SPECIAL ARTICLE

The ABO discrepancy index: A measure of case complexity

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A criterion for determining the acceptability of a case presented for the American Board of Orthodontics (ABO) Phase III clinical examination is case difficulty. Case difficulty can often be subjective; however, it is related to case complexity, which can be quantifiable. Over the past 5 years, the ABO has developed and field-tested a discrepancy index, made up of various clinical entities that are measurable and have generally accepted norms. These entities summarize the clinical features of a patient's condition with a quantifiable, objective list of target disorders that represent the common elements of an orthodontic diagnosis: overjet, overbite, anterior open bite, lateral open bite, crowding, occlusion, lingual posterior crossbite, buccal posterior crossbite, ANB angle, IMPA, and SN-GoGn angle. The greater the number of these conditions in a patient, the greater the complexity and the greater the challenge to the orthodontist. The ABO is considering several options for applying the discrepancy index to the Phase III clinical examination. (Am J Orthod Dentofacial Orthop 2004;125:270-8)

A criterion for determining the acceptability of a case submitted for the American Board of Orthodontics (ABO) Phase III clinical examination is case complexity. Case complexity is defined as "a combination of factors, symptoms, or signs of a disease or disorder which forms a syndrome."[1] Therefore, the ABO has devised the Discrepancy Index (DI) to provide an objective evaluation of complexity that might lead to a better understanding of difficulty. The DI is an objective method to describe the complexity of the treatment for a patient based on observations and measurements taken from standard pretreatment orthodontic records, including casts and cephalometric and panoramic radiographs.

Additionally, the DI was developed to create an alternative to the ABO case category requirements or possibly to supplement but not entirely replace them.[2] The rationale for this was to offer a broader basis to qualify cases for the ABO Phase III clinical examination. The case categories[3-9] were created to help establish target disorder[10] baselines for case presentations and to benchmark and measure specific treatment skills that are typical clinical challenges encountered by the orthodontic specialist.

This DI method of case analysis is the ABO's current approach to summarizing the clinical features of a patient's condition with a quantifiable, objective list of target disorders that represent common problems associated with orthodontic diagnosis.

HISTORY

The DI was initially developed in 1998 at a meeting of the 8 ABO directors and 6 former directors who were then serving as consultants to the ABO. During the 1999 Phase III examination, 100 cases submitted by candidates were scored for discrepancy by 2 directors, and this data provided the initial pilot study of the DI. Based on these results and the discussion that followed, the DI was modified, and additional field tests and data analyses were performed at the 2000, 2001, 2002, and 2003 examinations, with all directors and examiners scoring every case for discrepancy.

In addition, in 2002, candidates were asked to score their optional cases (categories 9 and 10) for discrepancies and, in 2003, were asked to score all the cases they presented. Based on these field tests, additional modifications were made to the DI, and candidate/examiner calibration was assessed. The results of these field tests are summarized in Figures 1 and 2. The results of the field tests show that 3 categories—5, 6,

