

MULTIDISCIPLINARY ASSESSMENT OF ORTHODONTIC TREATMENT
OUTCOME FOR THE ADULT MUTILATED DENTITION

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ABSTRACT

Orthodontic treatment in the adult is not new. Until lately, the challenges of treating the adult patient kept their numbers low. Over the last thirty years, however, there has been a steady increase in the prevalence of adults seeking orthodontic treatment. Many adults present with a mutilated dentition that often require a multidisciplinary approach for optimal treatment outcomes. Currently, guidelines for the evaluation of adult orthodontic treatment outcomes do not exist. The purpose of this study was to determine which factors are considered most important for the evaluation of the quality of adult orthodontic treatment outcome of patients with a mutilated dentition by practicing orthodontists, periodontists, and restorative dentists.

In this study, orthodontists, periodontists, and restorative dentists examined the records of ten adult patients in the mutilated dentition who received orthodontic treatment at Temple University in the Department of Orthodontics. This study was approached from both a quantitative and qualitative perspective. Two surveys were used to collect the data. One survey used a visual analogue scale to measure the overall result, occlusion, buccal bone height, periodontal health, restorability, case difficulty, and the amount of influence of the American Board of Orthodontics (ABO) standards when judging the cases. A second survey was used to determine if the examiner was ABO certified and asked a series of open-ended questions related to orthodontic treatment outcome.

Based on the data collected, the following conclusions were drawn:

1. Orthodontists, periodontists, and restorative dentists are consistent in their rating of orthodontic treatment outcome.
2. Periodontists and restorative dentists rate overall case finish and posttreatment occlusion higher than orthodontists.
3. When evaluating case finish, orthodontists tend to blend what is optimal as described by the guidelines of the American Board of Orthodontics with what is reasonably achievable for the patient.
4. Orthodontists, periodontists, and restorative dentists rate the following five factors to be most important when evaluating orthodontic treatment outcome: esthetics, occlusion, restorability, periodontal health, and stability.
5. Orthodontists, periodontists, and restorative dentists rate esthetics as the most important factor to use for evaluating orthodontic treatment outcome.

The data suggest that adult patients with mutilated dentitions can pursue orthodontic treatment and achieve an excellent result. Teamwork among all dental specialists providing treatment is essential for multidisciplinary treatment. Treatment goals among all providers must be aligned to reach the ultimate treatment goals.

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CHAPTER 1

INTRODUCTION

Orthodontic treatment in the adult is not new. Pierre Fauchard made the first reference to adult orthodontics in 1723 (Goldstein, 1953). Until lately, the challenges of treating the adult patient kept their numbers low. Over the last thirty years, however, there has been a steady increase in the prevalence of adults seeking orthodontic treatment (Buttke & Proffit, 1999; Grubb et al., 2008; Khan & Horrocks, 1991; Kokich & Spear, 1997; Natrass & Sandy, 1995; Ren, Boxum, & Sandham, 2009; Searcy & Chisick, 1994). Several factors have influenced the rise in adults interested in pursuing orthodontic treatment. There is an elevated awareness of dental esthetics in today's population that serves as a motivating factor to seek treatment (Proffit, Fields, & Sarver, 2007). Improved accessibility to the internet and an increase in external marketing have improved patient education regarding the positive impact of orthodontics on dental health and other dental procedures (Buttke & Proffit, 1999). Superior esthetics of orthodontic appliances and auxiliaries has made orthodontic treatment more desirable by beauty-conscious individuals (Buttke & Proffit, 1999). Lastly, the rising esthetic demands of society today contribute greatly to the rapid growth of adult orthodontic treatment (Ren et al., 2009).

The prevalence of malocclusion in the adult population is comparable to or even greater than what is observed in children and adolescents (McLain & Proffit, 1985). Various studies have estimated the prevalence of adults who could benefit from

orthodontic treatment at 40 to 77 percent (Brunelle, Bhat, & Lipton, 1996; Burgersdijk et al., 1991; Mathews & Kokich, 1997; Salonen, Mohlin, Gotzlinger, & Hellden, 1992; Searcy & Chisick, 1994; Soh & Sandham, 2004). There is an increasing demand for adult orthodontic treatment among those possessing a need for treatment (Buttke & Proffit, 1999). However, no current guidelines exist for evaluation of adult orthodontic treatment outcomes.

