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A METHOD FOR EPIDEMIOLOGICAL REGISTRATION OF MALOCCLUSION

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A thorough investigation of the occurrence of malocclusions among school-children would be of major importance in the planning of orthodontic treatment in the Public Dental Health Service. For this purpose it is necessary to have available detailed information on the prevalence of individual malocclusions among boys and girls at different ages, distributed regionally, and moreover, an analysis of the need for orthodontic treatment in the different school classes.

An analysis of such data collected from large groups of children would throw light on the relationship between different types of malocclusion, widen our knowledge of their etiology and hence increase the possibility of preventing them.

It is likewise important to carry out comparative studies of the prevalence of malocclusions in different racial groups on an objective basis, since the information they would provide might well throw light on the causes of malocclusion.

The results of many of the earlier epidemiological investigations are not comparable owing to subjective evaluation of the features registered. Moreover, only the most general conclusions have been drawn from the mass of data obtained in the investiga-

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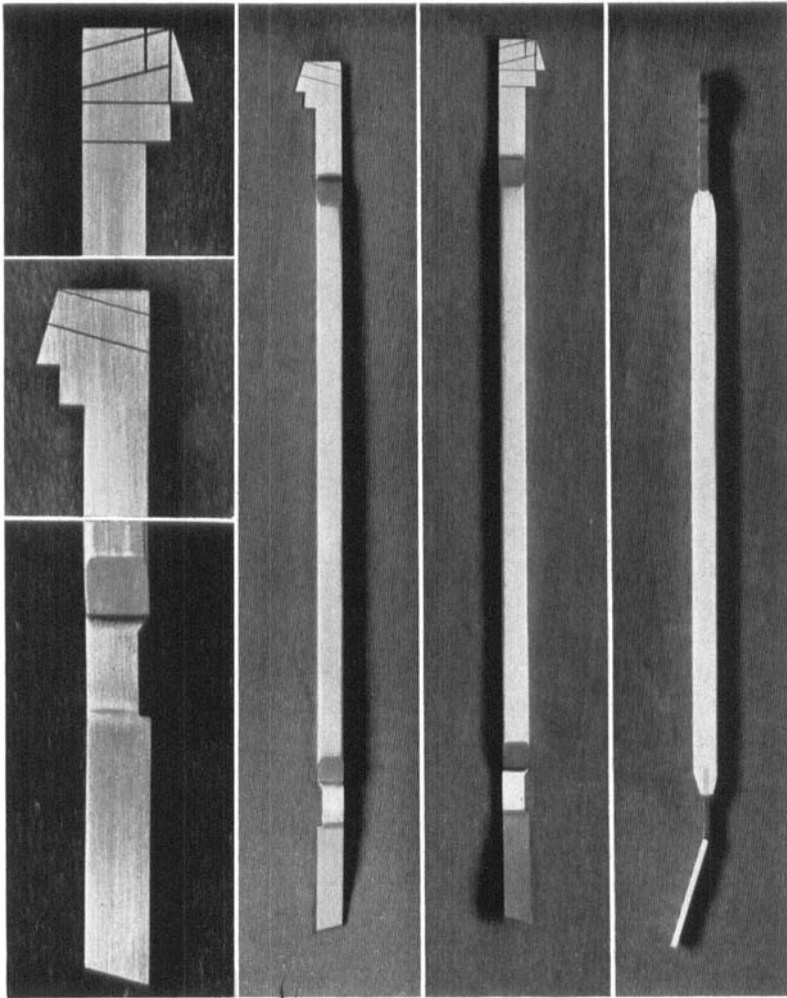


Fig. 1. An instrument for evaluation of certain malocclusions. It consists of a handle with two blades, one of them 2 mm and the other 1 mm in thickness. The thickness of the blades is used in the measurement of mandibular overjet, open bite, spacing, transverse forced bite, displacement of the midline and medial diastema. The thinner blade (bottom left) has one side 21 mm in length and may be used in the evaluation of spacing in the lateral sections. Maxillary overjet is measured with the transverse lines 6 and 9 mm from the edge on the thicker blade (top left). The longitudinal lines 5 and 7 mm from the edge on the same blade are used in the evaluation of deep bite. Rotation of incisors is measured either by means of the sloping lines of 15° on the thicker blade or by the sloping end surface of the thinner blade forming an angle of 15° with the end surface of the thick blade. Rotation of molars or tipping of teeth is measured either by means of the side of the thicker blade or the bending of the thinner blade, both forming an angle of 15° with the axis of the instrument. The instrument is 16.5 cm in length.