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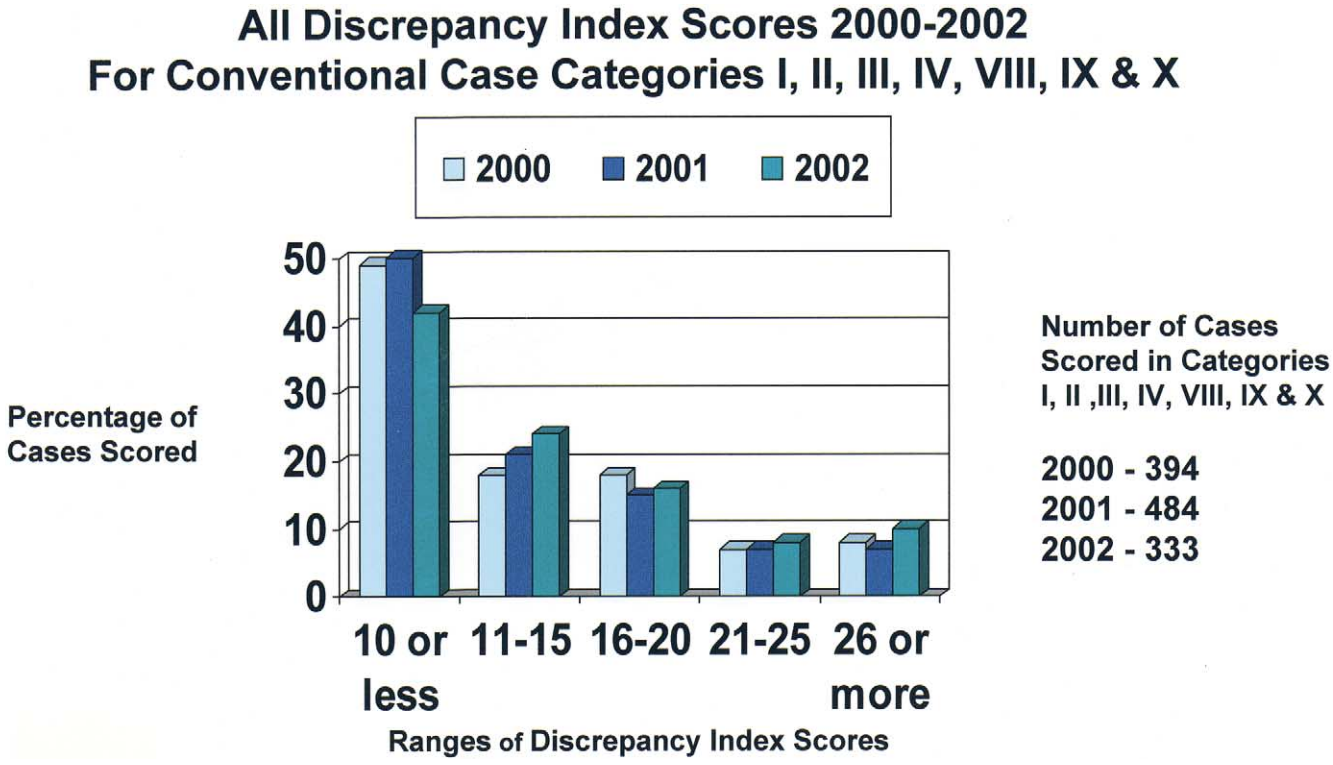

Fig 1. DI ranges.

