Research Paper Dental Sciences

A Systematic Method of Evaluating Treatment Outcome Using Abo Grading System: A Review

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ABSTRACT

A number of systems have been developed for evaluating proper finishing of orthodontic cases to provide the orthodontist with the chance to conduct self assessment and opportunities to improve constantly. The ABO index uses an occlusal index for measuring the success of treatment. It is an objective grading system to evaluate post treatment dental casts and panoramic radiograph. The ABOI is gaining increased recognition in the orthodontic profession as a valid measure of excellence in orthodontic finishing.

KEYWORDS ABO score, Fixed Orthodontic Mechanotherapy, Post Treatment Outcome

INTRODUCTION

Orthodontic mechanotherapy is primarily dependent upon the material science and design. Bracket designs and archwires greatly affect the efficiency of treatment. Since the beginning, there has been a continuous ongoing research for better and faster methods of treatment. With the bracket design reaching an accepted level of sophistication, rendering treatment of malocclusion efficient and the attention focused on efficiency or superiority in final outcome.

Excellence in treatment finishing constitutes one of the fundamental goals of orthodontics, which is to establish or reproduce a normal, healthy occlusion. During all stages of treatment one should keep these goals in mind, providing a protected occlusion, better aesthetics (both dental and facial), good periodontal health and long term stability, which are correlated to proper finishing.[1]

Proper finishing of orthodontic cases can be evaluated by a number of systems developed for that purpose, and if done routinely in practice, may provide the orthodontist with the chance to conduct self assessment of his or her own work and, hopefully, with it, opportunities to improve constantly. If one does not implement systematic clinical protocols, one risks providing patients with incomplete or even unsatisfactory treatment outcomes.[2]

In an effort to enhance the reliability of the examiners and provide the examinees with a tool to assess the adequacy of their finished orthodontic results, the American Board of Orthodontics has established a Model Grading System to evaluate the final dental casts and panoramic radiographs.

HISTORY

Haeger et al.[3] developed an index for morphologic evaluation of dental relationships. The Ideal Tooth Relationship Index (ITRI) was based on the visual inspection for occlusal analysis according to the inclined planes, interproximal contacts, occlusal contacts and the cusp to marginal ridges relationships, of 92 sets of casts of orthodontic patients, at different times. The authors then presented a percentile quantification of the ideal dental relationships found in the population studied: the initial ITRI mean was 26%, improving to 52% at the end of treatment and continuing to improve up to a mean of 59% during and after the observed retention period.

Eismann[4,5] developed a method to analyze the efficiency of treatment, evaluating following

criteria:

a) crowding or spacing of incisors (per jaw)
b) crowding or spacing of posterior teeth (per side and jaw)
c) vestibular eruption of canine (per side and jaw)
d) rotation of incisors
e) axial inclination of teeth
f) overbite
g) frontal open bite (including canines; per 1-2 pairs of opposite teeth)
h) open bite of posterior teeth (per pair of opposite teeth)
i) overjet
j) crossbite of two opposite teeth in the frontal region (including canines)
k) anteroposterior occlusion of posterior teeth (per side and jaw)
l) deviation between the midline of the dental arch and the raphe palatine median
m) deviation between the midlines of the upper and lower jaws
n) deviations in the transverse occlusion of posterior teeth (per jaw).

Each criterion after being measured is compared to tables of values the investigators considered to be normal, and then a score in points is given to it. The final score is obtained by

adding the individual scores and the total represents the "extent of the morphological abnormality."In 1987, the PAR Index (Peer Assessment Rating) was developed to assess an occlusion at any stage of development. Over 200 dental casts representing various pretreatment and post treatment stages of occlusion were used to establish this index.However this measuring system is not precise enough to discriminate between the minor inadequacies of tooth position.[6]

Generally, these indices compare pretreatment and post treatment records to determine the quality of the final result. However, these indices are not precise, and the validity and reliability of these indices has not been established.

American Board of Orthodontics Objective Grading System [7]

Criteria and Rationale:
The ABO Objective Grading System for scoring dental casts contains eight criteria; alignment, marginal ridges, buccolingual inclination, occlusal relationships, occlusal contacts, interproximal contacts, overjet and root angulation.

