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Finishing and Detailing in Orthodontics: The Final Steps Toward Functional and Esthetic Excellence

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Abstract

Finishing and detailing represent the final and arguably most demanding phase of comprehensive orthodontic treatment, translating the broad correction of malocclusion into a precise, stable, and esthetically pleasing occlusion. This review traces the historical evolution of finishing philosophy from Angle's reliance on natural settling through the biomechanically driven systems of Tweed, Ricketts, Begg, Andrews, and Roth, and synthesizes the criteria that modern clinicians use to evaluate a finished case, including Andrews' Six Keys to Normal Occlusion, Roth's functional finishing criteria, Dougherty's seventeen finishing factors, and the American Board of Orthodontics Objective Grading System. It further discusses the horizontal, vertical, transverse, dynamic, cephalometric, and esthetic considerations that guide detailing, the philosophy and clinical mechanics of finishing within Ricketts' bio-progressive therapy and Begg's and Refined Begg's technique, and contemporary applications in pre adjusted edgewise, lingual, and clear aligner systems. Strategies for achieving stable, relapse-resistant occlusion —

including Raleigh Williams' six treatment keys for eliminating lower retention, methods of final occlusal settling, tooth positioners, and overcorrection protocols — are also reviewed. The evidence indicates that, despite the sophistication of modern pre-programmed appliances, meticulous clinical judgement and selective wire bending remain indispensable to achieving an optimally finished case.

Keywords: Finishing, Detailing, Occlusion, Beggs's, auxiliary.

Introduction

Orthodontic finishing has often been described as an art that blends individual clinical perception with meticulous attention to detail. It is essential for enhancing dental and facial esthetics, restoring healthy function of the stomatognathic system, and achieving structural balance across the skeletal, dento alveolar, and muscular components of the orofacial region. [1] Finishing may be defined as the fine-tuning of individual tooth positions and inter- and intra-arch relationships to optimize treatment outcomes; it represents the final phase of active orthodontic therapy, and satisfactory results are difficult to achieve if the preceding treatment objectives and mechanics have not been properly executed.[1]

Detailing, a closely related and essential component of finishing, refers to the precise positioning of each tooth across three planes of space — the buccolingual position of the crown, rotational correction, and mesiodistal tip together with torque of the root.[1] Finishing, detailing, and settling together constitute the concluding stage of treatment, during which the clinician refines occlusion, corrects residual discrepancies, and ensures proper inter digitation between the maxillary and mandibular arches in both static and dynamic occlusion.[1,2]

Numerous authors have proposed guidelines for finishing over the decades, but the most widely followed contemporary standard is the American Board of Orthodontics (ABO) Objective Grading System (OGS), a quantitative method for assessing final occlusion. [14] Importantly, finishing quality is not determined solely at the end of treatment — it is shaped from the outset by diagnosis, treatment planning, and execution of macro-mechanics (major tooth movements), since precise micro-mechanics in the final stage can only be performed reliably when the preceding gross corrections have been carried out accurately. When treatment mechanics are suboptimal, clinicians often resort to indiscriminate inter maxillary elastics or shortcuts such as inter proximal reduction rather than genuine detailing. The extent of work required at the finishing stage is influenced by appliance mechanics, initial bracket positioning, the need for repositioning, arch form, arch wire coordination, and force levels. While pre adjusted appliances have improved efficiency, their outcomes remain limited by the orthodontist's skill in bracket placement and by each appliance's ability to adapt to individual patient variation — underscoring that enhanced finishing and detailing practice directly improves both clinical efficiency and the quality of care delivered to patients.[1]

Historical Perspective: Evolution of Finishing Philosophy

The concept of finishing in orthodontics has evolved considerably, shifting from an early reliance on natural biological settling toward highly controlled, bio mechanically engineered approaches.[2]

Edward H. Angle, regarded as the father of modern orthodontics, believed the orthodontist's primary role was to establish correct inter arch relationships and restore normal arch form, leaving "the finer adjustment to individual type form to be worked out by nature." This philosophy relied on natural occlusal forces, eruption,

and function to achieve final tooth settling, with minimal need for wire detailing.[6]

Tweed's finishing philosophy centered on placing the mandibular incisors upright over basal bone for facial esthetics and stability, introducing second-order (artistic) bends during finishing to perfect axial inclinations — a markedly more biomechanically driven approach than Angle's. Ricketts emphasized arch form and the anter oposterior position of the lower incisors relative to the A-Pog line; his bio-progressive therapy required scientific prediction, controlled force systems, and cephalometric guidance for final tooth inclination and interarch coordination.[7]

Begg's philosophy relied on overcorrection — for example, finishing deep bites in an edge-to-edge or slightly open relationship, Class II cases in super Class I, and Class III cases slightly over-retracted — allowing physiological rebound to complete the detailing rather than perfecting occlusion at appliance removal. [8] Kesling, developing the Tip-Edge appliance, questioned the obsession with precise finishing in the Begg technique, considering it an “illusionary problem” given the biological variability among patients, and instead emphasized anchorage efficiency and controlled force application as the natural route to finishing.[2]

Merrifield extended Tweed's legacy, supporting overcorrection for major discrepancies and introducing the concept of denture recovery — the idea that post-treatment neuromuscular adaptation would further refine occlusion. Bench and colleagues highlighted biological contributors to successful finishing, including eruption, occlusal contact, functional adaptation, and growth, reinforcing that finishing should accommodate individual physiological settlement rather than rely solely on arch wire adjustment.[2]

