

Orthodontically Assisted Restorative Dentistry

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A b s t r a c t

As treatment expectations of dental patients continue to escalate we, as restorative dentists, must provide an interdisciplinary treatment approach to ensure optimum results for our patients. In recent years the disciplines of periodontics, endodontics and oral surgery have continued to develop closer working relationships with the field of restorative dentistry. Unfortunately, this is not the common relationship that exists with the discipline of orthodontics. Most orthodontic therapy is directed at the treatment of malocclusion and is conducted with limited or no input from the restorative dentist. Orthodontics offers countless ways of assisting the restorative dentist in achieving treatment goals. Several of these orthodontic opportunities to enhance the restorative treatment plan are reviewed.

MeSH Key Words: mouth rehabilitation; orthodontics, corrective; patient care planning; patient care team

© J Can Dent Assoc 2001; 67(9):516-20
This article has been peer reviewed.

Although orthodontic therapy commonly precedes the restorative phase of treatment for our patients, the final restorative results sometimes fall short of their potential because the restorative dentist fails to direct and monitor the orthodontic phase of treatment. A less-than-complete understanding of what orthodontics can offer our patients limits our treatment planning process and therefore ultimately controls our potential as restorative dentists. Conversely, the orthodontist must clearly understand the restorative treatment goals before the onset of treatment and maintain open lines of communication with the restorative dentist throughout treatment. Traditionally, orthodontic treatment has assisted the restorative dentist by correcting malocclusions, levelling and aligning the dental arches and straightening teeth. As our patient population continues to place greater esthetic and functional demands on us, more opportunities exist for the orthodontist to help in the creation of an optimum restorative environment.

Restorative Treatment Goals for Orthodontic Therapy

The Importance of a Stable Occlusion

The occlusal stability achieved at the conclusion of orthodontic and restorative treatment depends on a stable mandibular working position before starting treatment.¹ Mandibular stabilization requires fully seated and repeatable condylar positions within the glenoid fossae. Preliminary occlusal appliance therapy is often necessary

before orthodontic treatment and again before restorative treatment to ensure condylar stability and thereby provide the opportunity to generate a stable occlusion.² This occlusal stability will in turn affect the long-term prognosis of treatment. Unfortunately, many orthodontists limit their focus to tooth positioning, and restorative dentists to esthetic replacement or repair of tooth structure, all at the expense of establishing and maintaining occlusal stability.

Positioning Teeth in the Face

The arrangement and position of teeth relative to one another and the surrounding soft tissues largely control our esthetic and functional treatment plan. As part of the initial clinical examination, it is important to evaluate how the teeth fit into the framework of the face.³ The maxillary incisal curve and lower lip curve should be roughly parallel to one another and perpendicular to the vertical midline drawn between the maxillary central incisors.⁴ Lower lip posture is relatively predictable and therefore commonly serves as a reference plane for the observer's eye (Fig. 1). Even when the midlines of one or both arches are not centred, it is more important to ensure that the anterior teeth are vertically oriented in the face and perpendicular to the incisal plane (Fig. 2).

The starting point for evaluating tooth position in the face is the maxillary central incisor. It dictates both the esthetic display and the occlusal relationship and guidance pattern of the teeth. In a normal Class I occlusion, the incisal edge of the maxillary central will follow approximately



Figure 1: The dental midline is oriented vertically in the face and is perpendicular to both the maxillary incisal curve and the lower lip curve, contributing to a pleasing visual symmetry.



Figure 2: The maxillary incisal curve and gingival plane both fail to harmonize with the lower lip curve, and the midline is not oriented vertically in the face, all contributing to an unattractive smile.



Figure 3: Correct positioning of the maxillary central incisal edges is critical to the esthetic and functional potential of any dentition. In an intact Class I occlusion, the maxillary central incisal edges normally follow the same plane as the maxillary posterior buccal cusp tips.



Figure 4: Class II malocclusions commonly demonstrate overerupted maxillary central incisors, excessive incisal display and an exaggerated smile curve.

the same plane as that of the maxillary canine and maxillary posterior tooth buccal cusp tips (**Fig. 3**). Commonly, Class II malocclusions result in overerupted centrals, contributing to an exaggerated smile curve and excessive incisal display (**Fig. 4**). Conversely, Class III malocclusions frequently lead to undereruption of the maxillary anterior teeth and result in a reverse smile curve and lack of visual display of the maxillary teeth during facial expression. Other causes of short maxillary incisors include heavy incisal wear resulting from protrusive bruxing, chemical erosion of the maxillary incisors or undereruption resulting from tongue thrusting or thumb sucking habits. Although using other teeth in the arch as a reference plane for the maxillary central is most often accurate, there will be times when the other teeth cannot serve as references due to wear, missing teeth or occlusal plane discrepancies.⁵ A further aid in evaluating maxillary central incisor position is phonetic testing with the “F” and “V” sounds. If the maxillary centrals trap the lower lip instead of lightly contacting the “wet-dry” line

of the lip when expressing “F” and “V” sounds, then the centrals are too long.

