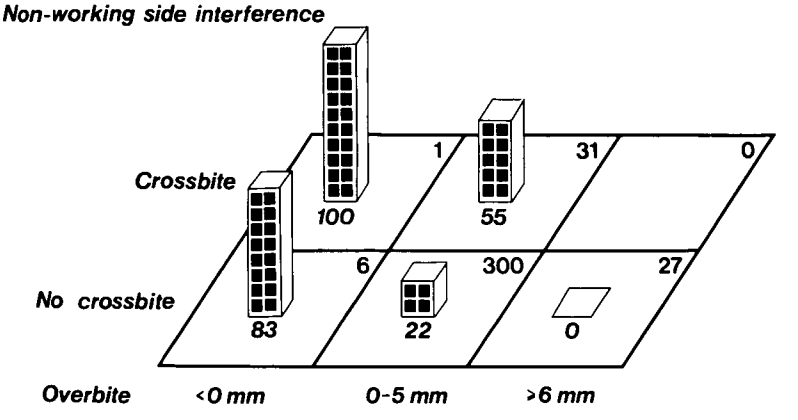


Fig. 2 Relationship between crossbite, overbite and nonworking side interference. The number of children is shown in each square, and the percentage with nonworking side interference is shown at the base of each column.

TABLE 2

Independent Variables for Explaining the Variation of the Dependent Variable Large RP-IP Distance

| *Independent variables* | *Type of relation* |
|---|---|
| Incisor crossbite | + |
| Postnormal occlusion | + |

TABLE 3

Independent Variables for Explaining the Variation of the Dependent Variable Lateral Deviation between RP and IP

| *Independent variables* | *Type of relation* |
|---|---|
| Buccal crossbite | + |
| Overjet | + |

TABLE 5

Independent Variables for Explaining the Variation of the Dependent Variable Non-working Side Interference

| *Independent variables* | *Type of relation* |
|---|---|
| Overbite | − |
| Crossbite, molar segment | + |

TABLE 4

Independent Variables for Explaining the Variation of the Dependent Variable Functional Non-working Side Interference

| *Independent variables* | *Type of relation* |
|---|---|
| Buccal crossbite | + |
| Postnormal occlusion, grade 2 | + |
| Frontal open bite | + |

TABLE 6

Independent Variables for Explaining the Variation of the Dependent Compound Variable "Severe Occlusal Interference"

| *Independent variables* | *Type of relation* |
|---|---|
| Incisor crossbite | + |
| Postnormal occlusion | + |
| Crossbite, molar segment | + |

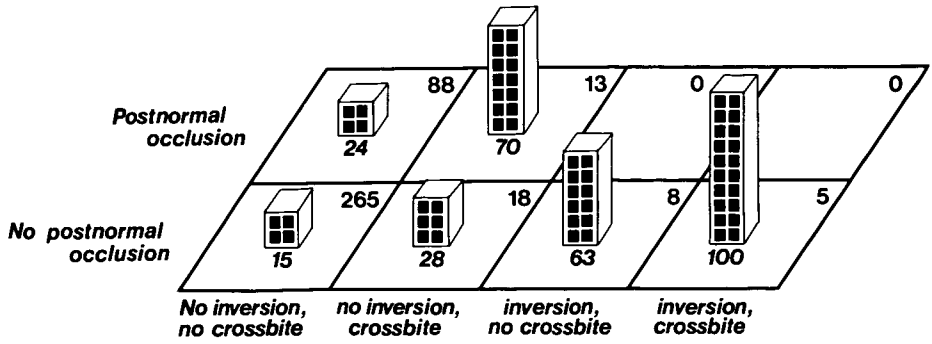


Fig. 3 Relationship between postnormal occlusion, incisor crossbite, buccal crossbite and severe occlusal interference. The number of children is shown in each square, and the percentage with severe occlusal interference is shown at the base of each column.

## Discussion

Three types of occlusal anomalies significantly correlated with the occlusal interference: incisor crossbite, postnormal occlusion and buccal crossbite of posterior teeth. On the other hand, prenormal occlusion and lingual crossbite were not found to be significantly correlated with the occlusal interferences considered in this study.

In adults, Angle Class III malocclusion and negative overjet have been found to predispose to mandibular dysfunction and to occlusal interference in RP, respectively (Mohlin, Ingervall & Thilander 1980). In this sample of children the incidence of prenormal occlusion was low and the cases found were mostly mild. The incisor crossbite anomaly is probably a sign of incipient negative overjet and Angle Class III malocclusion, consistent with the findings in adults.