A turning point came with Lawrence Andrews, who analyzed 120 untreated normal occlusions and derived the Six Keys to Normal Occlusion, standardizing torque, tip, and in-out values and building them into pre-adjusted brackets — the Straight-Wire Appliance. This dramatically reduced the detailing required during finishing by embedding biomechanical guidance into the appliance itself.[9,10] Roth subsequently expanded on Andrews' work by incorporating functional occlusion (gnathology), emphasizing centric relation, functional contacts, and long-term stability, and modestly adapting the bracket prescription accordingly.[11]

McLaughlin and Bennett advocated passive tie-backs and precise bracket placement, particularly in extraction cases, pioneering the MBT system in which finishing occurs proactively throughout treatment rather than as an isolated final phase. Lingual appliance systems adopted a Systematic Finishing Procedure involving sequential steps and specific finishing bends (inset, offset, v-bends, rotation bends). Overall, the historical trajectory shows a shift from finishing as an independent, labour-intensive final stage requiring extensive wire bending, toward finishing as a seamless outcome of effective case management embedded throughout treatment via pre-programmed appliances.[13]

Andrews' Six Keys to Normal Occlusion

Andrews' analysis of non-orthodontic normal occlusions established the benchmark against which finished orthodontic cases are still measured. [9]

A. **Key I — Inter arch Relationship**

This key addresses molar and canine inter digitation and incisor overlap, comprising seven criteria: correct mesio buccal cusp-to-groove relationship of the maxillary first molar; correct marginal ridge relationship between maxillary first and mandibular second molars; the mesiolingual cusp of the maxillary first molar seating in

the central fossa of the mandibular first molar; cusp-embrasure relationships of the premolars; a cusp-embrasure relationship of the canines; and overlap of the maxillary incisors over the mandibular incisors with coincident dental midlines.[9]

B. Key II — Crown Angulation (Tip)

The gingival portion of the long axis of each crown should be positioned more distally than the incisal portion, measured relative to a line perpendicular to the occlusal plane. A positive reading denotes correct distal gingival positioning; a negative reading indicates a mesially positioned gingival portion. [9]

C. Key III — Crown Inclination (Torque)

Assessed from the mesial or distal aspect, crown inclination for upper incisors should be positive and for lower incisors negative, with an average inter - incisal angle of 174°. Posterior crown inclination becomes progressively more negative moving distally in both arches. Because lingual root torque applied to the anterior segment produces a proportional (roughly 4:1) mesial convergence of the crowns, inadequate anterior inclination is often mistaken clinically for tooth-size discrepancy.[9]

D. Key IV — Rotations

Teeth should be entirely free of rotations, as even minor residual rotation increases the effective mesiodistal width of a tooth and predisposes to relapse.[9]

E. Key V — Tight Contacts

Contact points should be fully abutting in the absence of a genuine tooth-size discrepancy; open contacts compromise both esthetics and long-term arch stability.[9]

F. Key VI — Curve of Spee

A flat to slightly concave curve of Spee (0–2.5 mm) is the treatment goal, since deeper curves confine the upper arch and encourage mesial and distal spillage of maxillary teeth, whereas an overly reversed curve creates excess space. Because the curve of Spee tends to deepen naturally over time, a flat plane at debonding functions as a built-in overcorrection.[9]

4. Roth's Criteria for Finishing

Roth modified the Andrews bracket prescription in all three planes of space to build in overcorrection and incorporated gnathologic (functional occlusal) objectives into finishing. During the finishing phase he recommended full-dimension steel wires (0.021 × 0.025″ or 0.022 × 0.028″) to achieve complete bracket expression, anchorage control, and arch stabilization, together with short Class II or III elastics reviewed at two-week intervals.[11] Roth also catalogued the tendencies of teeth to relapse after appliance removal — spaces reopening, buccal segment teeth tipping and rotating mesially as extraction sites close, loss of anterior torque as spaces close, and the tendency of maxillary lingual cusps to migrate occlusally until contacting the opposing arch — observations that directly informed his overcorrection-based finishing protocol.[11,12]

Building on Andrews' six keys, Roth added functional finishing requirements, including the positioning of lower incisors relative to the A-Pog line for facial esthetics and anchorage planning; incisal display of 2–2.5 mm below the relaxed lip line; no more than 1 mm of visible attached gingiva on full smile; an over jet–overbite relationship of approximately 2.5 mm; a flat occlusal plane at the end of active treatment (anticipating settling to a 1–1.5 mm curve); mandibular incisors aligned contact-point to contact-point with a 2° mesio-axial inclination; lower canines angulated mesially at 5° with the cusp tip 1 mm incisal to the lateral incisor edge; and, in extraction cases, a slightly exaggerated mesial rotation of the lower cuspids. Detailing in Roth's philosophy begins with the mandibular arch — alignment, canine inclination and rotation, upright and slightly distally

rotated premolars and molars, a symmetrical arch free of spacing, and a leveled curve of Spee — followed by upper-arch criteria emphasizing molar distal rotation and torque, symmetric incisal edge heights, and proper cuspid guidance.[11]