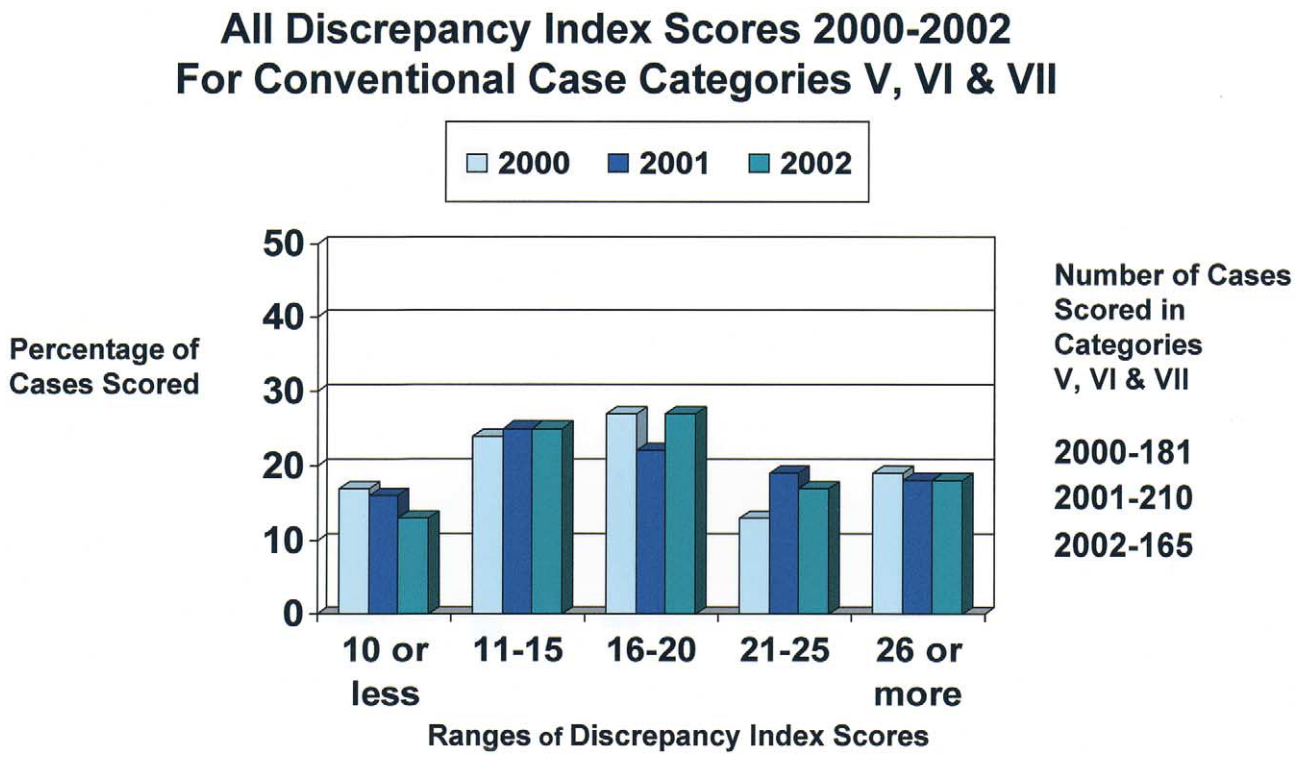

Fig 2. DI ranges.

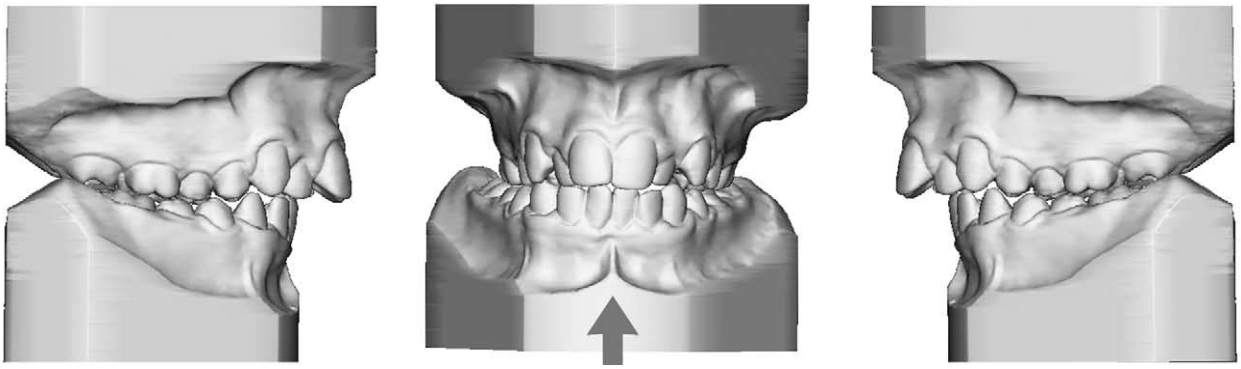

Fig 3. Occlusal relationship position.

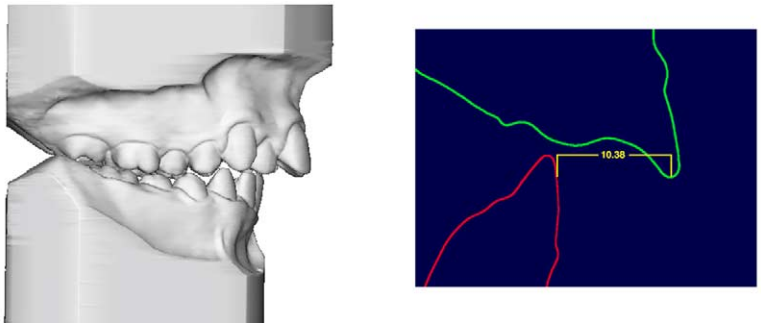

Fig 4. Overjet.

