An objective method of examining for and assessing malocclusion in population groups is presented in this report. The procedure is rapid and simple, and has been used as an epidemiological survey tool. Results of such application are described and discussed by the authors.

ASSESSMENT OF MALOCCLUSION IN POPULATION GROUPS

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THE DETERMINATION of inciting factors and their role in the distribution and frequency of malaligned teeth and improper jaw relationships has been seriously hampered by the lack of objective criteria for establishing norms, describing prevailing situations, and assessing group differences.

In the past, dental surveys of population groups have emphasized facts that reflect the impact of caries on dental health status. Counts of decayed, filled, and missing teeth, expressed as DMF rates, have proved to be objective devices for assessing the caries problem, and evaluating the progress of preventive and restorative programs. The DMF survey provides a rapid and reliable method for acquiring these useful data.

Recently, a survey method for periodontal disease has been developed.[1] The procedure involves scoring on a progressive scale the condition of the investing tissues of each tooth. The findings are expressed as an index based upon an average of scores for the individual teeth. When conducted in conjunction with a DMF assessment, this added feature greatly broadens the scope of the examination and causes little added discomfort or inconvenience to the person examined.

This paper is a progress report of preliminary work in the development of an examination procedure for malocclusion. The procedure gives promise of extending further the scope and usefulness of information collected.

Because of the nature of malocclusion there are many limitations that affect the objectives of any assessment method that may be adopted. Malocclusion is not a single entity, but rather a collection of situations, each in itself constituting a problem. Many of the situations are complicated by a multiplicity of causes and are reversible through growth and development, or through tooth loss and treatment. In the work carried out so far, it has been assumed that the primary purpose of an assessment of malocclusion is to provide data useful for group study, even though the index may not be sufficiently sensitive for selecting cases for treatment.

While a screening procedure may evolve as a valuable outgrowth of the assessment, this feature has been con-
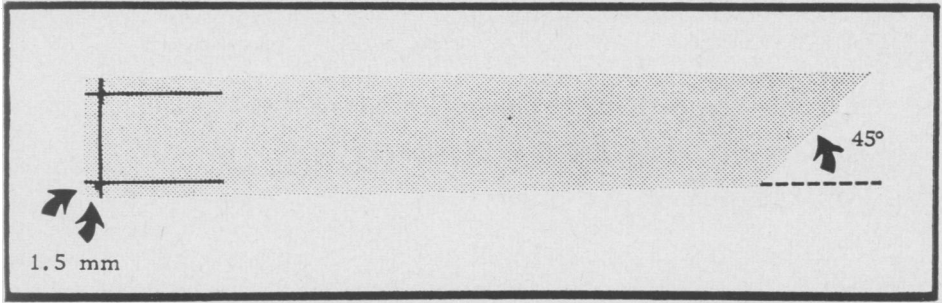
Figure 1—Schematic Drawing of Instrument Used for Measurement

The clear plastic ruler-like instrument ½″ x 4″ has a 45° angle cut at
one end and lines etched 1.5 mm from the edges of the other end.

sidered as secondary to group comparisons. Emphasis was placed upon the development of an objective examination method to assure that differences, once found, would reflect true group differences. The procedure has been kept simple to assure its rapid applicability in field programs. It is designed to provide index values which should not only quantify the level of malocclusion in individual mouths but should also rank the build-up of problems in population groups. This would permit both a comparison between groups examined and an assessment of changes associated with preventive or corrective programs.

The assessment method differs from that followed in a routine clinical examination by an orthodontist or other dentist. Neither a conventional dental chair nor an examination light is used, although an adequate fixed source of light is essential. A small plastic, gauge-like tool especially designed for the work is the only instrument used in making the necessary measurements for assessment (Figure 1).

Malalignment of teeth was selected for measurement because of the frequency of its occurrence, and its high degree of association with other situations which are most commonly represented in the total malocclusion complex. Scoring of individual tooth findings are summated for the anterior and right and left posterior segments of each arch. A final malalignment index is obtained as the total of the six segment scores.

Examination and Scoring Procedure

The segments are assessed in the following order: Maxillary anterior, maxillary right posterior, maxillary left posterior, mandibular anterior, mandibular right posterior, and mandibular left posterior. Each tooth present in a segment is scored 0, 1, or 2.

A score of 0 is for Ideal Alignment. Here the tooth shows no apparent deviation from the ideal arch line as projected through the contact areas (Figure 2).

Score 1 represents Minor Malalignment of two types. The first is Rotation. Here the angle formed by the line projected through the contact areas of observed tooth and the ideal arch line is less than 45°. The second is Displacement. In this situation, both contact areas of the tooth are removed in the same direction from their position in

ideal alignment but less than 1.5 mm removed (Figure 2).