1									
2									
3									
4									
5									
6									
7									
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9									
0									

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Fig. 2. Forms on which the code numbers are entered.

tion of large population groups. The method outlined below is designed to overcome these difficulties through the use of an objective registration procedure based on detailed definitions of the recorded symptoms which makes it possible to analyse the data by electronic computers.

The registration of the malocclusions is divided into three parts:

A. *Anomalies in the dentition*, i.e. tooth anomalies, abnormal eruption and misalignment of individual teeth.

B. *Occlusal anomalies*, i.e. deviations in the positional relationship between the upper and lower dental arches.

C. *Deviations in space conditions*, i.e. spacing or crowding of the teeth.

The advantage of this principle of registration is that any malocclusion may be described in terms of a combination of well defined single symptoms within these three groups. The program is designed so that when the data are transferred to punch cards or to punch tape it is possible to obtain, with respect to sex, age and stage of dental development, the prevalence of any particular anomalies and their combinations, at the same time as individuals with any particular symptoms may be excluded.

An indication of the need for orthodontic treatment is included in the registration. This item cannot be recorded objectively in the same way as that of the malocclusions, however, and must therefore be based on an individual estimate.

As an aid in the evaluation of the malocclusions a special instrument is used (Fig. 1).

The data are recorded in code according to a table of code numbers (Fig. 3) and the code numbers are entered on a special form (Fig. 2).

The following definitions of the various malocclusions and of the need for treatment used in the registration procedure have been worked out on the basis of three pilot studies, each on 100 children, and modified in the light of experience derived from these studies. In order to evaluate the systematic errors of registration, the examinations in one of these studies were performed by three dentists. In another study the examinations were performed twice by the same dentist to determine the random error of registration. It is intended on the basis of the

following definitions to work out and publish tables of the prevalence of the malocclusions and the need for treatment in selected school classes as well as tables of association between the recorded malocclusions, and to report the error of the method.

DEFINITIONS

Each recorded item is denoted by a code number and the registrations are made consecutively from 1 to 567. The presence or absence of each item is decided. If present, this is denoted by the corresponding code number, if it is not present no entry is made. All items must therefore be examined, as any omission would imply that the anomaly in question is absent. The code numbers are entered on special forms on which the subjects are numbered consecutively. The code numbers 60—357 and 378—493 relate to the permanent teeth; for the deciduous teeth the same code numbers are preceded by a minus sign. Entries under »Occlusion» and »Space conditions» relate to both the deciduous and the permanent dentitions, no sign being required.

GENERAL INFORMATION

1— 2: *Sex*

3—24: *Age or age group*

31—44: *School class*

The course (A or B stream) is noted where appropriate.

49—59: *Dental stage (DS)*

Anterior teeth

DS	Definition	Significance
01	Deciduous teeth erupting	Deciduous dentition erupting
02	Deciduous teeth fully erupted	Deciduous dentition complete
1	Incisors erupting	Early mixed dentition
2	Incisors fully erupted	Intermediate mixed dentition
3	Canines or premolars erupting	Late mixed dentition
4	Canines and premolars fully erupted	Adolescent dentition
5		Adult dentition

The stage of dental development is denoted by one of the code numbers for DS 01 to DS 4, in accordance with the above definitions. The individuals are considered to be in DS 02, DS 2 or DS 4 even if not all the teeth concerned are present, provided that the reason for the absence of a tooth is extraction or dentitional anomaly. When only one of the stages is recorded this implies that all the earlier stages are complete. If a new stage occurs before the previous one is complete — as for instance when a canine or premolar is visible before all the incisors are fully erupted — both stages are recorded, that is, in this case DS 1 and DS 3.

DS 5 is used in examinations in which registration of molar eruption has not been performed. If information on molar eruption is required the latter is recorded separately.