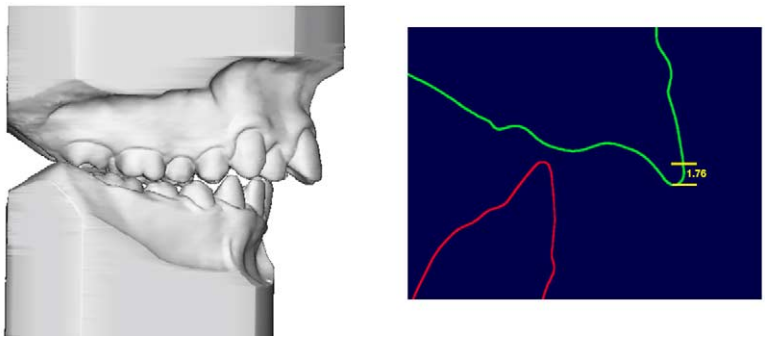

Fig 5. Overbite.

and 7—have higher discrepancy scores, and categories 1, 2, 3, 4, 8, 9, and 10 show moderate to lower discrepancy scores.

The target disorder elements chosen to make up the DI are measurements of overjet, overbite, anterior openbite, lateral openbite, crowding, occlusion, lingual posterior crossbite, buccal posterior crossbite, ANB angle, IMPA and SN-GoGn angle.

An additional category designated "Other" is also available so that other conditions that might affect or add to treatment complexity can be scored. When scoring discrepancy, model occlusion (Fig 3) is determined by placing the backs (bases) of models on a flat surface after they have been placed together in occlusion. All measurements must be made from this occlusal relation position. A description of each measurement follows.

Overjet (Fig 4) is scored as the distance between the

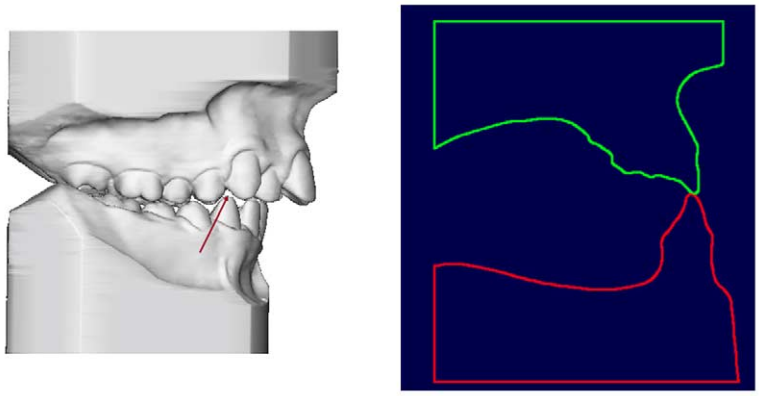

Fig 6. Anterior open bite.

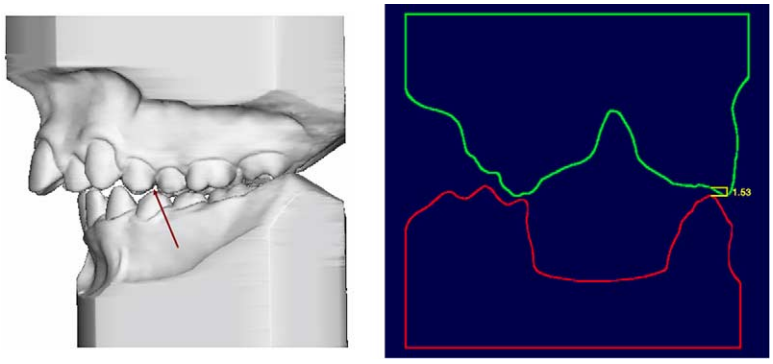

Fig 7. Lateral open bite.