Dougherty's Seventeen Factors in Finishing and Detailing

In 1976, Dougherty [29] proposed a systematic checklist of 17 factors that should be carefully evaluated during the finishing and detailing phase of orthodontic treatment. These factors serve as a comprehensive guide for achieving ideal occlusion, optimal esthetics, functional harmony, and long-term stability before appliance removal. The 17 factors are:

1. Correction and overcorrection of the anter oposterior jaw relationship
2. Establishing correct tip of the upper and lower anterior teeth
3. Establishing correct torque of the upper and lower anterior teeth
4. Coordinating arch widths and arch form
5. Establishing correct posterior crown torque
6. Establishing marginal ridge relationships and contact points
7. Correction of midline discrepancies
8. Establishing the inter digitation of teeth
9. Checking cephalometric objectives
10. Checking the parallelism of roots
11. Maintaining the closure of all spaces
12. Evaluating facial and profile aesthetics
13. Checking for temporomandibular joint (TMJ) dysfunctions such as clicking and locking
14. Checking functional movements
15. Determining whether all oral habits have been corrected
16. Correction of rotations and overcorrection where indicated
17. Establishing a relatively flat plane of occlusion

These factors provide a structured approach to the finishing phase by ensuring that skeletal, dental, occlusal, functional, and esthetic objectives are thoroughly assessed before debonding. Although contemporary orthodontics has witnessed significant advances in appliance design, digital treatment planning, and aligner therapy, Dougherty's principles remain clinically relevant and continue to form the basis of meticulous finishing and detailing protocols.

American Board of Orthodontics Objective Grading System

The ABO Objective Grading System (OGS) provides a standardized, quantitative method for scoring a finished case, assessing seven features on the dental casts and one on the panoramic radiograph[14]

- Tooth alignment — in the anterior region, coordination of incisal edges and lingual/labial surfaces of incisors and canines; in the posterior region, alignment of central grooves (maxilla) and buccal cusps (mandible) in the same mesiodistal plane.
- Marginal ridges — adjacent posterior teeth should have marginal ridges at the same vertical level, or no more than 0.5 mm apart, to achieve flat bone levels and proper occlusal contact.
- Buccolingual inclination — a straight edge placed across the lingual cusps of the maxillary posterior teeth (or buccal cusps of the mandibular posterior teeth) should bring the opposing cusps within 1 mm, preventing occlusal interference. Fig 1
- Occlusal relationships — assessed via the anter oposterior alignment of canine, premolar, and molar cusps and embrasures, with defined criteria for Class I, Class II, and Class III finished occlusions.

- Occlusal contacts — functional cusps (buccal cusps of mandibular posterior teeth, lingual cusps of maxillary posterior teeth) should contact the opposing occlusal surface for optimal inter cuspation.
- Over jet — mandibular incisal edges should contact the lingual surfaces of the maxillary anterior teeth, with posterior buccal cusps seating centrally within the opposing fossae.
- Inter proximal contacts — all arch spaces should be closed, since residual spacing is both unesthetic and predisposes to food impaction.
- Root angulation — assessed radio graphically, with roots ideally parallel to one another and perpendicular to the occlusal plane to preserve adequate inter radicular bone and periodontal health.

The OGS translates what were once largely subjective finishing judgements into a reproducible scoring framework and remains the most widely used contemporary benchmark for evaluating treatment outcomes.[14]

General Considerations in Finishing and Detailing

Rebecca Poling described a systematic method for evaluating patients at the finishing stage, built around a “Detailing Form” Fig 2 completed at the final detailing appointment. The form has six sections — three for recording examination findings and three for the corresponding wire adjustments — organized under four broad objectives.[30]

- Extra oral objectives — facial and occlusal-plane symmetry, incisor display at rest and on smiling, coincidence of the dental and facial midlines, and screening for functional habits such as tongue thrust, mouth breathing, and bruxism or TMJ dysfunction that could affect esthetics or stability.
- Intra-arch objectives — alignment of incisal edges, crown torque, parallelism of premolar facial surfaces, level marginal ridges, and a gentle curve of Spee within each arch.
- Inter-arch objectives — Angle classification, overjet, overbite, posterior transverse relationship, and coincidence of the dental midlines, verified chairside with a hand mirror.
- Radiographic objectives — a panoramic radiograph to confirm root parallelism and angulation and to screen for apical root resorption before the appliance is removed.

Findings are recorded on the form in one ink color and the corresponding root-angle, vertical, and torque bends are placed in sequence at review; once no further changes are needed, the appliance is removed and centric contacts are verified with articulating paper to eliminate balancing interferences.[30]

Finishing Procedures and Retention in Bio-Progressive Therapy

Ricketts' bio-progressive philosophy treats finishing as something planned for from the very beginning of treatment rather than improvised at the end. According to Hilgers and colleagues, the greatest value of the Visual Treatment Objective (V.T.O.) lies in establishing the specific end result at the outset: the V.T.O. accounts for morphological and functional variation related to facial type and proposes the incisor torque, arch form, and tooth positions appropriate to each patient's individual facial axis. The resulting “cephalometric setup” thus becomes a key tool for visualizing the final finishing procedure well before the finishing stage is reached.[7,20]

A central concept in bio-progressive therapy is planned overtreatment, intended to compensate for the original malocclusion and the abnormal function that accompanied it. Ricketts observed that the natural forces of eruption and occlusion combine with physiology and growth to settle teeth functionally into the best position

for each individual; overtreatment is, in effect, a deliberate attempt to harness this natural biological tendency so that post-treatment settling guides the teeth into their best functional occlusion rather than away from it.[7]

Bio-progressive therapy further emphasizes functional influences on both finishing and retention. Proper location and function of the condyle within the temporomandibular joint is considered essential to occlusal health and stability.