M o l a r s

DS	Definition
M ₀	First molars not fully erupted
M ₁	First molars fully erupted
M ₂	Second molars fully erupted
M ₃	Third molars fully erupted

The eruption stage of the molars is recorded according to the definitions in the above table, and this recording is performed in addition to the recording of the anterior dental stage. The complete recording of the dental stage thus usually consists of two numbers. For instance the dental stage DS 1—M₁ is recorded with the numbers 51, 57 and the stage DS 4—M₂ with the numbers 54, 58.

60—91: *Erupted teeth*

An erupted tooth is defined as a tooth which is visible in the oral cavity. A tooth is considered fully erupted when it has reached occlusal level. The recording of the individual erupted teeth usually is not necessary, since the dental stage recording generally yields a sufficient description of the developmental stage of the dentition. For special investigations, however, it may be of interest to obtain a detailed record of the individual erupted teeth.

Since the dental stages already have been recorded, this registration is greatly facilitated. It is sufficient to register only the teeth whose eruption may vary at the given dental stage, the remaining erupted teeth being determined automatically by the computer. This is illustrated by the following examples: In the dental stages DS 2 and DS 4 no anterior teeth are recorded, in the dental stage DS 3 only the erupted canines and premolars are recorded, and in the dental stage DS M₁ only the erupted second molars are recorded, and so on.

92—123: *Missing teeth*

Deciduous teeth, premature loss: Only prematurely extracted or shed deciduous teeth are entered under this heading. The criterion is that the succeeding permanent tooth shall not have penetrated the mucous membrane, nor be palpable immediately beneath it. No other missing deciduous teeth are recorded.

Missing permanent teeth: All missing permanent teeth are registered, even if they have been replaced by a bridge. It is possible to mistake a missing tooth for a congenitally absent tooth and vice versa, but only one of these items may be registered. In case of doubt the entry is made under »Missing tooth» and under »Remarks».

124—155: *Defective teeth*

This class comprises all deciduous or permanent teeth that are decayed or provided with crowns or fillings if this is responsible for a change of at least 2 mm in the length of the arch segment.

MALOCCLUSIONS

156—544

Dentition

Unless otherwise indicated anomalies in the dentition are recorded only for permanent teeth. In the *incisor* section the registration is performed from DS 2, with radiographic examination in the case of abnormal eruption. In the *canine*

and premolar sections the registration is performed from DS 3, with radiographic checks of all unerupted permanent teeth. In the molar sections the registration comprises the first molars from DS M_1 inclusive, and the other molars from DS M_2 inclusive, with radiographic checks of all unerupted third molars. For the third molars, only the presence of supernumeraries, aplasia and anomalous eruption is recorded.

156—249: *Anomalies*

Supernumerary teeth: Every extra tooth or tooth germ is counted as supernumerary irrespective of shape and size. It is entered with the code number of the corresponding normal tooth, or, in doubtful cases, according to location. Mesiodens in the maxilla is registered with code number 164. In cases in which the number or the location of a supernumerary lower incisor cannot be decided, it is entered as 181. Supernumerary teeth known to have been extracted are not recorded as supernumerary but are noted under »Remarks».

Aplasia: This is noted after a radiographic check as specified under »Dentition».

Malformation: Teeth of abnormal shape or size are registered, the type of anomaly is entered under »Remarks».

250—377: *Eruption*

Ectopic eruption: Defined as abnormal position or eruption of a tooth originating in a displacement of the germ itself. Anomalous eruption of a tooth as a result of malformation of the tooth or the tooth germ is also recorded as »Ectopic eruption».

Hindered eruption: Defined as obstruction of normal eruption caused by the presence of supernumerary teeth, retained roots, odontomas or suchlike.

When the eruption of molars is obstructed by neighbouring teeth, and when the eruption of third molars is anomalous, whatever the cause, this is also recorded as »Hindered eruption».

Anomalous eruption resulting from crowding of anterior teeth is not recorded as »Hindered eruption». Confusion between

»Hindered eruption» and »Crowding» may occur, but only one of these two items is recorded.

Arrested eruption: Defined as cessation of the eruption caused by an anomalous eruption mechanism as in the case of submerged teeth or traumatized teeth.

Physiological retardation of eruption of the deciduous teeth at the shedding time is not recorded as »Arrested eruption» but as »Open bite». Confusion between »Arrested eruption» and »Open bite» may occur, but only one of these two items may be recorded.

Transposition: Interchange of position of two permanent teeth is recorded for the tooth having the lower number. This applies only to the incisors, canines and premolars.