During the initial examination, it is important to record the amount of maxillary incisal display with lips at rest and the amount of display when smiling. It is commonly accepted that an ideal smile shows the full length of the maxillary centrals and a slight amount of gingiva apical to the centrals.⁶ Considering the large variation in lip mobility among people, it is important to discuss with patients how much incisal display they wish to have during facial expression. This measurement can then be correlated with the desired incisal display with lips at rest (generally averaging 2 mm in males and 3.5 mm in females and decreasing with age) to determine maxillary incisor length and incisal edge position.⁷ In addition, the mandibular incisal edge position and occlusal plane must be evaluated. Ideally, 1 to 1.5 mm of mandibular incisal length is visible when lips are at rest (repose), and both the maxillary and mandibular occlusal planes are perpendicular to the



Figure 5: Mandibular anterior overeruption resulting from a Class II malocclusion often compromises both the esthetic and the functional potential of our patients.

vertical midline of the face. Unfortunately, many of our potential restorative patients have malocclusions resulting in discrepancies of incisal edge position or the occlusal plane (Fig. 5). A series of clinical photographs showing a full smile and lips in repose is recommended to assist in this facial analysis and determination of incisal position.

Diagnostic casts mounted accurately in retruded mandibular position will further aid the orthodontist and restorative dentist in evaluating tooth position and defining treatment goals. The clinically established ideal maxillary central incisor position, in combination with the posterior occlusal plane reference point of two-thirds the way up the retromolar pads, allows us to establish the optimum posterior occlusal plane.

Further diagnostic records should include an orthodontic series of skeletal radiographs (typically lateral and frontal cephalometric films and a panorex), a full mouth series of intraoral radiographs and a periodontal assessment.⁸ This combined evaluation will allow the orthodontist and restorative dentist together to outline treatment goals and possible approaches to achieve these goals. An example of this treatment planning process would be the situation of excessive maxillary anterior gingival display (gummy smile). Depending on the circumstances, this patient type can be treated with any of a variety of approaches, such as periodontal crown lengthening, orthodontic intrusion or orthognathic surgery (maxillary impaction). Factors determining the treatment approach would include the crown-root ratio of the anterior teeth, whether these front teeth require restorative treatment, the clinical crown length of the front teeth and whether the excessive tooth display is localized to the anterior region or includes the posterior teeth.

Orthodontically Assisted Gingival Contouring

In addition to facial and dental analysis it is also important to evaluate our patients for gingival symmetry. The

gingival levels of teeth not only control the esthetic potential for our patients but also dictate the clinical crown length available for restoration. During the initial clinical examination, it is important to evaluate the maxillary and mandibular gingival planes for bilateral symmetry and harmony with the proposed incisal and occlusal planes of the final treatment result. Although gingival asymmetries are often addressed surgically (periodontal crown lengthening or orthognathic surgery), orthodontic treatment can be an effective method of leveling the gingival planes before restorative treatment. However, if gingival levelling is to be achieved orthodontically, then the orthodontist must be informed of this goal so that he or she can position the orthodontic brackets on the teeth relative to the gingival margins instead of the incisal edges and buccal cusp tips. This treatment approach often results in uneven incisal and occlusal surfaces during and after orthodontic treatment because the arch wires level the gingival planes instead of the teeth. This treatment method is appropriate for patients scheduled for extensive restorative treatment following orthodontics, allowing for the re-establishment of incisal and occlusal harmony. When using this treatment approach the orthodontist may need to recontour certain teeth during the orthodontic treatment to maintain acceptable esthetics and function. Localized gingival asymmetries can also sometimes be treated orthodontically. Forced eruption of an isolated tooth results in osseous and gingival tissues migrating coronally with the tooth and thereby often correcting gingival defects.⁹⁻¹²

As restorative dentists we often strive to avoid open gingival embrasure spaces, particularly in the esthetic zone of the mouth. The length and shape of interdental papillae largely control the proximal contours of the restorations we make. In turn, papilla length and shape are controlled by the shape and volume of the gingival embrasure space and the level of interseptal bone.¹³ In patients who have a healthy periodontium and favourable interseptal bone levels, papilla length and shape can be modified by changing gingival embrasure space through orthodontics or restorative treatment. Crowded or rotated teeth, slipped proximal contacts and unfavourable root proximities lead to restricted gingival embrasure spaces in turn leading to compromised papillae. Conversely, divergent roots or open proximal contacts are accompanied by excessively large embrasure volumes and result in short and wide interdental papillae.¹⁴ A common complication following orthodontic closure of a maxillary midline diastema is divergence of the central incisor roots, leading to an enlarged gingival embrasure space and a short interdental papilla. When planning treatment, it is important that the orthodontist and restorative dentist discuss soft tissue volume interproximally and that the orthodontist appreciates the importance of orienting the brackets perpendicular to the long axes of the teeth