A normal airway, since it affects basic respiratory pattern, tongue posture, and tongue function, is likewise important to denture stability, as is the pattern of lip function, which influences incisor alignment and its long-term maintenance.

Finally, the buccal and facial musculature, together with the muscles of mastication, are recognized as ongoing influences on occlusal stability well beyond the point of appliance removal — reinforcing that, in this philosophy, finishing and retention are inseparable from the neuromuscular environment in which the dentition sits.[21]

Finishing Objectives in Begg's and Refined Begg's Technique

Precision finishing with the classic Begg appliance is inherently more difficult than with pre adjusted systems, because the Begg bracket engages only round arch wires, whereas rectangular wires seated in rectangular slots give the clinician three-dimensional control of the dentition. In Begg mechano therapy, second-order (root-paralleling) tooth movements are achieved with up righting springs, while third-order (torque) movements are achieved with torquing auxiliaries or, where posterior torque is required simultaneously across several teeth, with rectangular finishing wires — round base wires cannot deliver simultaneous posterior torque as efficiently. Begg auxiliaries permit highly individualized tooth movement, but realizing this potential requires continuous evaluation and control throughout treatment.[8]

A. The Third Stage - Goals and Arch wire Construction

Since Begg's introduction of the light-wire technique in 1956, the third (final) stage of treatment — conducted with round wires — is regarded as the finishing stage proper. Its three goals correspond to the three orders of tooth control: achieving normal buccolingual tooth position (first order), paralleling the roots of all teeth (second order), and torquing teeth to acceptable angulation (third order). This mainly involves lingual root torque of the maxillary incisors together with paralleling of the bicuspid, cuspid, and lateral incisor roots, and is organized around two steps — base arch wire construction and auxiliary placement.[8]

Because low-resistance crown movements have already been completed by this stage, only higher-resistance root movements remain, so a heavier 0.020-inch base arch wire is used, primarily to maintain arch form and symmetry and to resist the reactive forces generated by the auxiliaries. The anterior segment of this base arch is positioned gingivally in deep-bite cases and incisally in open-bite cases, and the wire is contoured with a cuspid offset and a gentle curve over the buccal cusps of the premolars and molars. A reverse curve is incorporated in the buccal segment, scaled to the depth of the original curve of Spee — the deeper the pre-treatment curve, the more pronounced the reverse curve required — since even flat occlusal planes need a slight reverse curve to counteract the depressing effect of the paralleling auxiliaries; in the maxilla, a reverse curve is routinely used in deep-overbite cases to offset extrusion produced by torquing auxiliaries.[8]

First-order (buccolingual) control is provided by the arch wire itself through in-out bends, much as in an edgewise appliance, while root parallelism and torque are managed through auxiliaries working alongside the main archwire. Key first-order adjustments include slight lingual positioning of the upper lateral incisors relative to the centrals, an archwire offset between the upper lateral and canine to accommodate differing crown thickness, a further offset between the upper premolar and molar to compensate for buccal contour differences, toe-in of the upper first (and, if needed, second) molar to correct disto-lingual rotation for a Class I relationship, and control of arch curvature between the upper canine and first molar to prevent flattening when premolars have been expanded. Lower canines are typically "tucked in" slightly to reduce the risk of lower incisor crowding relapse, with an inset/offset combination reserved for severely crowded cases. Second-order adjustments include keeping the upper lateral incisor slightly shorter than the central and canine, a mild mesial angulation and occlusal tip-down bend for the upper first molar (following Andrews' recommendation) to seat its disto-buccal cusp correctly, slight mesial angulation of the upper canines for cuspid-protected occlusion, and arch wire steps to level the lower canines and lateral incisors as needed.[8,9]

B. Root-Paralleling and Torquing Auxiliaries

Root-paralleling (up righting) springs Fig 3 are helical springs whose stem engages the bracket pin channel while an activating arm rests over the arch wire; they vary in helix size, coil number, arm length, wire diameter, and hook offset, with an offset, shorter hook generally preferred since it requires less displacement to engage and avoids unwanted rotation.

A spring pin Fig 4 — combining a lock pin with an up righting auxiliary — secures the arch wire in the slot while simultaneously producing mesiodistal root up righting without risk of extrusion. Mini up righting springs Fig 5, introduced by Mollenhauer using thin (0.009-inch) high-resilience wire, correct root angulation during the third stage with light, continuous force, minimal anchorage strain, easier hygiene, and better esthetics than conventional springs.[24]