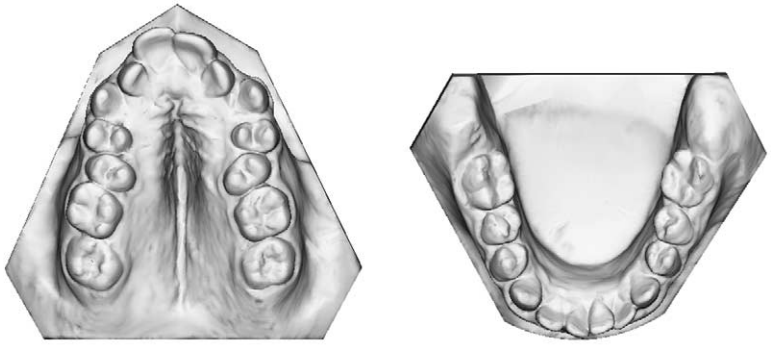

Fig 8. Crowding.

lingual incisal edge of the most forwardly positioned maxillary incisor to the labial incisal edge of the most forwardly positioned mandibular incisor. For an overjet of 0 mm (edge to edge), 1 point is scored; for overjets of 1-3 mm, no points are scored; for 3.1 to 5 mm, 2 points are scored; for 5.1 to 7 mm, 3 points are scored; for 7.1-9 mm, 4 points are scored, and if greater than 9 mm, 5 points are scored. If there is a negative overjet (anterior crossbite), the score is recorded as 1 point per mm for each anterior tooth in crossbite.

For an overbite (Fig 5) up to 3 mm, no points are scored. If the overbite is 3.1-5 mm, 2 points are scored; if it is 5.1-7 mm, 3 points are scored. If the mandibular

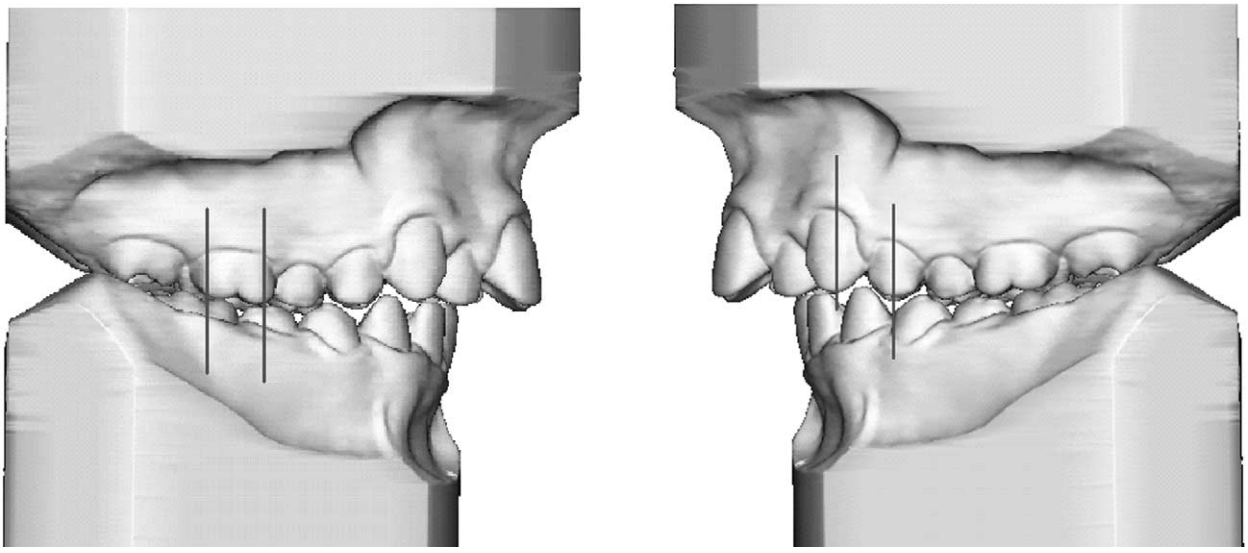

Fig 9. Occlusion.

Fig 10. Lingual posterior crossbite.