ABO MEASURING GAUGE



Step (A) is 1mm in width and measures discrepancy in alignment, overjet, occlusal contacts, interproximal contact and occlusal relationships; (B), steps measure 1mm in height and are used to determine discrepancies in mandibular posterior bucco- lingual inclination; (C), steps measure 1mm in height and are used to determine discrepancies in marginal ridges; (D), steps measures 1mm in height and are used to determine discrepancies in maxillary posterior buccolingual inclination.

Alignment (Fig 1): In the maxillary, mandibular & anterior regions, proper alignment is characterized by coordination of alignment of the incisal edges and lingual incisal surfaces of the maxillary incisors and canines, and the incisal edges and labial incisal surfaces of the mandibular incisors and canines. In the mandibular posterior quadrants, the mesiobuccal and distobuccal cusps of the molars and premolars should be in the same mesiodistal alignment. In the maxillary arch, the central grooves (mesio-distal) should all be in the same plane or alignment. If all teeth are in alignment, or within 0.50 mm of proper alignment, no points are scored. If the mesial or distal alignment at any of the contact points is 0.50 mm to 1 mm deviated from proper alignment 1 point shall be scored for the tooth that is out of alignment. If the discrepancy in alignment of a tooth at the contact point is greater than 1 mm, then 2 points shall be scored for that tooth. No more than 2 points shall be scored for any tooth.

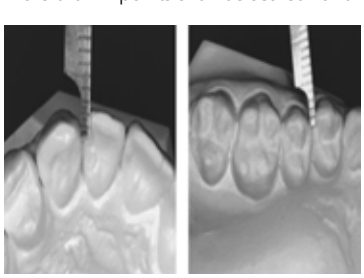

Fig 1

Scoring:

Deductions	Criteria
0	All teeth in alignment or within 0.5 mm of proper alignment.
1	0.5 - 1 mm deviation from proper alignment (for each tooth)
2	> 1mm deviation from proper alignment (for each tooth)

Marginal Ridges (Fig 2): Marginal ridges are used to assess proper vertical positioning of the posterior teeth. In patients with no restorations, minimal attrition, and no periodontal bone loss, the marginal ridges of adjacent teeth should be at the same level. If the marginal ridges are at the same relative height, the cementoenamel junctions will be at the same level. In a periodontally healthy individual, this will result in flat bone level between adjacent teeth. In scoring, do not include the canine-premolar contact; and do not include the distal of lower 1st premolar. If adjacent marginal ridges deviate from 0.50 to 1 mm, then 1 point is scored for that interproximal contact. If the marginal ridge discrepancy is greater than 1 mm, then 2 points shall be scored for that interproximal contact. No more than 2 points will be scored for any contact point. The marginal ridge will be considered as the most occlusal point that is within 1 mm of the contact at the occlusal surface of adjacent teeth.

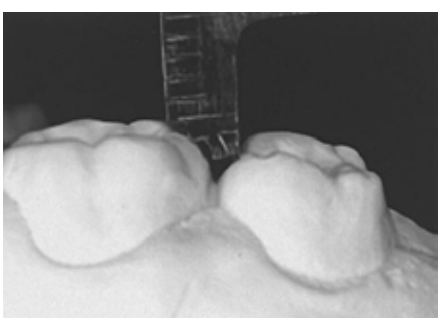

Fig 2

Scoring:

Deductions	Criteria
0	Marginal ridges of adjacent posterior teeth at the same level or within 0.50 mm of the same level.
1	Adjacent marginal ridges deviate from 0.50 to 1mm (for each tooth)
2	Marginal ridge discrepancy is greater than 1mm (for each tooth)

Buccolingual Inclination (Fig 3)**:** The buccolingual inclination is used to assess the buccolingual angulation of the posterior teeth. In order to establish proper occlusion in maximum intercuspation and avoid balancing interferences, there should not be a significant difference between the heights of the buccal and lingual cusps of the maxillary and mandibular molars and premolars, assessed by using a flat surface that is extended between the occlusal surfaces of the right and left posterior teeth. When positioned in this manner, the straight edge should contact the buccal cusps of contralateral mandibular molars and premolars. The lingual cusps should be within 1 mm of the surface of the straight edge. In the maxillary arch, the straight edge should contact the lingual cusps of the maxillary molars and premolars. The buccal cusps should be within 1 mm of the surface of the straight edge. The mandibular 1st premolars and the distal cusps of the second molars are not scored. If the mandibular lingual cusps or maxillary buccal cusps are more than 1 mm, but less than 2 mm from the straight edge surface, 1 point shall be scored for that tooth.

