The objective grading system according to the American Board of Orthodontics

The ABO has established an objective grading system to assist candidates for assessment of the adequacy of their finished orthodontic results. This system contains 8 criteria: alignment, marginal ridges, buccolingual inclination, occlusal relationships, occlusal contacts, overjet, interproximal contacts, and root angulation.

The **buccolingual inclination** is used to evaluate the clinical crown torque of the posterior teeth. 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. The ABO directors use a special step gauge to assess this relationship.

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**ASK AN EXPERT**

**THINGS YOU WANT TO KNOW**

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**Buccal uprighting of canines and premolars for improved smile esthetics and stability**

In this era of evidence-bolstered orthodontics, the clinical orthodontist must integrate the best scientific information available with his or her clinical experience to better serve each patient’s values and needs. Nonetheless, the American Board of Orthodontics (ABO) has established ideal static occlusal goals as assessed on dental casts for their phase III examination. The Board apparently operates on the premise that ideal occlusion occurs naturally, and that this occlusal arrangement is a desirable orthodontic goal for every patient. There is no evidence that such narrowly defined “ideal occlusion” is in any way a measure of oral health and quality of life. With the modern-day paradigms of esthetic enhancement and evidence-based decision-making in mind, is it a reasonable expectation that such arbitrary criteria for buccal crown inclinations, etc, constitute valid treatment goals that will achieve the best result and most esthetic outcome for all orthodontic patients?

—James L. Ackerman, Pittsboro, North Carolina, USA
ABO guide for grading buccolingual inclination of posterior teeth on dental casts

The buccolingual inclination of the maxillary and mandibular posterior teeth is assessed by using a flat surface that is extended between the occlusal surface of the right and left posterior teeth. The mandibular and maxillary arches are evaluated as follows:

In the mandible, the straight edge shall contact the buccal cusps of the contralateral molars. The lingual cusps should be within 1 mm of the surface of the straight edge. In the maxilla, the straight edge shall contact the lingual cusps of the molars and premolars. The buccal cusps shall be within 1 mm of the surface of the straight edge. 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 is subtracted for that tooth. If the discrepancy is greater than 2 mm, then 2 points are subtracted for that tooth. No more than 2 points are subtracted for any tooth. The total number of deductions is subtracted from 40 to give a score for posterior inclination. By using this grading system, candidates for the Board can grade their own results before their examination.

Validity of ABO criteria challenged

The practice of mechanically morphing the patient’s teeth into the ABO’s construct of ideal occlusion has recently been challenged,2 and an alternative paradigm predicated on a patient-centered, evidence-based clinical practice (EBCP) model. Specifically, it was emphasized that oral health–related quality of life includes many other factors than a narrowly defined ideal static occlusion on orthodontic plaster casts. In this light, the validity of the ABO certification process may be questioned.

In particular, orthodontics should embrace the concept of esthetic improvement as part of wellness and include the patient’s desire for dentofacial change, which is directly linked to his or her emotional wellness.2,3 Since an esthetic improvement of their tooth display is the main reason why most patients want orthodontic therapy, it would be prudent that the ABO define objective esthetic criteria or requirements of the finished orthodontic cases in the vertical and transverse dimensions for their examination. Detailed information may be available on the pre- and posttreatment photographs taken with the lips at rest and on smiling3–13. For individual patients, the most esthetic crown torque of the canines and posterior teeth may, or may not, correspond to the buccal inclination favored in the ABO grading system (see below).

Esthetic smile design

As discussed before,4,5 there are several individual design elements in the dentition that contribute to create an optimally attractive tooth display and smile for each patient. Prominent among these factors are the tooth reveal, tooth display at rest and during speech, the smile arc and its relationship to the lower lip contour, the occurrence or not of buccal corridors, and the symmetry and degree of crown torque of the canines and premolars.4,5 Esthetic smile design is a multifactorial decision-making process that allows the orthodontist to treat patients with an individualized approach.5

Optimal esthetic crown torque of canines and premolars

We have little evidence-based knowledge with regard to what is the most desirable and esthetic buccolingual inclination (clinical crown torque) of the maxillary and mandibular canines and premolars in different individuals. This is unfortunate, since such knowledge may be a key to providing each patient with a full and radiant smile, particularly in the premolar extraction cases.4 The crown torque of the terminal tooth shown on smiling (generally the first or second premolar7) appears to be more important for reflection of dental arch fullness than the presence or absence of buccal corridors5–13 (Fig 1).
Fig 1  Undesirable premolar crown torque in an extraction case. Note that the lingual crown inclination of both premolars (arrows in a) make these teeth almost “disappear” in the frontal smile view (b).

Fig 2  Excessive lingual crown torque of maxillary right canine and primary molars before the orthodontic treatment (a) necessitated marked third-order bends to provide adequate lingual root torque during treatment (b). Final result shows optimal and symmetric crown torque of the canines and premolars (c).