Score 2 covers Major Malalignments of Rotation and Displacement. Major Rotation is present when the angle formed by the line projected through the contact areas of the observed tooth and the ideal arch line is 45° or larger. Major Displacement occurs when both contact areas of the tooth are removed from their position in ideal alignment by 1.5 mm or more (Figure 2).

The plastic instrument is superimposed over the teeth for the scoring measurements. As the examination is completed for each segment, the values are summated to give a score for that segment. The final malalignment index is obtained as the sum of the scores recorded for all six segments. Experience to date indicates that one minute or less is required for the entire procedure. The range of values may extend from 0 to 64 in mouths with 32 teeth present. How-
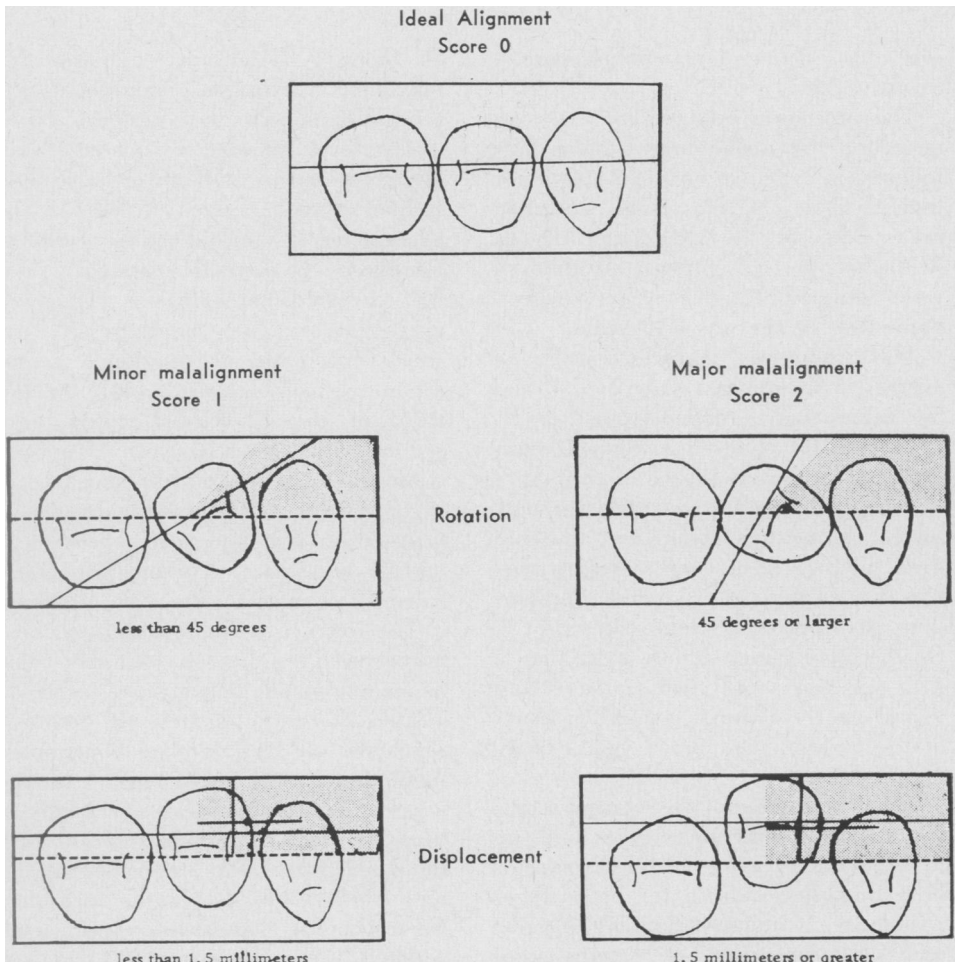

Figure 2—Schematic Diagram of Malalignment Scoring Procedure

Table 1—Per cent Distribution of Grouped Malalignment Scores by Age for 2,100 Junior High School Students

Age	Number Examined	Average Malalignment Scores	Range of Malalignment Scores				
			All	0–5	6–7	8–9	10 and Greater
All	2,100	7.5	100.0	28.3	26.8	21.5	23.4
Under 12 years	16	6.7	100.0	37.5	25.0	25.0	12.5
12 years	473	6.9	100.0	34.9	29.2	19.0	16.9
13 years	620	7.4	100.0	31.2	25.2	22.3	21.3
14 years	719	7.6	100.0	25.2	25.1	24.4	25.3
15 years	237	8.3	100.0	19.4	29.1	16.5	35.0
16 years and older	35	8.6	100.0	8.6	42.8	17.1	31.5

ever, in practice, few mouths score 0 or above 18.