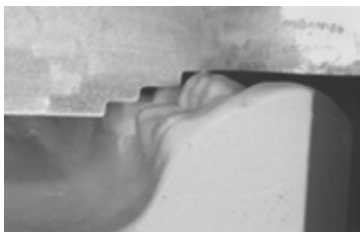



Fig 3

Scoring:

Deduction	Criteria
0	The discrepancy of buccal /lingual cusp within 1mm.
1	The discrepancy of buccal / lingual cusp between 1 -2 mm.
2	The discrepancy of buccal / lingual cusp greater than 2mm.

Occlusal Relationship (Fig 4): The occlusal relationship is used to assess the relative anteroposterior position of the maxillary and mandibular posterior teeth. In order to achieve accuracy and reliability in measuring this relationship, results of previous field tests have shown that the most verifiable method of scoring this criteria is to use Angle's relationship. Therefore, the buccal cusps of the maxillary molars, premolars, and canines must align within 1 mm of the interproximal embrasures of the mandibular posterior teeth. The mesiobuccal cusp of the maxillary first molar must align within 1 mm of the buccal groove of the mandibular first molar. If the maxillary buccal cusps deviate between 1 and 2 mm from the aforementioned positions, then 1 point shall be scored for that maxillary tooth. If the buccal cusps of the maxillary premolars or molars deviate by more than 2 mm from ideal position, then 2 points shall be scored for each maxillary tooth that deviates. No more than 2 points shall be scored for each maxillary tooth. In some situations, the posterior occlusion may be finished in either an Angle Class II or Class III relationship, depending upon the type of tooth extraction in the maxillary or mandibular arches.



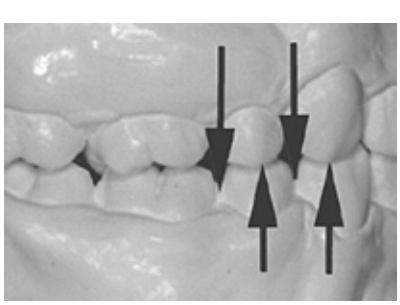

Fig 4

Scoring:

Deduction	Criteria
1	Maxillary buccal deviate between 1 - 2 mm from the afore mentioned positions
2	Discrepancy more than 2 mm from ideal position.

Occlusal Contacts (Fig 5)**:** Occlusal contacts are measured to assess the adequacy of the posterior occlusion. A major objective of orthodontic treatment is to establish maximum intercuspation of opposing teeth. Therefore, the functioning cusps are used to assess the adequacy of this criterion, i.e., the buccal cusps of the mandibular molars and premolars and the lingual cusps of the maxillary molars and premolars.

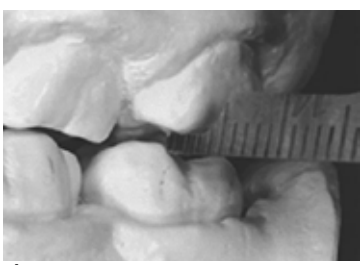

Fig 5

Scoring:

Deduction	Criteria
0	Cusps in contact with the opposing arch.
1	Cusps out of contact with discrepancy 1mm or less.
2	Cusps out of contact with discrepancy greater than 1mm.

Interproximal Contacts (Fig 6)**:** Interproximal contacts are used to determine if all spaces within the dental arch have been closed. Persistent spaces between teeth after orthodontic therapy are not only unaesthetic, but can lead to food impaction.

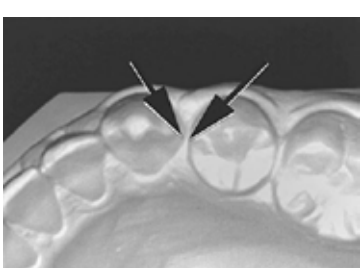

Fig 6

Scoring:

Deduction	Criteria
0	No interproximal space exist
1	Upto 1mm of interproximal space exists between two adjacent teeth.
2	More than 1mm of space between two adjacent teeth.