Current guidelines, as determined by the American Board of Orthodontics (ABO), for assessment of treatment outcomes are most easily applied to “ideal” adolescent cases. The use of these guidelines is for orthodontists to judge the final outcome of orthodontic cases for the purpose of Board certification. It is the hope of the ABO that these guidelines will also be applied when reviewing cases in clinical practice (Casko et al., 1998). A major limitation with the Objective Grading System (OGS) used by the ABO is that many of these grading criteria rely on anatomical landmarks such as incisal edges, cusp tips, marginal ridges, and central grooves to evaluate the final position of teeth. These landmarks are not easily identified in an adult dentition exhibiting worn incisal edges and cusp tips, restorations, and/or missing teeth. According to a publication by the National Institute of Health in 1987, periodontal involvement was found in patients as young as 18 years old and was common in most patients over 45 years of age (Grubb et al., 2008). Such complex adult cases often require a multidisciplinary approach for optimal treatment outcomes (Buttke & Proffit, 1999; Goldstein, 1953; Proffit et al., 2007; Shaughnessy, 1995). With so many adults seeking orthodontic treatment, it is important

to devise a set of guidelines to judge the orthodontic treatment outcome in a patient who requires a multidisciplinary approach.

CHAPTER 2

REVIEW OF THE LITERATURE

2.1 History of Adult Orthodontic Treatment

Pierre Fauchard was the author of the first known scientific book on dentistry, *Le Chirurgien Dentiste*, published in 1723. He was likely the first person to discuss adult orthodontic treatment. Fauchard observed that it is easier to perform orthodontic treatment on younger patients than older patients. Fauchard stated, “When persons of years undertake to have [orthodontics] performed, considerable time is required before success can be obtained” (Goldstein, 1953).

Thomas Berdmore published, *A Treatise on the Disorders and Deformities of Teeth*, in 1768. In his book, Berdmore advised against adult orthodontic treatment and this set the trend for nearly the next one hundred years. It wasn't until 1858 that Henry Peebles made what was notably the first statement in favor of adult orthodontic treatment in the *American Dental Review*: “I deem all cases of irregularity remediable or curable. I prefer taking charge of such cases, as a general rule, at a period of age above, rather than below 25 years of age. I then have a mature mental and moral as well as a mature physical subject to deal with” (Goldstein, 1953). This statement was an influential force for adult orthodontic treatment during the years to follow.

In regards to the acceptable age for orthodontic treatment, Norman Kingsley offered a case report of orthodontic treatment in a woman over 40 years old and advocated adult orthodontic treatment. He stated, “It may be regarded as a settled fact

that there is hardly any limit to the age when the movement of teeth might not succeed” (Kingsley, 1880).

One hundred years later, adult orthodontic treatment was still a popular topic for debate. Simeon Guilford, a Philadelphian, published *Orthodontia, or Malposition of the Human Teeth; Its Prevention and Remedy*, in 1889. In his book, Guilford stated,

“The correction of irregularities, under favoring conditions, may be begun and carried forward successfully through a wide range of years. The most favorable time for correction in cases as they usually present is between the ages of thirteen and eighteen. Earlier than this the operation is advisable under certain circumstances, and later the difficulties increase with the years” (Guilford, 1889).

Victor Hugo Jackson, former Chairman of the Department of Orthodontics at Temple University, was another early leader of the orthodontic specialty. Jackson published a book entitled, *Orthodontia and Orthopaedia of the Face*, in 1904 with statements that supported the views of both Kingsley and Guilford to promote adult orthodontic treatment. Jackson stated,

“In determining whether to correct the position of the teeth for mature patients, the age is not so much to be taken into consideration as is the permanent advantages to be gained by an operation, namely, the improved occlusion and appearance of the teeth, the prevention of excessive wear on them, and the contour of the features. In the case of older patients, the health and firmness of the teeth in their sockets must naturally be considered, and whether they are affected with calcareous deposits or pyorrhea alveolaris. I have been successful in the correction of many cases of irregularity in patients from forty to fifty years of age” (Jackson, 1904).