The torque prescriptions for most preadjusted appliance systems tend to create too much lingual crown torque of the maxillary and mandibular canines and posterior teeth. This is particularly true if these teeth have a pronounced lingual crown torque at the start of treatment (Fig 2). The view that the canines and premolars should have considerable lingual crown torque in an optimally treated orthodontic case, irrespective of jaw size, face type, and facial expressivity, is disputed from an esthetic perspective. In my opinion, the most appealing appearance of the dentition occurs when, in a normal-width dental arch, the maxillary canines have a bilaterally symmetric slight lingual inclination, and the first and second premolars are upright and display bilateral torque symmetry (Figs 3 and 4). Such an arrangement will secure full and radiant smiles in most patients. The presence of minimal buccal corridors helps eliminate the appearance of too many teeth in the front of the mouth. Excessive buccal corridors (see Fig 7c), however, are unesthetic to both orthodontists and laypersons.

With regard to jaw size, it appears to be a general rule for obtaining optimal smile esthetics that the smaller the maxillary apical base, the more buccal crown torque should be given to the canines and premolars (Figs 5d to 5f). This will mimic nature’s way of compensating for different sizes of the maxilla and the mandible (Figs 5a to 5c).

Since a broader smile is judged by laypersons to be more attractive than a narrow smile, it is important that the maxillary premolars are treated to an upright position in patients with narrow and tapered arch forms (Figs 4, 6, and 7).

It may be argued that a straight arrangement of the maxillary and mandibular premolars may induce a risk for functional balancing-side interferences and/or temporomandibular joint symptoms. The functional problems, if occurring, can safely be handled by careful equilibration of the lingual cusps. It is unlikely that occlusal patterns alone cause hyperactivity of the masticatory muscles associated with the temporomandibular joint.
Fig 3  Ideal buccal inclination of maxillary and mandibular canines and premolars (a,b) to provide full and radiant smile in a nonextraction orthodontic case (c,d). The canines have a slight lingual crown inclination, whereas the premolars are upright and straight (b). Note the bilateral symmetry.

Fig 4  Narrow dental arch (a,b) with constricted smile and large buccal corridors pre-treatment (c). Posttreatment the maxillary arch is only slightly enlarged and rounded (e), the canines have a slight lingual tilt, whereas the premolars are straight (d). Note proper derotation of the maxillary first molars (e). The smile 4 years after treatment is attractive with minimal buccal corridors (f).
Fig 5  Adult Class III case with an open-bite tendency before (a to c) and after (d to f) treatment. Note nature’s way of apical base compensation with labial crown inclination of both canines and premolars in the small maxilla, and lingual crown inclinations of lateral incisors in the larger mandible (a). The maxillary crowding was handled by interproximal enamel reduction (stripping) to avoid arch-form change (b,e). The slight labial inclination of the maxillary canines and premolars in the final result (d) is essential for the full and attractive smile (f).

Fig 6  Adult female patient with unilateral crossbite on the right side and rolled-in mandibular posterior teeth (a). Treatment included partial arch expansion for the crossbite, and uprighting of maxillary and mandibular posterior teeth by third-order bends to provide the necessary lingual root torque of these teeth during treatment (b). The maxillary canines have slight lingual crown inclination after treatment, whereas the premolars are uprighted to provide a full smile (c).

Need for third-order canine and premolar bends
For long-term stability reasons, it seems preferable not to change a normal arch form during orthodontic intervention, and obtain the smile fullness by intentionally adding buccal crown torque to lingually inclined canines and premolars rather than to (over)expand the arches laterally, which could lead to periodontal problems and instability. The additional buccal crown torque in the lower posterior segments will provide buccal uprighting and eliminate their tendency to roll in lingually (see Figs 6 and 7), which is a common side-effect of ortho-
dontic treatments with both standard and pretorqued brackets. The most obvious shortcoming of the preadjusted appliance systems is their inability to provide optimal and symmetric crown torque of canines and posterior teeth, particularly when there are evident torque asymmetries of contralateral teeth pretreatment (see Fig 2). The main reasons are due to (1) the small contact area between the archwire and the bracket wings to carry out a rather difficult tooth movement that involves moving an entire portion of the root through alveolar bone, and (2) that a full-size archwire is normally not used for adequately long time periods. Obviously, no single set of torque values exists that will solve the needs of all patients. Therefore, third-order canine and premolar bends are frequently needed for optimal torque control.

**Conclusion**

It is possible to obtain full and attractive smiles with minimal buccal corridors in patients with narrow-normal dental arch forms. By using third-order wire bends to torque the maxillary and mandibular canines and premolars around their centers of resistance during treatment, only moderate widening (and some rounding) of the dental arches will take place (see Figs 4, 5, and 7). When excessive lateral expansion is avoided, the chances for achieving long-term stability will be enhanced. The esthetic improvements of the patient’s smiles may be striking (see Figs 4 to 7), and may greatly contribute to the patient’s satisfaction with his or her treatment result. In this light, the strict ABO grading criteria for buccal inclinations may not provide the most optimal esthetic outcome for all patients.
REFERENCES


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