Third-order (torque) adjustments intentionally over-torque and over-tip roots by roughly 10–15% to allow for settling during finishing. Anterior root torque — palatal movement of the maxillary central incisor roots together with distal and palatal movement of the lateral incisor roots — is produced using spur- or wing-type torquing auxiliaries. Two-spur auxiliaries (typically 0.014-inch wire) are used when only the central incisor roots require torque, delivering roughly 4° of lingual root movement per month at an optimal force of about 55 g; four-spur auxiliaries extend this to both central and lateral incisor roots. Wing-type auxiliaries, such as the Kitchton Torquing Auxiliary Fig 6 (used with a heavier 0.020–0.025-inch arch wire and pinned only to the central incisor brackets) and Perlow's Universal Torquing Auxiliary (adaptable to a 0.020-inch round wire or a Hawley retainer, and usable for extraction or non-extraction, upper or lower, labial or lingual torque), provide alternative means of anterior root control. A Reverse Torquing Auxiliary is used where labial (rather than lingual) root torque is required — for example, to build canine eminence around a palatally positioned canine root — while a Lower Reverse Torquing Auxiliary uprights Fig 7 procumbent mandibular incisors and increases mandibular anchorage. Auxiliaries are maintained until the relevant axial inclinations are slightly overcorrected, since discontinuing force typically produces some rebound and band-space closure tends to reverse some of the auxiliary-induced root movement;

overcorrection is confirmed radio graphically (peri apical or panoramic views for canine/premolar inclination, lateral cephalometric films for incisor root torque).[8,25]

C. Common Finishing Problems and Their Management

If bracket placement and staging have been accurate throughout treatment, corrections required after Stage III should be minor. Undesired rotations may arise from bracket distortion during band welding, excessive force during band seating, occlusal interference, trauma, or improper wire-engagement technique; while minor rotations can be corrected with bayonet bends, replacing a distorted bracket is often simpler and preserves arch form, and rotation associated with a sound but enlarged bracket slot can be managed with an elastic thread ligature.[26]

Iatrogenic anterior open bite is prevented by maintaining an edge-to-edge incisor relationship throughout treatment and, where Class II elastic traction is still needed, substituting triangular elastics (which add a vertical component) for conventional Class II elastics; vertical (box) elastics may supplement arch wire adjustment where anterior open bite still needs closing. [24] Improper arch form is assessed using an occlusal mirror and corrected through coordinated arch wire form together with cross- and vertical elastics as needed.

To permit spontaneous occlusal settling while guarding against relapse of overjet or incisor rotation, a labial finishing (holding) archwire — typically 0.016-inch nichrome or stainless steel, contoured with offsets for the lateral incisors and canines — is placed after removing all bands except the maxillary molar bands. Small hooks soldered mesial to the molar tubes are tied back with steel (or, for larger spaces, elastic thread) ligatures to close residual band spaces gradually; this archwire is checked weekly and typically remains in place for one to three weeks until space closure and settling are complete, after which impressions are taken for the retention appliance.[8]

D. Rectangular Finishing Wires

Mollenhauer popularized rectangular finishing wires for the Begg technique, typically a 0.018 × 0.022-inch alpha-titanium ribbon wire used with rectangular (or converted round) molar tubes. This wire permits precise anterior torque control via a torquing turret, is relatively soft and easy to contour before gaining intraoral hardness through hydrogen absorption, and its 0.022-inch vertical dimension provides adequate clearance within the 0.040-inch Begg vertical slot for continued vertical settling.[27] Reported advantages of rectangular finishing wires include facilitation of molar rotation control (following Zachrisson's principles), simultaneous stabilization of root and crown position, fine control of arch form and coordination, improved long-term retention stability, better buccal inter digitation, effective torquing of molars and premolars, utility as a stabilizing wire in orthognathic surgery cases, and reduced tooth mobility at the time of debonding and deband.[27,28]

Finishing with Pre adjusted Appliances

The widespread adoption of pre adjusted (straight-wire) appliances has transformed finishing by embedding tip, torque, and in-out values directly into the bracket prescription, substantially reducing the wire bending historically required. However, since these prescriptions are engineered around average tooth morphology, they cannot fully account for individual biological variation, and clinical imperfections such as bracket mispositioning still necessitate targeted finishing bends.[13]

Bio-progressive therapy, associated with Ricketts, contributed the concept of the Visual Treatment Objective (V.T.O.) — a cephalometric setup used to visualize the desired end result from the outset of

treatment — along with a philosophy of overtreatment intended to compensate for the original malocclusion and abnormal function. This approach also emphasizes functional influences on finishing and long-term stability, including proper condylar position within the temporomandibular joint, a normal airway and tongue posture, balanced lip function, and coordinated buccal and masticatory musculature.[7,20]

Finishing in Lingual Orthodontics

Lingual appliances, first developed by Craven Kurz in 1975 through modification of labial edgewise systems, present unique finishing challenges arising from patient-specific anatomy of the lingual surfaces, the biomechanics of lingual tooth movement, patient factors, and the nature of the original malocclusion.[3] While the underlying dynamic, cephalometric, esthetic, and functional principles of finishing are shared with labial technique, lingual appliances offer the advantage of an unobstructed labial view and reduced gingival hyper trophy.

The Systematic Finishing Procedure for lingual technique proceeds through defined steps — beginning with restoration of full arch wire engagement (commonly using a resilient 0.017 × 0.017-inch copper-nickel-titanium wire for several months to differentiate genuine torque or vertical discrepancies from incomplete wire expression) — followed by occlusal settling with elastics and detailing bends such as inset, offset, v-bends, and rotation bends.[3]

Finishing in Clear Aligner Therapy

Since the introduction of the Invisalign ® system by Align Technology in 1999, clear aligners have evolved from a niche option for mild malocclusion into a widely applicable modality, aided by advances in digital planning, materials, and biomechanical design. [4] Finishing in aligner therapy is governed largely by digital treatment planning software (such as Clin Check ®), which allows visualization of the intended end result before treatment begins; however, discrepancies between the virtual setup and actual clinical outcome are inevitable given variability in biological response and aligner fit. The refinement phase — involving new scans or impressions and a revised aligner series — functions as the aligner equivalent of fixed-appliance finishing and detailing.[4]

Because aligners deliver intermittent, surface-based force through sequential thermoplastic trays (each typically producing about 0.25–0.3 mm of movement per stage) rather than continuous force through a bonded wire, control of root movement, torque, and rotation is comparatively less predictable.