After orthodontics was declared a specialty in 1900 there was an explosion of interest in all facets of the field, including adult orthodontic treatment. The literature during the early 1900s highlights case reports of adult orthodontic treatment, with less

focus on indications, contraindications, and specific biomechanical principals for treatment of the non-growing patient (Goldstein, 1953).

In 1927, Frank Gray mailed questionnaires to well known practicing orthodontists to gather information about the current attitude regarding adult orthodontic treatment.

The responses are written below:

Charles Hawley: "I have treated a number of patients at 35-40."

John Mershon: "I treat a good many adults, meaning past 18, with very gratifying results."

Albert Ketcham: "There is no arbitrary limit if the patient may be benefitted." Leuman Waugh: "Very much is possible in adult cases and treatment is the duty of the orthodontist" (Goldstein, 1953).

The opinions of well-known leaders in the field of orthodontics paved the way for others.

Their support for adult orthodontic treatment was crucial for its continued advancement and success.

Motivation for seeking orthodontic treatment in the adult patient has changed over the years. In the 1950s, the driving force for adult patients to seek orthodontic treatment was to correct a facial deformity (Goldstein, 1953). In more recent years, however, the primary motivation for adults to seek orthodontic treatment was to improve dental esthetics, with more adults seeking treatment for minor corrections even without a referral from their general dentist (Buttke & Proffit, 1999; Soh & Sandham, 2004).

The May 1981 issue of the American Journal of Orthodontics released a statement by Robert McGonagle, President of the American Association of Orthodontists at the time, that a major change was taking place in Orthodontics. There was a wave of adult interest in orthodontics. He advised increased advertising in magazines concentrating on education of the adult population. He speculated that with increased insurance benefits

and better awareness, a higher proportion of adult patients would seek treatment in the years to come (McGonagle, 1981).

There was much accuracy to McGonagle's predictions. Over the last thirty years, there has been a steady increase in the prevalence of adults seeking orthodontic treatment (Buttke & Proffit, 1999; Grubb et al., 2008; Khan & Horrocks, 1991; Kokich & Spear, 1997; Natrass & Sandy, 1995; Ren et al., 2009; Searcy & Chisick, 1994). From 1970 to 1990, the proportion of adult orthodontic patients in the United States grew from five percent to 25 percent (Buttke & Proffit, 1999). This rise in adult orthodontic treatment is in part due to the success of preventative dentistry measures, with more patients retaining their teeth into adulthood (Khan & Horrocks, 1991; Kokich & Spear, 1997). Khan and Horrocks found that as many as 25 percent of adult patients treated in their practice were patients seeking re-treatment, primarily those with a Class II division 1 malocclusion (Khan & Horrocks, 1991). Certainly more attention has been given to the orthodontic treatment needs of adults who were not given the opportunity to receive treatment as adolescents (Muir, Wareing, & McDonald, 1986). Another interesting finding is that women are more aware of their malocclusion than men and comprise the majority of adult orthodontic patients, reportedly over 70 percent (Khan & Horrocks, 1991; Ren et al., 2009; Rusanen, Lahti, Tolvanen, & Pirttiniemi, 2010; Salonen et al., 1992). It has been suggested that men may be reluctant to accept orthodontic treatment when esthetics is the primary objective (Varela & Garcia-Camba, 1995).

Major reasons for the dramatic rise in adult orthodontic treatment have been cited as elevated awareness of dental esthetics, increased social awareness of the availability of

orthodontic treatment for adults, increased social acceptance of appliance therapy, increased appreciation of how orthodontics can facilitate other dental treatment to maintain the dentition, and improvements in orthodontic appliances and auxiliaries (Breece & Nieberg, 1986; Buttke & Proffit, 1999; Khan & Horrocks, 1991; Proffit et al., 2007). Some improvements in orthodontic appliances and auxiliaries include Invisalign®, Incognito™, temporary anchorage devices (TADs), and design features that are smaller, less noticeable, and easier to maintain. Other reasons include improvement in occlusion and function, periodontal health, speech, general health, and psychosocial factors (Breece & Nieberg, 1986; Brook & Shaw, 1989; Natrass & Sandy, 1995; Sergl & Zentner, 1997; Sergl & Zentner, 1997).