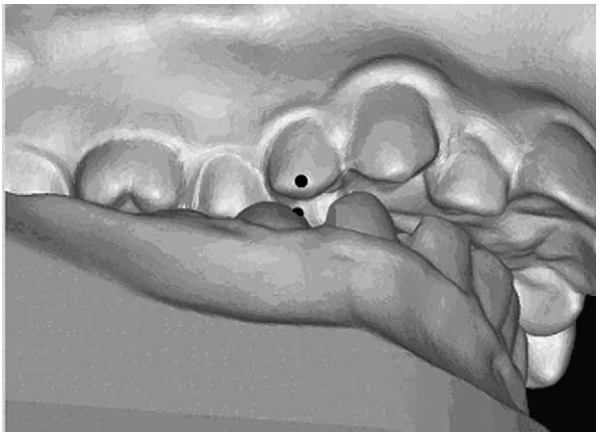

Fig 11. Buccal posterior crossbite.

incisors are impinging on the palatal tissue (100% overbite), then 5 points are scored.

For anterior open bite, if the maxillary and mandibular incisors are in an edge-to-edge relationship (overbite = 0), then 1 point is scored. For each millimeter of openbite, 2 points are scored for each maxillary tooth involved from canine to canine. No points are scored for the maxillary canines if they are blocked out of the arch to the labial (Fig 6).

For lateral open bite, for each maxillary tooth (from first premolar to third molar) in an open bite relationship with the mandibular arch, 2 points are scored per millimeter of open bite for each tooth (Fig 7).

When scoring crowding (Fig 8), the most crowded dental arch is considered. If crowding is 1-3 mm, 1 point is scored; from 3.1-5 mm, 2 points are scored; from 5.1-7mm, 4 points are scored, and if greater than 7 mm, 7 points are scored.

When scoring occlusion (Fig 9), the Angle classification is used. If the mesiobuccal cusp of the maxillary first molar occludes with the buccal groove of the mandibular first molar or anywhere forward of the buccal groove but short of the mesiobuccal cusp, no points are scored. If the occlusal relationship is end on (cusp to cusp) toward a Class II or Class III but less than a Class II or Class III relationship, 2 points are scored per side. If the relationship is a full Class II or Class III, then 4 points are scored per side.

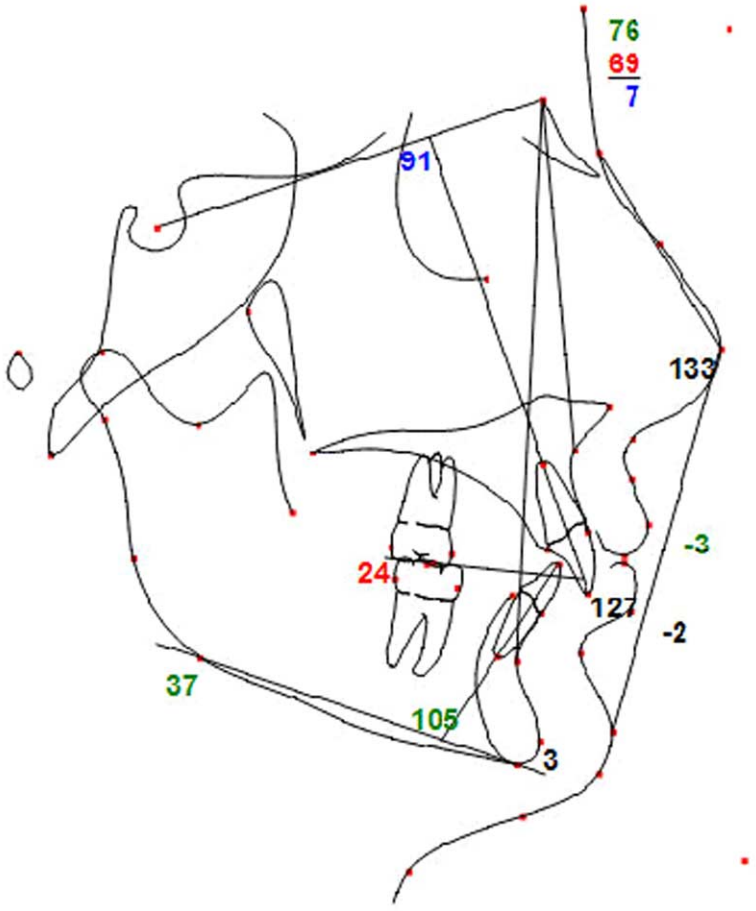

Fig 12. Cephalometric values.