Successful aligner finishing therefore depends on accurate treatment planning and staging to avoid cumulative error, effective use of attachments to enhance control of specific tooth movements, strict compliance with wear time to maintain consistent force delivery, and timely refinement to correct residual imperfections and complete detailing.[4]

Raleigh Williams' Six Treatment Keys for Eliminating Lower Retention

Raleigh Williams proposed six treatment keys aimed at minimizing or eliminating the need for lower fixed retention by establishing a stable lower anterior dentition during active orthodontic treatment. These principles emphasize precise positioning of the lower incisors and canines to enhance long-term post-treatment stability.

The first key recommends positioning the lower incisal edges on or approximately 1 mm anterior to the A–P line, as incisor position is more critical than inclination for long-term stability. Excessive proclination beyond this limit increases the risk of relapse and often necessitates permanent retention.

The second key advocates distal divergence of the lower incisor root apices, with slightly greater divergence of the lateral incisors than the central incisors. Root convergence or parallelism predisposes the crowns to crowding after treatment.

The third key emphasizes positioning the lower canine root apex distal to its crown, using the occlusal plane as the reference. This angulation minimizes mesial tipping of the canine crown and helps maintain lower incisor alignment.

According to the fourth key, the apices of all four lower incisors should lie in the same labiolingual plane. Adequate control of root position during treatment, particularly with rectangular mechanics or appropriate auxiliaries, prevents undesirable labiolingual displacement and contributes to post-treatment stability.

The fifth key states that the lower canine root apex should be positioned slightly buccal to the crown apex. This orientation counteracts functional lingual forces acting on the canine crown and reduces the tendency for post-treatment lingual drift.

The sixth key recommends selective interproximal enamel reduction (slenderizing) of the lower incisors when indicated. Flattening the contact areas improves resistance to rotational and crowding relapse by reducing mesial pressure and harmonizing tooth size with arch length, thereby decreasing the need for long-term lower retention. Collectively, Raleigh Williams' six treatment keys provide biologically sound guidelines for achieving stable lower anterior alignment and reducing dependence on permanent lower retainers following orthodontic treatment.

Final Settling of Teeth

Following Class II or Class III correction with inter arch elastics, teeth show a natural tendency to rebound toward their original positions even in the presence of full rectangular arch wires, making deliberate overcorrection essential — for example, finishing a Class II deep-bite case in an end-to-end incisor relationship, with complete elimination of over jet and overbite, before discontinuing elastics or headgear. [11] Two key finishing principles follow from this: inter arch elastics and headgear should be discontinued approximately four to eight weeks before appliance removal to allow rebound to occur naturally, and, as a final step, all teeth should be brought into stable, solid occlusal contact without reliance on heavy arch wires.[11]

Three principal methods achieve final occlusal settling. The first, introduced by Tweed in 1940, substitutes the rectangular finishing wire for a light round arch wire (retaining prior first- and second-order bends) for a few weeks, promoting rapid settling, though at some cost to anterior control.

A later, refined approach removes only the posterior segment of the rectangular wire while retaining anterior control (canine to canine), combined with lace elastics, allowing posterior settling without compromising anterior alignment.[2] The second method employs posterior vertical (settling) elastics, and the third employs a tooth positioner.

Tooth Positioners for Finishing

First introduced by H. D. Kesling in 1945, the tooth positioner is a single-piece, resilient rubber or plastic appliance designed to fill the freeway space and cover the clinical crowns and adjacent gingiva. Fabricated four to six weeks before debonding from an impression with the teeth on the working cast reset to an idealized position, its elastic properties gently guide teeth toward the predetermined setup over roughly three to four weeks when the recently moved teeth remain especially responsive to light forces.[2]

In addition to refining minor rotations and closing residual spaces, the positioner helps maintain treatment results and enhance long-term occlusal harmony and stability, though — as studies such as Vorhies' have shown — it does not produce a fixed or permanent correction and works best as an adjunct to, rather than a substitute for, sound preceding mechanics.[2]

Special Finishing Procedures to Avoid Relapse

According to Proffit, post-treatment relapse arises chiefly from two sources: unfavorable continued growth of the patient after treatment, and rebound of surrounding soft tissues once orthodontic forces are removed.[17] Corresponding finishing strategies address each source directly.