The procedure outlined for assessing teeth for the malalignment index was followed in examinations for 2,100 junior high school children from suburban areas adjacent to Washington, D. C. With but few exceptions the children were between 12 and 15 years of age— their average age was 13.9 years.

The group was characterized by an average malalignment score of 7.5, and the values scored ranged from 0 to 21. Of the 2,100 children examined, however, only five were scored 0, and scores in excess of 18 were recorded for only seven. More than a fourth of the children (28.3 per cent) had scores between 0 and 5 (Table 1). A similar proportion (26.8 per cent) were scored 6 or 7. On the other hand, slightly more than a fifth (21.5 per cent) had scores of 8 or 9 and nearly a fourth (23.4 per cent) of the children had index values of 10 or more.

The contribution of the segment scores to the total malalignment index built up to somewhat greater levels in anterior than in posterior teeth for both arches (Table 2). Similarly, for both anterior and posterior teeth, the scores were greater in the mandible than in the maxilla. The scores for the four areas were

as follows: Mandibular anterior 2.2, maxillary anterior 2.0, mandibular posterior 1.8, and maxillary posterior 1.5.

The level reflected by average malalignment scores built up in an orderly fashion as age increased (Table 1). The average for 12-year-old children was 6.9. For those who were 15 years old, it was 8.3. Coincidental with this change in average scores was a progressive upward shift in the distribution of scores for individual children. More than a third of the 12-year-old group were scored with values between 0 and 5, while one in six had malalignment scores of 10 or more. In contrast, only one 15-year-old in five had scores between 0 and 5, and more than one-third were rated 10 or more on the scale of values.

The average score for each segment also showed a progressively higher value as the total malalignment score increased (Table 2). Proportionately, the posterior segments of both arches contributed more than anterior segments to the increase. Between the ages of 12 and 15 years, average scores for anterior teeth increased from 1.9 to 2.1 in the maxilla, and from 2.2 to 2.3 in the mandible. Corresponding changes in posterior teeth resulted in expansion from 1.3 to 1.7 in the maxilla, and from 1.5 to 2.2 in the mandible. In other words, the scores

Table 2—Average Malalignment Scores and Average Segment Score by Age for 2,100 Junior High School Students

| Age | Number Examined | Average Malalignment Scores | | | | |
		Total Score	Maxillary Anterior	Mandibular Anterior	Maxillary Posterior	Mandibular Posterior
All	2,100	7.5	2.0	2.2	1.5	1.8
Under 12 years	16	6.7	2.1	2.5	1.2	0.9
12 years	473	6.9	1.9	2.2	1.3	1.5
13 years	620	7.4	2.0	2.2	1.5	1.7
14 years	719	7.6	1.9	2.1	1.6	2.0
15 years	237	8.3	2.1	2.3	1.7	2.2
16 years and older	35	8.6	2.0	2.3	2.0	2.3

for anterior segments expanded by less than a tenth, in contrast with increases of about a third for posterior teeth in both arches.

There was little evidence to suggest any difference between boys and girls in the distribution of segment scores. Nor was there any difference in the manner in which the total malalignment index increased with advance in age.

In the course of the preliminary work leading to the development of the malalignment index, dental examinations were completed on each of more than 300 teenage boys in a special study group. For the most part these boys were 15, 16, or 17 years of age. Their average age was 16.6 years. The average malalignment index for the group was 7.6, not far different from that found for the younger junior high students. The distribution of their individual scores was also similar, except that somewhat greater proportions were concentrated in the 0 to 5 (33.2 vs. 28.3 per cent), and the 10 and over categories (27.7 vs. 23.4 per cent). Correspondingly fewer scores were found in the 6 to 9 range (39.1 vs. 48.3 per cent).*

As a preliminary assessment of the malalignment index as a measure of severity of malocclusion, a selected small sample of 152 boys was drawn from the teenage group. Concurrent appraisals by the index and by a clinical evaluation of an experienced orthodontist were performed. To minimize the effect of gross neglect and tooth loss upon the appraisal, the sample, by and large, was composed of boys with full complements of anterior teeth, and with somewhat better dental conditions than most of the group.

The average malalignment score for this sample of boys was 6.9, slightly below that for all boys in the teenage group. The proportion with scores between 0 and 5 rose to 35.5 per cent, those between 6 and 9 to 42.8 per cent.