Individuals with postnormal occlusion are known from earlier studies of children to have a larger than average distance between RP and IP (Ingervall 1968, Malmgren 1980). These results confirm those earlier studies. However, it has not been previously demonstrated that postnormal occlusion is also positively related to functional nonworking side interference. The potential dangers of Class II malocclusion are further emphasized by the association with muscle tenderness found in both adults (Mohlin et al. 1980) and children (Malmgren 1980).

The unfavorable associations of crossbite found in this study (lateral deviation between RP and IP and nonworking side interference) are completely in line with the results of Mohlin & Kopp (1978), who found that crossbite predisposed to these two types of occlusal interference. Ahlgren & Posselt (1963) also found a positive association in children between crossbite and the two types of cuspal interferences mentioned above. In our sample there does not seem to be any great difference in the effects of crossbite in the cuspid-bicuspid or in the molar segments.

Frontal open bite in adults has been found to be positively related to nonworking side interference in adults (Mohlin et al. 1980), as was found for children in this study. Other observations also point to the same unfavorable associations of frontal open bite. Mohlin & Kopp (1978) found a greater prevalence of frontal open bite among patients seeking treatment for mandibular dysfunction than was to be expected from the prevalence in the whole population. Another observation pointing in the same direction is that of Carlsson *et al* (1976), finding individuals with occlusal interference to have greater facial height than those without such interference.

The detrimental effect of frontal open bite may be related to the lack of anterior guidance, which can disengage posterior teeth during lateral excursions of the mandible. The favorable connotation of such anterior guidance in this context is evident from the negative relation found in this study between overbite and nonworking side interference during unrestricted lateral excursion.

Although this study has demonstrated statistically significant relations between occlusal interference and several types of occlusal anomalies, the associations were numerically weak. This means that many other factors, apart from those studied, must be involved in occlusal interference.

The results in this study largely confirm the impressions gained in

earlier investigations, and point to the unfavorable functional associations of such malocclusions as anterior or posterior crossbite, frontal open bite and postnormal occlusion. On the other hand, deep bite is once again found to be unrelated to unfavorable mandibular functional pattern under the criteria used in this study.

SUMMARY

The associations between different types of occlusal interference and of occlusal anomalies were studied in children 7, 11 and 15 years of age. Incisor and buccal crossbite and postnormal occlusions were positively related to large antero-posterior distance or lateral deviation between the retruded and intercuspal mandibular positions, and to nonworking side interference. There was a positive correlation between frontal open bite and nonworking side interference, while large overbite was negatively correlated. The correlations found were numerically small, indicating that other factors apart from those studied must be significantly involved in such occlusal interferences.

REFERENCES

Ahlgren, J., and Posselt, U.: Need of functional analysis and selective grinding in orthodontics. *Acta Odontol. Scand.*, 21:187-226, 1963.

Bradley, J. V.: *Distribution-free statistical tests.* Prentice-Hall, London, 1968.

Carlsson, G. E., Ingervall, B., Lewin, T., and Molin, C.: Relation between functional disturbances of the masticatory system and some anthropometric, physiological and psychological variables in young Swedish men. *J. Oral Rehabil.*, 3:305-310, 1976.

Egermark-Eriksson, I.: Malocclusion and functional recordings of the masticatory system in Swedish schoolchildren. *Swed. Dent. J.*, 5:9-20, 1981.

Egermark-Eriksson, I., Carlsson, G. E., and tional recordings of the masticatory system in Swedish schoolchildren. *Swed. Dent. J.*, 5:9-20, 1981.

Egermark-Eriksson, I., Ingervall, B., and Carlsson, G. E.: The dependence of mandibular dysfunction in children on functional and morphologic malocclusion. In manuscript.

Ingervall, B.: Studies of mandibular positions in children. *Odont. Revy*, 19:suppl, 15, 1968.

Malmgren, O.: Studies on the need and demand for orthodontic treatment. *Swed. Dent. J.*, suppl. 6, 1980.

Mohlin, B., and Kopp, S.: A clinical study on the relationship between malocclusions, occlusal interferences and mandibular pain and dysfunction. *Swed. Dent. J.*, 2:105-112, 1978.

Mohlin, B., Ingervall, B., and Thilander, B.: Relation between malocclusion and mandibular dysfunction in Swedish men. *Europ. J. Orthodont.*, 2:229-238, 1980.

Siegel, S.: *Nonparametric statistics.* McGraw-Hill, New York, 1956.