A. Control of Unfavorable Growth

Recurrence of Class II, Class III, deep-bite, or open-bite problems due to ongoing skeletal growth is better conceptualized as continued active treatment ("active retention") rather than true relapse, and may be managed with continued extra oral appliance wear (such as night-time headgear) or substitution of a functional appliance for a conventional retainer.[17]

B. Control of Soft Tissue Rebound

Because some rebound of stretched periodontal and gingival fibers is inevitable — particularly after inter arch elastic use — management strategies include planned overcorrection (so that minor relapse brings teeth into their ideal final position) and, in selected cases, adjunctive periodontal surgery (such as circumferential supracrestal fiberotomy) to reduce fiber-mediated relapse. In cases with a high inherent relapse tendency, permanent retention may still be necessary despite optimal finishing.[17]

Summary and Conclusion

Orthodontic treatment outcomes are governed by countless variables across three planes of space, making disciplined finishing and detailing essential to an efficient, high-quality result. Occlusion is not simply a matter of straight teeth but a holistic balance of dental morphology with the functional demands of mastication, speech, and deglutition; when morphology and function are harmonized, both esthetic and long-term structural health follows.[1]

Pre adjusted (pre-programmed) appliances have made their greatest contribution precisely at the finishing stage, building in compensations for tip, torque, and in-out that historically required extensive wire bending. Yet this has fostered a misconception that modern systems eliminate the need for wire bending altogether.

In reality, custom wire bending remains a necessary clinical skill for two reasons: bracket prescriptions are engineered around average tooth morphology and cannot fully account for individual biological variation, and clinical imperfections — imprecise bracket placement or the deliberate overcorrection needed to counter relapse — routinely require targeted correction. The literature reviewed here consistently affirms that the final tooth position, not the specification of the appliance, is what ultimately determines success; regardless of the technology employed, the orthodontist's judgement and skill in executing the final, strategic adjustments remain the true determinant of an excellently finished case.[1, 18, 19]

Legend Figures

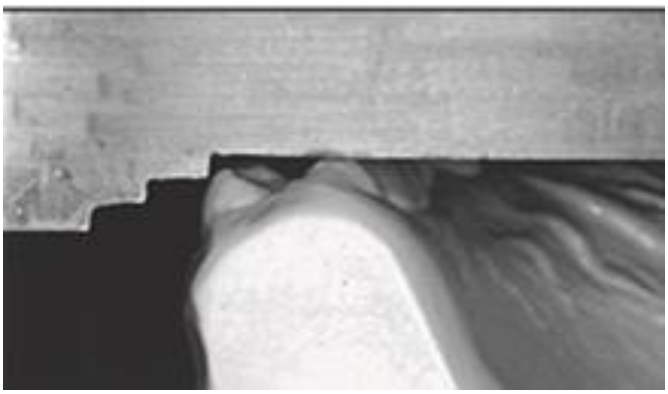
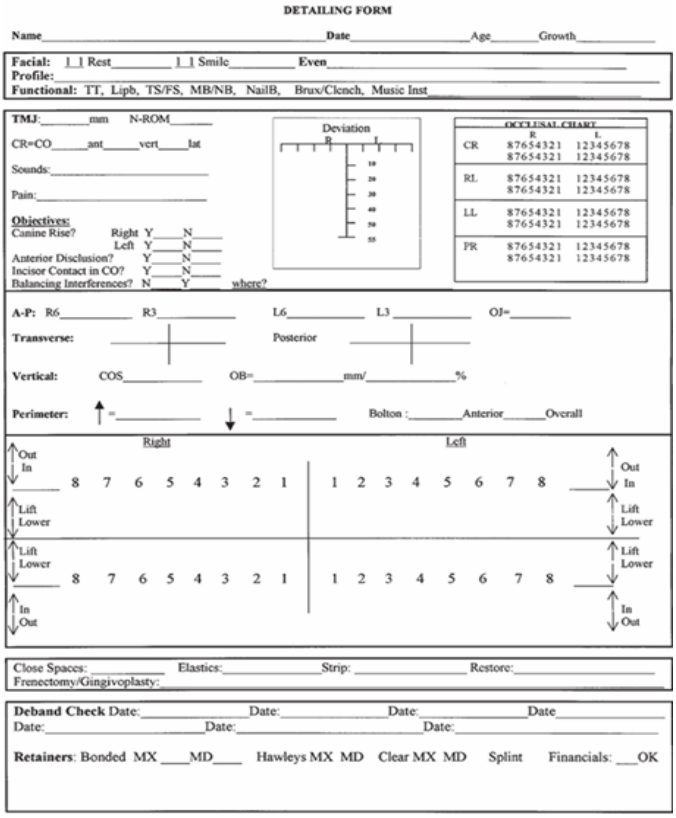


Fig 1: Buccolingual inclination of maxillary arch.


DETAILING FORM

Name_____Date_____Age_____Growth_____

Facial: 1_1 Rest_____ 1_1 Smile_____ Even_____
Profile:_____
Functional: TT, Lipb, TS/FS, MB/NB, NailB, Brux/Clench, Music Inst_____

TMJ:_____mm N-ROM_____
CR=CO_____ant_____vert_____lat
Sounds:_____
Pain:_____
Objectives:
Canine Rise? Right Y____N____
Left Y____N____
Anterior Disclusion? Y____N____
Incisor Contact in CO? Y____N____
Balancing Interferences? N____Y____ where?