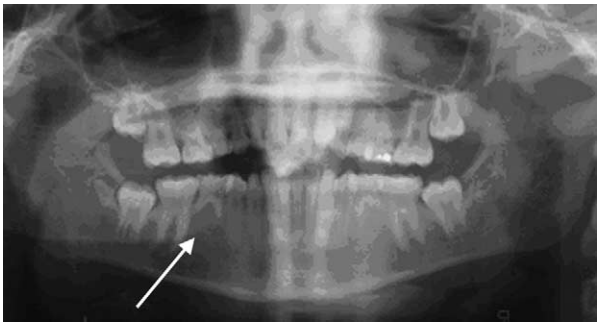

Fig 13. Congenital absence.

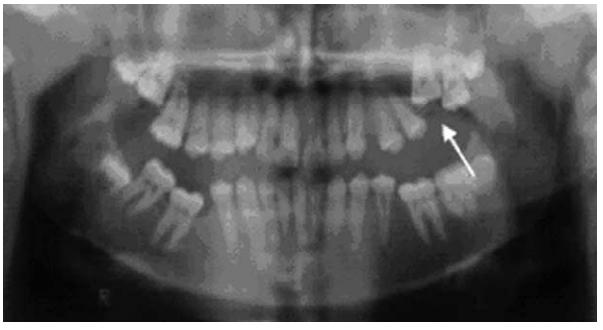

Fig 14. Ectopic eruption.

If the relationship is greater or beyond Class II or Class III, then 1 additional point is scored per side.

For lingual posterior crossbite, for each maxillary tooth in lingual crossbite, 1 point is scored (Fig 10).

For each maxillary posterior tooth in complete buccal crossbite, from first premolar to third molar, 2 points are scored (Fig 11).

Procedures for scoring skeletal or dental relationships that increase case complexity based on cephalometrics

1. If the ANB angle is greater than 5.5° or less than −1.5°, 4 points are scored. For each additional degree above or below these values, 1 point is scored.

Fig 15. Transposition.

2. If the SN-GoGn angle is between 27° and 37°, no points are scored.
3. If the SN-GoGn angle is greater than 37°, then 2 points are scored for each degree above 37°.
4. If the SN-GoGn angle is less than 27°, then 1 point is scored for each degree below 27°.
5. If the IMPA angle is greater than 98°, 1 point is scored for each degree above 98°.

The following is an example of a cephalometric grading sequence (Fig 12).

SNA 76.0°
SNB 69.0°
ANB 7.0°: 5 points scored
SN- GoGn 37.0°: no points scored
IMPA 105.0°: 7 points scored

Other

Because it is impossible to include every clinical entity that might contribute to treatment complexity in an index, the "other" category permits the scoring of other commonly occurring conditions. An additional 2 points can be scored for each of the following: missing or supernumerary teeth (Fig 13), ectopic eruption (Fig 14), transposition (Fig 15), anomalies of tooth size and shape, CR-CO discrepancies, skeletal asymmetry, excess curve of Wilson. Each "Other" condition scored must be noted on the scoring sheet (Fig 16).

DISCUSSION

The target disorders of which this index is comprised were chosen because they represent most conditions that orthodontists treat. They were also chosen because all could be related to deviations from generally accepted norms. Another consideration was that the DI measurements could be done relatively quickly and simply.

Do these measurements equal difficulty? Difficulty is elusive because inherently it remains somewhat subjective and a matter of perception. Some conditions

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DISCREPANCY INDEX

CASE CATEGORY _____

TOTAL D.I. SCORE _____

CAST EVAL. SCORE _____

OVERJET

0 mm. (edge to edge)	=	1 pt.
1 – 3 mm.	=	0 pts.
3.1 – 5 mm.	=	2 pts.
5.1 – 7 mm.	=	3 pts.
7.1 – 9 mm.	=	4 pts.
> 9 mm.	=	5 pts.

Negative OJ (x-bite) 1 pt. per mm. per tooth =

Total = _____

OVERBITE

0 – 3 mm.	=	0 pts.
3.1 – 5 mm.	=	2 pts.
5.1 – 7 mm.	=	3 pts.
Impinging (100%)	=	5 pts.