Persistent deciduous teeth: Deciduous teeth are denoted as persistent when, owing to aplasia or anomalous eruption of the corresponding permanent teeth, the deciduous teeth remain in the mouth beyond the normal time of shedding. Late but otherwise normal shedding is not included.

378—493: *Alignment*

Rotated teeth: Fully erupted teeth which are rotated more than 15° are registered under »Mesial» or »Distal rotation». The degree of rotation is measured with the registration instrument.

Inversion of incisors: In this condition an upper incisor occludes lingually to lower incisors or canines. Not more than three incisors may be entered as inverted, the inversion of all four being recorded only under »Mandibular overjet».

Tipping: Mesial or distal tipping of fully erupted permanent teeth is registered when it exceeds 15° . The tipping is measured with the registration instrument.

Occlusion

The occlusion is recorded from DS 02. Incisal occlusion is judged from the most prominent central incisor. The evaluation of sagittal molar occlusion is performed with respect to the mesial contact points of the upper and lower first permanent molars. Before full eruption of the first permanent molars the molar occlu-

sion is determined from the distal surfaces of the second deciduous molars. The position of the third molars is disregarded in the registration of vertical and transversal occlusion.

If the occlusion cannot be assessed, as during shedding or in the case of absence or anomalies of teeth, this is noted under »Section not recordable».

499—510: *Sagittal occlusion*

Extreme maxillary overjet: Measured with the registration instrument level with the occlusal plane of the maxilla, and classed as follows:

Grade 1: 6 to 9 mm.

Grade 2: 9 mm and over.

Mandibular overjet: Measured with the registration instrument and classed as follows:

Grade 1: 0 to 2 mm.

Grade 2: 2 mm and over.

Distal molar occlusion: Deviation from normal molar occlusion is evaluated for each side and is classed as follows:

Grade 1: One-half to one cusp width.

Grade 2: One cusp width and over.

Mesial molar occlusion: Deviation from normal molar occlusion is evaluated for each side. It is classed as follows:

Grade 1: One-half to one cusp width.

Grade 2: One cusp width and over.

511—518: *Vertical occlusion*

Open bite, frontal: Measured at the central incisors with the registration instrument and classed as follows:

Grade 1: 0 to 2 mm.

Grade 2: 2 mm and over.

Open bite, lateral: Recorded for the canine and pre-molar section (C—P) and for the molar section (M) on each side. When a single tooth is involved, the whole section is recorded.

Deep bite, frontal: Measured with the registration instrument and classed as follows:

Grade 1: 5 to 7 mm.

Grade 2: 7 mm and over.

519—526: *Transverse occlusion*

Crossbite: Recorded for each side for the canine and premolar section (C—P) and for the molar section (M), if the buccal cusp of the upper tooth occludes lingually to the buccal cusp of the corresponding lower tooth. Crossbite is thus recorded only when the cusps have passed one another. The registration is made in the appropriate segment as soon as one tooth is deviating.

Scissorsbite: Recorded on each side for the canine and premolar section (C—P) and for the molar section (M) if the lingual cusp of the upper tooth occludes buccally to the buccal cusp of the corresponding lower tooth. Scissorsbite is thus recorded only when the cusps have passed one another. The registration is performed in the appropriate section as soon as one tooth is deviating.

Spacing conditions

527—544: *Crowding and spacing*

This anomaly is recordable from DS 02. For each jaw it is recorded for the incisor section (I), comprising all the incisors, and for the lateral sections (C—P), comprising the canines and premolars of each side.

The incisor section is demarcated by the distal contact points of the two lateral incisors, when the lateral incisors do not deviate labially or lingually in relation to the midline of the alveolar process. The lateral sections are limited by these points and the mesial contact points of the first molars. When a lateral incisor deviates, the demarcation point is taken as the mesial contact point of the canine. When both lateral incisor and canine deviate, a point is used on the midline of the alveolar process between the two contact points. Insufficient

space for the third molar is recorded under »Hindered eruption».

Crowding or spacing is registered when there is a deviation of at least 2 mm in a section, and is evaluated by means of the registration instrument.

Before shedding, the spacing is judged from the size of the deciduous teeth, and after shedding, from that of the permanent teeth. The evaluation of spacing is complicated at shedding and in the case of anomalies in the dentition; if the registration cannot be performed, this is noted under »Section not recordable».