Deviation R L

OCCLUSAL CHART

	R	L
CR	87654321	12345678
	87654321	12345678
RL	87654321	12345678
	87654321	12345678
LL	87654321	12345678
	87654321	12345678
PR	87654321	12345678
	87654321	12345678

A-P: R6_____ R3_____ L6_____ L3_____ OJ=_____
Transverse: Posterior
Vertical: COS_____ OB=_____mm/_____%
Perimeter: ↑=_____ ↓=_____ Bolton :_____Anterior_____Overall

Right Left

Out In 8 7 6 5 4 3 2 1 1 2 3 4 5 6 7 8 Out In
Lift Lower Lift Lower
Lift Lower 8 7 6 5 4 3 2 1 1 2 3 4 5 6 7 8 Lift Lower
In Out In Out

Close Spaces:_____ Elastics:_____Strip:_____Restore:_____
Frenectomy/Gingivoplasty:_____

Deband Check Date:_____Date:_____Date:_____Date_____
Date:_____Date:_____Date:_____

Retainers: Bonded MX____MD____ Hawleys MX MD Clear MX MD Splint Financials: ___OK

Fig 2: Detailing Form.

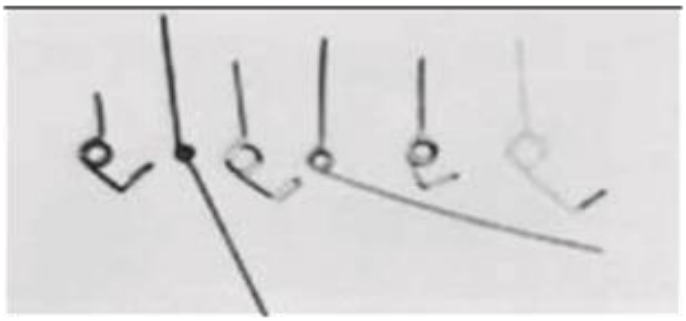


Fig 3: Various shapes of paralleling auxiliaries.

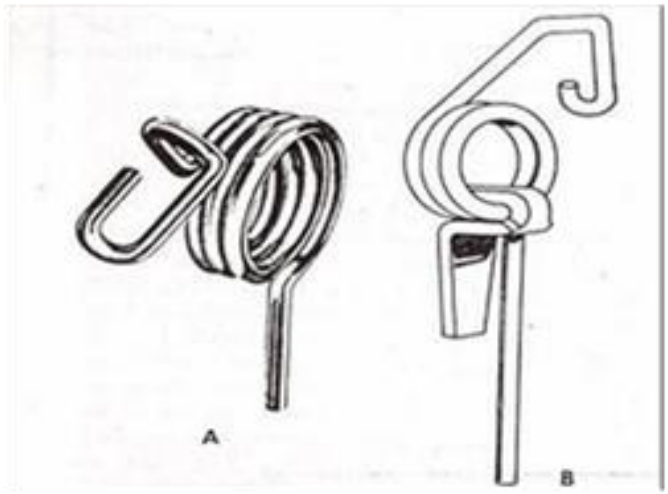


Fig 4: Spring Pin.

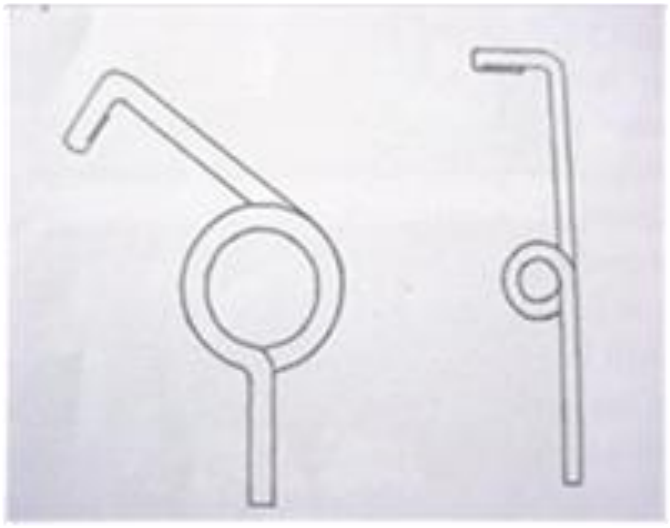


Fig 5: Mini up righting springs.

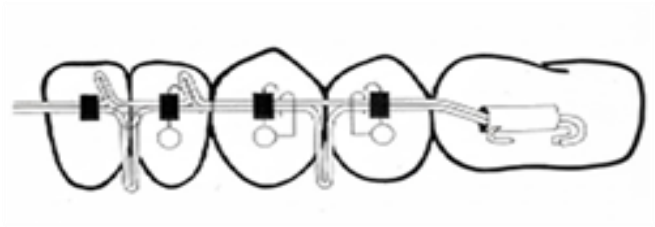


Fig 6: Kitcht on Torquing Auxillary.

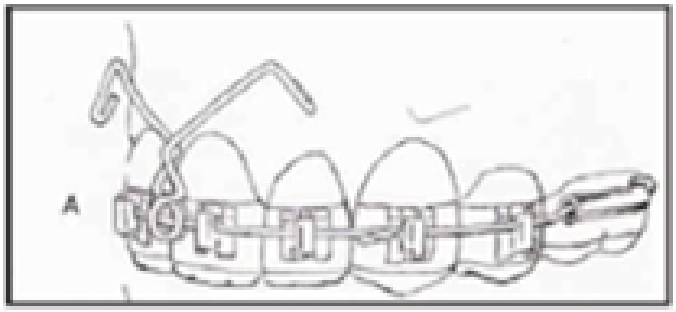


Fig 7: Lower reverse torque complex.

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