The amount and quality of information available have been reported to be key factors in the decision for an adult to seek orthodontic treatment (Sergl & Zentner, 1997). Today's society is more focused on fashion and beauty, and orthodontics can improve self-esteem by providing a patient with improved dental and facial esthetics (Buttke & Proffit, 1999; Natrass & Sandy, 1995; Ong & Wang, 2002; Sergl & Zentner, 1997; Whitesides, Pajewski, Bradley, Iacopino, & Okunseri, 2008). According to a recent study of the demographics of adults seeking orthodontic treatment, people of all socio-economic groups found the benefits to be so valuable that they elected to undergo orthodontic treatment despite the economical impact (Whitesides et al., 2008).

2.2 Prevalence of Malocclusion in Adults

The prevalence of malocclusion in the adult population is comparable to or even greater than what is observed in children and adolescents (McLain & Proffitt, 1985). It was found that nearly 77 percent of a sample of enlisted United States Army recruits had a malocclusion that would benefit from orthodontic treatment, with 16 percent of the sample possessing a severe or handicapping malocclusion (Searcy & Chisick, 1994). In a sample of Asian male army recruits, half were found to possess a malocclusion that would require orthodontic treatment for dental health reasons (Soh & Sandham, 2004). Studies in Holland and Sweden reported the prevalence of adult malocclusion to range between 40 and 76 percent (Burgersdijk et al., 1991; Salonen et al., 1992).

The Adult Dental Survey conducted in 1988 in the United Kingdom provides insight concerning adult orthodontic treatment need. It was found that six percent of adults had an overjet of seven millimeters or more, representing a Class II malocclusion. Nine percent of adults exhibited had a deep bite impinging on the palate, 56 percent had at least one maxillary tooth out of alignment, and 69 percent had at least one mandibular tooth out of alignment. While the objective need for treatment was not assessed, the study certainly suggests many adults may benefit from orthodontic treatment (Todd & Lader, 1988).

The Third National Health and Nutrition Examination Survey offered a more complete assessment of the extent of malocclusion, finding that malocclusion was observed in up to two thirds of adults in the United States. The survey included occlusal traits as part of its oral health component which provided a more detailed assessment of

the occlusal characteristics of the adult population. More specifically, only 43 percent of adults had an ideal incisor overjet of one to two millimeters, approximately 50 percent had excessive overjet, six percent had an anterior crossbite, and five percent had a maxillary diastema greater than two millimeters. Adults were also found to exhibit considerable crowding, misalignment of maxillary and mandibular incisors, and posterior crossbite (Brunelle et al., 1996). In summary, United States and European studies suggest that two-thirds to three-fourths of adults possess some form of malocclusion (Buttke & Proffit, 1999).

2.3 Interdisciplinary Care of Adult Orthodontic Patients

The orthodontist has a tremendous opportunity of service for the health of the patient in cooperation with the general dentist, periodontist, restorative dentist, and oral surgeon, especially with adult treatment. Adults are more likely than adolescents to present with excessive wear on their dentition, heavily restored teeth, periodontal disease, and tooth loss. Thus, adults commonly require an interdisciplinary approach to their care (Buttke & Proffit, 1999; Goldstein, 1953; Proffit et al., 2007; Shaughnessy, 1995).

Advanced periodontal disease affects approximately eight to thirty percent of adults (Ong & Wang, 2002). It is important to identify patients with a history of periodontal disease and those with risk factors for developing it prior to initiating orthodontic treatment. Orthodontic treatment is not contraindicated for patients with severe adult periodontitis and may even improve the possibilities of saving and restoring a deteriorated dentition (Re, Corrente, Abundo, & Cardaropoli, 2000). Apart from root

resorption, which is usually minor at approximately one to one and one half millimeters, orthodontic treatment has minimal detrimental effects on the health of the periodontium in both the short and long terms (Harris & Baker, 1990; Ong & Wang, 2002).