* Per cent Distribution of Grouped Malalignment Scores of 307 Teenage Boys

| Number Examined | Average Malalignment Score | Range of Malalignment Scores | | | |
		All	0–5	6–9	10 and Greater
307	7.6	100.0	33.2	39.1	27.7

The proportion with scores of 10 or more was 21.7 per cent.* The clinical appraisal by the orthodontist rated 15.8 per cent with slight, 37.5 per cent with mild, and 46.7 per cent with moderate or severe malocclusion (Table 3).

The association between malalignment scores and the orthodontist's appraisals, even though based upon a small sample, is very striking (Table 3). Of the 55 boys with index scores of 5 or less, 32.7 per cent were classified with slight, 43.6 per cent with mild, and 23.7 per cent with moderate or severe malocclusions. The 65 individuals with scores between 6 and 9 included only 9.2 per cent with slight, 41.5 per cent with mild, and 49.3 per cent or nearly one-half with moderate and severe malocclusion. Finally, among the 32 boys with malalignment scores of 10 or more, the orthodontist found no case he could classify as slight. He rated only 18.8 per cent with mild malocclusion, but found 81.2 per cent with moderate or severe malocclusion.

A project carried out to test agreement in the findings of two examiners in their application of a dental screening examination of broad scope offered an opportunity to compare malalignment in-

dex values for paired observations. The sample, while limited to 67 boys from the teenage group, included members who were especially selected to reveal poor oral hygiene and periodontal disease.

The impact of adverse selection in the subsample used is reflected in the high malalignment index values which averaged 10.8. This is divergent from the average of 7.6 found in all the teenage groups and the 6.9 for the subsample used in the orthodontic appraisal. For this group only 3.7 per cent were scored between 0 and 5, 40.3 per cent between 6 and 9, and 56.0 per cent 10 or more.†

Analysis of the malalignment scores recorded in the two sets of examinations showed no large divergence. The average index values were 10.6 and 11.1.

Summary

An objective method for assessing malocclusion in population groups has been presented. The examination provides for scoring the departure of each tooth from its ideal position in the arch and the summing of these scores for a malalignment index. The examination

* Per cent Distribution of Grouped Malalignment Scores for 152 Teenage Boys

Number Examined	Average Malalignment Score	Range of Malalignment Scores			
		All	0–5	6–9	10 and Greater
152	6.9	100.0	35.5	42.8	21.7

† Per cent Distribution of Grouped Malalignment Scores for 67 Teenage Boys

Examiner	Number of Examinations	Average Malalignment Score	Range of Malalignment Scores			
			All	0–5	6–9	10 and Greater
Average[1]	134	10.8	100.0	3.7	40.3	56.0
A	67	10.6	100.0	3.0	44.8	52.2
B	67	11.1	100.0	4.5	35.8	59.7

1. Average of examinations performed by two dentists on 67 boys.

Table 3—Per cent Distribution of Grouped Total Malalignment Scores by Orthodontic Rating of Malocclusion for 152 Teenage Boys

Range of Malalignment Scores	Number Examined	Orthodontic Rating			
		All	Slight	Mild	Moderate and Severe
All	152	100.0	15.8	37.5	46.7
0–5	55	100.0	32.7	43.6	23.7
6–9	65	100.0	9.2	41.5	49.3
10 and greater	32	100.0	0	18.8	81.2

procedure is both rapid and simple in its application. In its preliminary use as an epidemiological survey tool, the malalignment index has demonstrated a progressive increase in average scores from age 12 to age 15 years. The increase is three times as great in the posterior as in the anterior areas of the jaws. In the age groups studied, the largest contribution to the total score is made by the mandibular anterior segment, but as age increases, the differences become progressively less apparent.

REFERENCE

1. Russell, A. L. A System of Classification and Scoring for Prevalence Surveys of Periodontal Disease. J. Dent. Res. 35:350–359 (June), 1956.

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Nurses Invited to a Pre-APHA Symposium

The American Heart Association extends a cordial invitation to nurses attending the APHA Annual Meeting to participate in a program for nurses in Philadelphia on Saturday, October 24.

Of special interest to those concerned with administration and nursing education, the program includes a symposium on "An Experience in the Preparation of the Nurse for the Care of the Patient with Cardiovascular Disease—A Report of the Minnesota University Training Program," to be moderated by Marion Murphy, R.N.; a luncheon sponsored by the Heart Association's Council on Community Service and Education, to be addressed by the Honorable Arthur S. Flemming, Secretary, U. S. Department of Health, Education, and Welfare; optional attendance at a regular scientific session on clinical cardiology; and a tour of the scientific exhibits.

Advance registration is important, and registration and hotel reservation forms may be had from: American Heart Association, 44 East 23rd St., New York 10, N. Y.