SUBJECTS WITHOUT MALOCCLUSIONS

545

Under this heading all registered subjects not included under the code numbers 156—544 are recorded.

UNRECORDABLE SUBJECTS

546

No registration of malocclusion is performed in cases with multiple extractions and cases with too extensive caries. These cases are denoted here to obtain the total number of investigated subjects. Cases with severe pathological conditions, and children who have had, or are having, orthodontic treatment are likewise excluded from the registration of malocclusions.

SUPPLEMENTARY REGISTRATION

547—555

Items recorded under this heading are registered as supplementary data.

Sagittal forced bite: In case of mandibular overjet the presence of incisal forced bite, with forward movement of the mandible in occlusion, is recorded.

Transverse forced bite: Registered if, in occlusion, the lower jaw is displaced laterally by at least 2 mm, measured at the incisors. The direction of displacement of the mandible is indi-

cated by an R (right) or an L (left). The registration instrument is used for this measurement.

Midline displacement: This is recorded if the midline of the mandibular arch in occlusion is displaced by at least 2 mm in relation to the midline of the upper arch. Displacements to the right and left of the lower midline are denoted by R and L, respectively. The registration instrument is used.

Maxillary medial diastema: Recorded if there is a diastema of at least 2 mm between the upper central incisors. The registration instrument is used.

Abnormal maxillary labial frenulum: This anomaly is recorded where the maxillary labial frenulum is inserting in the incisal papilla and this becomes anaemic when the upper lip is stretched.

Remarks: Special anomalies or cases of uncertainty are recorded under this heading and a note is made on the registration form.

NEED FOR TREATMENT

556—567

If orthodontic treatment is indicated, the need for treatment, its type, duration and time are registered. This item is noted for all the subjects examined, including the group »Unrecordable subjects» (546) and the cases in which the malocclusions are too small to be registered under the above definitions. If, on the other hand, malocclusions are registered where treatment is not indicated, no recording under this heading is made.

Type of treatment (one or more groups may be registered):

Observation

Instruction

Grinding of teeth

Extraction of deciduous teeth

Extraction of permanent teeth

Appliance therapy

Oral surgery

Duration of treatment (only one of the groups is registered):

Minor treatment: less than 6 months.

Moderate treatment: 7—12 months.

Major treatment: longer than 12 months.

Time for treatment:

P r e s e n t: Treatment to be performed within 2 years.

L a t e r: Treatment not for 2 years or longer.

In the case of treatment being indicated both at the present time and later, this is noted under both code numbers.

SUMMARY

A method for epidemiological registration of malocclusion.

An account is given of a method for epidemiological investigation of the prevalence of malocclusions. The method consists in a systematic registration of carefully defined individual symptoms. The registration of some of the symptoms is facilitated by using a specially designed instrument.

The need for treatment is also investigated but this registration is necessarily subjective.

The study has been designed with view to electronic analysis of the data and this will be described later.

RÉSUMÉ

MÉTHODE POUR L'ENREGISTREMENT ÉPIDÉMIOLOGIQUE DES MALOCCLUSIONS

On expose une méthode ayant pour but des recherches épidémiologiques sur la fréquence des malocclusions. La méthode consiste dans l'enregistrement systématique de symptômes individuels soigneusement définis. L'enregistrement de quelques symptômes est facilité par l'emploi d'un instrument spécialement conçu.

On recherche également les nécessités d'un traitement éventuel mais leur enregistrement est nécessairement subjectif.

ZUSAMMENFASSUNG

EINE METHODE ZUR EPIDEMIOLOGISCHEN REGISTRIERUNG VON MALOCCLUSIONEN

Eine Methode für epidemiologische Untersuchungen über das Vorkommen von Malocclusionen wird angegeben. Die Methode wird als eine systematische Registrierung genau definierter individueller Symptome beschrieben. Die Registrierung einiger Symptome wird durch den Gebrauch eines speziell konstruierten Registrierungsinstrumentes erleichtert. Das Behandlungsbedürfnis kann auch mit dieser Methode festgestellt werden, doch ist dieses notwendigerweise subjektiv.

Die Untersuchung ist für eine elektronische Analyse der eingesammelten Daten angelegt, und diese wird später beschrieben werden.

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