Total = _____

ANTERIOR OPENBITE

0 mm. (edge to edge) = 1 pt.
then 2 pts. per mm. per tooth

Total = _____

LATERAL OPENBITE

2 pts. per mm. per tooth
Total = _____

CROWDING

0 – 3 mm.	=	1 pt.
3.1 – 5 mm.	=	2 pts.
5.1 – 7 mm.	=	4 pts.
> 7 mm.	=	7 pts.

Total = _____

OCCLUSION

Class I to end on	=	0 pts.
End on Class II or III	=	2 pts. per side
Full Class II or III	=	4 pts. per side
Beyond Class II or III	=	1 pt. per mm. Additional

Total = _____

LINGUAL POSTERIOR X-BITE

1 pt. per tooth Total = _____

BUCCAL POSTERIOR X-BITE

2 pts. per tooth Total = _____

CEPHALOMETRICS

ANB > 5.5 or < -1.5	=	4 pts.
Each Additional Degree	=	1 pt.
SN-GO-GN 27 deg. – 37 deg.	=	0 pts.
SN-GO-GN > 37 deg.	=	2 pts. per degree
SN-GO-GN < 27 deg.	=	1 pt. per degree
IMPA > 98 deg.	=	1 pt. per degree

Total = _____

OTHER 2 Points = _____
(See instructions)

INDICATE PROBLEM _____

_____

_____

Fig 16. DI scoring sheet.

that are considered difficult by some orthodontists might be perceived as relatively easy to treat by others. This might be due to differences in overall approach to treatment, differences in appliances or appliance design, or differences in training. However, most clinicians will agree that the greater the number of target disorders, the greater the complexity of the case. For this reason the term discrepancy, rather than difficulty index, has been used.

Over the years, indexes[11-13] have been developed primarily to assess treatment need. Generally, when using these indexes, a threshold is set, and cases must reach that threshold to set the priority for treatment need. This did not serve the ABO's purpose, which was not to determine treatment need but to develop a method to assist in the selecting cases for the Phase III examination that was related to the complexity of treatment.

Some indexes are also used to evaluate the outcome of treatment by measurements made before and after treatment. Although the score of the target disorders might be reduced to near zero after treatment, the case would still have to meet the requirements of a finished occlusion according to the ABO cast and panoramic radiograph grading system.[14,15] Therefore, how can the DI be used?

After 5 years of field testing and with feedback from the orthodontic educational community and other members of the specialty, the ABO is considering how the DI can be applied to the Phase III examination. Several possibilities have emerged. It could be used to substitute for a category when category substitutions are allowable, it could be used as an alternative to strict category requirements, or it could be factored into the overall decision of case acceptability and completeness. As of this writing, the ABO has decided to offer the DI as an alternative to case category requirements for the next 3 years and then to evaluate the results.[15] The results of the field tests indicated that 2 ABO case categories consistently displayed a high DI, 6 were in the moderate range, and 2 were in the lower range (Figs 1 and 2).

Based on these statistics, the requirement for using the DI has been set at a DI of 25 and above for 2 cases, a DI of 16 and above for 6 cases, and a DI of 7 and above for 2 cases. The case display must include at least 2 Class II cases, 1 of which requires extraction of teeth in both arches, 1 case started in the mixed dentition, and 1 adult case (patient 21 years or older). No more than 2 can be combined orthodontic-orthognathic surgical cases. The intent of offering DI as an alternative to case categories is to provide a broader basis for cases to qualify for the Phase III examination.

The ABO will continue to closely monitor the results of this and future field tests. The DI will no doubt continue to contribute to the overall objectivity of the Phase III examination and be available to make candidates aware of what is expected of them as they prepare for their examination. The tools that the ABO has developed to evaluate cases presented for certification are also meant to be a mechanism for self-assessment for orthodontists; this can lead to improvement over the life span of a practice.

To make the certification process as clear and open as possible, the ABO will continue to publish articles that shed light on the examination process to help prepare candidates for an examination that will remain fair and comprehensive. A video disk presentation describing the DI will be available in the ABO office soon.

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