Overjet (Fig 7)**:** Overjet is used to assess the relative transverse relationship of the posterior teeth and the anteroposterior relationship of the anterior teeth. In the posterior region, the mandibular buccal cusps and maxillary lingual cusps are used to determine proper position within the fossae of the

opposing arch. In the anterior region, the mandibular incisal edges should be in contact with the lingual surfaces of the maxillary anterior teeth. If the mandibular buccal cusps deviate 1 mm or less from the center of the opposing tooth, 1 point is scored for that tooth. If the position of the mandibular buccal cusp deviates more than 1mm from the center of the opposing tooth, two points are scored for that tooth. No more than 2 points are scored for any tooth. In the anterior region, if the mandibular canines or incisors are not contacting lingual surfaces of the maxillary canines and incisors, and the distance is 1 mm or less, then 1 point is scored for each maxillary tooth. If the discrepancy is greater than 1 mm, then 2 points are scored for each maxillary tooth.

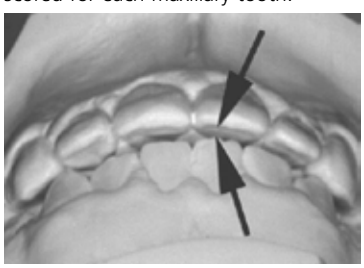

Fig 7

Scoring:

Deduction	Criteria (Buccal region)
0	Ideal relationship
1	Mandibular buccal cusps deviate 1mm or less from the centre of opposing tooth.
2	Discrepancy more than 1mm.

Deduction	Criteria (anterior region)
0	Ideal relationship
1	Mandibular canines or incisors not contacting the lingual surfaces of the maxillary canines and incisors and the distance is 1mm or less.
2	Discrepancy greater than 1mm.

Root Angulation (Fig 8): Root angulation is used to assess how well the roots of the teeth have been positioned relative to one another. If roots are properly angulated, then sufficient bone will be present between adjacent roots, which could be important if the patient were susceptible to periodontal bone loss at some point in time. The relative angulation of the roots of the maxillary and mandibular teeth is assessed on the panoramic radiograph. Generally, the roots of the maxillary and mandibular teeth should be parallel to one another and oriented perpendicular to the occlusal plane. If a root is angled to the mesial or distal (not parallel) and is close to, but not touching, the adjacent tooth root, then 1 point is scored for each discrepancy (anterior, premolar, and/or molar areas. If the root is angled to the mesial or distal and is contacting the adjacent tooth root, then 2 points are scored for that tooth.

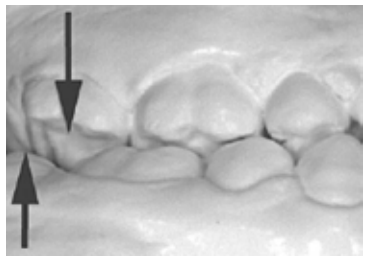

Fig 8

Scoring:

Deduction	Criteria
0	Deviation of the apex 1 mm or less,
1	Mild discrepancy with apex of the affected tooth greater than 1 mm but less than 2 mm from its ideal relationship
2	Discrepancy greater than 2 mm

The sums of the deductions of all the eight criteria were added together, yielding the overall ABO score. The total ABO score as well as the individual ABO scores for all the criteria of ABO grading system were analyzed and compared between the 3 groups. This provided an estimate of how far a case deviated from normal and the total deductions for post-treated cases reflected the success of treatment. In general, a case report that looses less than 20 points passes and greater than 30 points deducted fails.

SUMMARY

The ABO index uses an occlusal index for measuring the success of treatment. It is an objective grading system to evaluate post treatment dental casts and panoramic radiograph. The ABO index was designed to evaluate finished study casts to determine whether the finished case met the ABO standards for alignment of teeth. The 8 criteria summed to yield the ABO score are alignment, marginal ridges, buccolingual inclination, occlusal relationships, occlusal contacts, overjet, interproximal contacts and root angulation. These 8 criteria cover 85% of the mistakes. A unique factor of the ABOI is that it uses only final models and does not require the initial study casts to generate a score. The ABOI is gaining increased recognition in the orthodontic profession as a valid measure of excellence in orthodontic finishing.

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