Figure 6: This maxillary lateral incisor implant crown has been contoured interproximally to mimic natural tooth root anatomy, which controls embrasure shape and volume, thereby maintaining papilla height.

so that divergent or convergent roots can be avoided post-orthodontically.

Under certain circumstances, orthodontic treatment may be unable to optimize gingival embrasure volume, and the restorative dentist will be required to modify the proximal contour of the dental restoration to provide the necessary lateral support for the interdental papilla.¹⁵ This proximal contouring has been referred to as the “compression method” and is especially useful during restoration of dental implants, extruded teeth and peg lateral incisors. These situations all present the same problem of a narrow cervical root form relative to the dimensions of the coronal restoration and therefore exhibit enlarged gingival embrasure spaces (Figs. 6 and 7).

Enhancing the Restorative Recipient Site

For restorative dentists to create restorations that mimic natural anatomy, the restorative space must be sufficient in all 3 dimensions. With proper planning, orthodontic treatment can create ideal anatomic space for the planned restorations, for example, when establishing slight mesial and distal spacing for anatomic restoration of a peg lateral incisor. Slightly more distal space should be established to accommodate the more convex distal line angle relative to the straighter mesial line angle of a lateral incisor. Another example of orthodontically assisted establishment of favourable restorative space would be the case of severe anterior tooth wear or chemical erosion resulting from bulimia. Initial orthodontic intrusion can often re-establish optimum gingival planes and vertical restorative space for these patients before restorative treatment.

When a potential pontic site or implant site exhibits a deficient osseous ridge contour, this area can sometimes be enhanced orthodontically. In the case of a missing premolar, orthodontically moving the adjacent premolar into the space can create a favourable edentulous ridge contour for



Figure 7: The same patient exhibits favourable interseptal bone levels adjacent to the implant — a key factor in maintaining papilla height. The orthodontist made this possible by creating enough space between neighbouring teeth to allow for healthy interproximal bone and soft tissue following implant placement.

implant placement in the location the tooth occupied before orthodontic treatment.¹⁶ Similarly, in cases of a congenitally missing lateral incisor, if the canine is allowed to erupt adjacent to the central incisor and subsequently is moved distally with orthodontic treatment, a broad and favourable lateral incisor implant site is created. Sites so created have been shown to exhibit minimal resorption (Figs. 8 and 9). Retaining primary molars is an efficient means of maintaining restorative space for future implant or pontic placement in the case of congenitally missing teeth. However, it is recommended that these retained teeth be reduced in dimension to mimic the missing teeth they are replacing. This reduction allows the orthodontist to complete treatment and establish a stable occlusion before primary tooth replacement. An exception would be if ankylosis occurred while the patient was still growing, which would necessitate primary tooth removal to limit the potential damage associated with asymmetric development of the dental arch. Another example of orthodontically enhancing a potential pontic or implant site involves the forced eruption of a tooth before extraction.¹⁷ This treatment can be performed on periodontally compromised teeth and sometimes on teeth failing as a result of endodontic complication or root fracture.¹⁸ Tensile forces placed on an isolated tooth are capable of precipitating coronal tooth movement along with movement of the surrounding osseous crest and gingival tissues. At the approximate treatment rate of 1 mm of tooth extrusion per month it is



Figure 8: Orthodontic distal movement of the canine creates abundant hard and soft tissue volume for implant replacement of a congenitally missing lateral incisor.



Figure 9: Following placement of the implant crown, the same patient enjoys anatomic tissue contours resulting from initial orthodontic creation of an optimum implant site.

possible to migrate the periodontium several millimetres coronally, relative to the adjacent teeth.¹⁹

When a potential implant patient is undergoing orthodontic treatment, it is important that the orthodontist be aware of proposed implant sites so that roots of adjacent teeth are aligned to avoid impinging on the surgical site. With the advent of implants, many orthodontists are having to change their treatment approach to avoid tipping teeth when establishing pontic space, as this can result in root convergence into the implant site. Radiographic confirmation of root alignment and a minimum of 6 mm of space between neighbouring roots is advisable before orthodontic debanding. Unfortunately, many implant candidates are required to re-enter orthodontic treatment before implant surgery because of this oversight. ♦

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The author has no declared financial interests.

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