Orthodontic treatment can be classified as adjunctive or comprehensive.

Adjunctive orthodontic treatment is the movement of teeth to facilitate other dental procedures necessary to control disease, restore function and/or enhance appearance (Buttke & Proffit, 1999; Ong & Wang, 2002; Proffit et al., 2007). Comprehensive orthodontic treatment for adults involves treatment of one or both dental arches with the goal of producing the best balance between dental and facial esthetics, ideal occlusal relationships, and long-term dentoalveolar stability (Buttke & Proffit, 1999; Ong & Wang, 2002; Proffit et al., 2007).

Adjunctive orthodontic treatment is often desired by patients who have other dental needs and want to maintain what they have. For these patients, orthodontics is included as part of a larger treatment plan to serve as an adjunctive procedure to the other periodontal and restorative goals. Treatment planning and coordination is essential for patients with dental needs spanning several branches of dentistry. For patients requiring adjunctive orthodontic treatment, the general dentist is the principal organizer of the treatment plan. Irrespective of the initial occlusal relationship, the goals of adjunctive orthodontic treatment are to:

- (1) Improve periodontal health by eliminating plaque-retaining areas and improving the alveolar ridge contour adjacent to the teeth
- (2) Establish favorable crown-to-root ratios and position the teeth so that occlusal forces are transmitted along the long axes of the teeth
- (3) Facilitate restorative treatment by positioning the teeth so that more ideal and conservative techniques can be used and optimal esthetics can be obtained with bonding, laminates, or full coverage porcelain restorations (Proffit et al., 2007).

Adjunctive orthodontic procedures are customized to the specific needs of each patient.

Typically, treatment involves the following procedures:

- (1) Repositioning teeth that drifted after extractions or bone loss to improve implant placement or fabricate more ideal fixed or removable partial dentures
- (2) Alignment of anterior teeth to improve esthetics restorations or for the purpose of splinting, while maintaining good interproximal bone contour and embrasure form
- (3) Crossbite correction if function is compromised
- (4) Forced eruption of badly broken down teeth to expose sound root structure for crown placement (Proffit et al., 2007).

Comprehensive adult orthodontic treatment is indicated for malocclusions that lead to unacceptable esthetics, reduced masticatory function, or increased trauma that predisposes a patient to caries or periodontal disease. In addition to what adjunctive orthodontic treatment can accomplish, comprehensive treatment can also correct malocclusion, vertical bite relationships, and skeletal excess or deficiency in adult patients. Treatment time for comprehensive orthodontic treatment is longer and more costly than adjunctive orthodontic treatment (Buttke & Proffit, 1999).

Acquiring adequate anchorage for orthodontic tooth movement is a major challenge in adults with partial edentulism and limited amounts of alveolar bone support. The advent of TADs has improved both the potential to achieve tooth movements that were previously not thought possible and to decrease treatment time. TADs have been

found to aid in preprosthetic tooth alignment, retracting and realigning malpositioned teeth, closing edentulous spaces, correcting midline relationships and anterior spacing, reestablishing proper anteroposterior and mediolateral positions for malposed molar abutments, intruding or extruding teeth, correcting a reverse occlusal relationship, correcting an anterior open occlusal relationship, protracting an arch or the entire dentition, and providing stabilization for teeth with reduced bone support (Ong & Wang, 2002).

In a study at the Eastman Dental Hospital in London, it was found that over half of the adults undergoing orthodontic treatment required adjunctive dental procedures by other dental departments (Khan & Horrocks, 1991). Musich conducted a survey of adult orthodontic patients in two private practices and reported that only about 30 percent of patients required orthodontic treatment alone, 45 percent required treatment by another dental specialist, and 25 percent required treatment by multiple dental specialists (Musich, 1986b).

Interdisciplinary treatment demands greater cooperation from the patient. It has been found that increasing the number of dental specialties involved in treatment of an orthodontic case also increases the rate of discontinuation from treatment (Musich, 1986a). It has also been suggested that patient age is directly proportional to the rate of discontinuation from orthodontic treatment (Haynes, 1982). Orthodontic treatment can provide complete rehabilitation in terms of both the appearance and function with a satisfactory long-term prognosis if the patient is reasonably well motivated and responds well to initial periodontal therapy (Ong & Wang, 2002). The orthodontist must use

judgment and ingenuity in the treatment of adult patients with a mutilated dentition in order to achieve the goals of an esthetically pleasing and physiologic occlusion that facilitates other dental treatment, instead of a so-called ideal occlusion as defined by Angle (Goldstein, 1953; Proffit et al., 2007). In clinical orthodontics, establishing Angle's Class I molar occlusion is not always a sufficient achievement to maintain superior interarch relationships (Brader, 1972). Orthodontic treatment in conjunction with other necessary dental treatments must be performed to provide the maximum benefit to the patient. It is imperative to impress upon the various specialists and general practitioners that concern must be taken for the whole patient and not just one's own field of interest.

2.4 Benefits of Adult Orthodontic Treatment

In society today, a person's smile is an important component of facial attractiveness and clearly affects one's self esteem, self-image, and overall sense of well-being (Bergstrom & Halling, 1996; Proffit et al., 2007; Ren et al., 2009). Studies have shown that patients who finished orthodontic treatment experienced a significant improvement in dental esthetics, a positive impact on the psychosocial aspects of his or her life, an improved body image, greater self-confidence, and a significant improvement in his or her quality of life (Brook & Shaw, 1989; Gazit-Rappaport, Haisraeli-Shalish, & Gazit, 2010; Lew, 1993; Z. Liu, McGrath, & Hagg, 2009; Varela & Garcia-Camba, 1995). Quality of life is defined as a person's sense of well-being that stems from satisfaction or dissatisfaction with the areas of life that are important to him or her

(Cunningham & Hunt, 2001). A recent study out of Finland found that patients with severe malocclusion or dentofacial deformities reported significantly higher levels of oral health impacts than the general population, suggesting that severe malocclusion impairs patients' quality of life more than many other oral conditions (Rusanen et al., 2010). A more relaxed social behavior and smiling without hesitation are made possible by improvement in dental esthetics after orthodontic treatment (Gazit-Rappaport et al., 2010; Rusanen et al., 2010). Clearly, the psychological benefits are significant.

Most adults can be treated with adjunctive or comprehensive orthodontic treatment to improve esthetics, restore function, and facilitate other dental procedures. Orthognathic surgery is also often required to treat an adult patient with a skeletal maxillomandibular discrepancy in order to produce a more harmonious skeletal relationship and favorable facial esthetics (Pahkala & Kellokoski, 2007).

Orthodontic treatment in the adult patient may initially seem like a big undertaking for the patient. It is encouraging to note that it was found that adults adapt psychosocially to fixed appliances more easily than adolescents (Brown & Moerenhout, 1991). Proper treatment planning and coordination of orthodontic treatment with other dental treatments results in considerable benefits to the adult patient.

2.5 Assessment of Orthodontic Treatment Outcome

Each person possesses an individual sense of what is beautiful, and one's cultural and ethnic background may contribute to how beauty is perceived. A study of facial attractiveness judged by Chinese and American orthodontists showed that each group more consistently rated patients of their same ethnicity in comparison with the other ethnic group (Y. Liu et al., 2009). History shows that the perception of beauty has changed over time (Shafiee, Korn, Pearson, Boyd, & Baumrind, 2008; Torsello, Mirigliani, D'Alessio, & Deli, 2010). With such variation in what is believed to be beautiful, it is necessary to take a qualitative approach when judging the orthodontic treatment outcome for patients.

Numerous methods of quantitative analysis have been suggested for orthodontic treatment outcome assessment. The Peer Assessment Rating (PAR) Index and the Index of Complexity, Outcome, and Need (ICON) have gained popularity in Europe. Over the years, several methods of treatment outcome analysis have been used by the American Board of Orthodontics (ABO) with a major emphasis always placed on the final occlusion of a case (Casko et al., 1998). The ABO uses the discrepancy index (DI) to measure case difficulty, but does not have a true measure of treatment need. The ABO developed the Objective Grading System (OGS) to assess treatment outcome for the purpose of board certification and for use by orthodontists to determine if they are producing "Board quality" results. The ABO hopes that this method of self-evaluation using the OGS will elevate the overall quality of orthodontic care (Casko et al., 1998). It is of interest to note that the ABO reports an increase in the number of adult cases

presented for the ABO clinical examination that parallels the increase in active adult orthodontic treatment (Grubb et al., 2008).

The PAR Index is a British occlusal index that was developed in 1987 to measure the severity of dental malocclusion and estimate deviation from normal alignment and occlusion at any stage of development. Over 200 pretreatment and posttreatment plaster study models representing various types of orthodontic cases were used to construct this index. The difference in scores between pretreatment and posttreatment study models reflects the degree of improvement and thus the success of orthodontic treatment. A score is assigned to each of the following eleven occlusal traits: upper right segment, upper anterior segment, upper left segment, lower right segment, lower anterior segment, lower left segment, right buccal occlusion, overjet, overbite, centerline, and left buccal occlusion. The sum of all scores represents the amount that a case deviates from normal alignment and occlusion. Each component of the PAR Index has been weighted to reflect current British orthodontic opinion, but the Index is flexible in that the weightings may be changed to reflect future standards and standards held in other countries (Richmond et al., 1992).

The PAR Index has been shown to be a reliable and valid measure of occlusion (Richmond et al., 1992). Treatment difficulty and PAR scores were found to be significantly correlated and PAR scores can be used to estimate treatment complexity (DeGuzman et al., 1995). The PAR index was also found to be significantly correlated with the professional assessment of orthodontic treatment need (Richmond et al., 1992).

The PAR Index is widely used and quite popular in European countries. In the United States, it is used to provide a rough estimate of changes in tooth position and is also for research purposes. It is not used by the ABO for case assessment because it lacks precision in discriminating between minor discrepancies of tooth position (Casko et al., 1998).

ICON was developed to serve as an orthodontic index to assess treatment need, complexity, improvement, and outcome based on international professional opinion. It was the first occlusal index that was capable of assessing treatment need and outcome using one set of occlusal traits. It is intended for use by practicing orthodontists and to serve as a basis for quality assurance standards in orthodontics. This occlusal index is based on the subjective opinion of an international panel of 97 orthodontists who judged 240 pretreatment and 98 posttreatment plaster study models. Five occlusal traits were identified for use with this index, including: Index of Orthodontic Treatment Need (IOTN) Aesthetic Component, crossbite, spacing, buccal segment anteroposterior relationships, and the anterior vertical relationship. Each trait is weighted appropriately depending on if treatment need or treatment outcome is being evaluated, and a score is determined (Daniels & Richmond, 2000). ICON has relatively lower predictive accuracy for treatment outcome than for treatment need judgments. This is identified as a limitation by the ABO and thus the Index is not used (Daniels & Richmond, 2000; Schabel, McNamara, Baccetti, Franchi, & Jamieson, 2008).

Over the years, the ABO used both objective and subjective methods to judge orthodontic treatment outcome. At one time, the Occlusal Index was used by the

American Board of Orthodontics (ABO) to determine treatment quality. The Occlusal Index uses dental age, molar relationship, overbite, overjet, posterior crossbite, posterior openbite, tooth displacement, midline relationship, and missing permanent teeth in its assessment. Due to its method of evaluation, it was deemed more appropriate for scoring pretreatment records to determine the need for treatment rather than posttreatment outcomes (Summers, 1971). Currently, the ABO uses the OGS to assess orthodontic treatment outcome for the purpose of Board certification (ABO, 2010). The scoring system was developed systematically through a series of four field tests over a five year period. The OGS was officially finalized for use in 1999 (Casko et al., 1998).

There are eight components of the OGS, including: alignment, marginal ridges, buccolingual inclination, occlusal relationship, occlusal contacts, overjet, interproximal contacts, and root angulation. Points are scored for each deviation from ideal and a high score results in failure of the examination (Casko et al., 1998). A major limitation with the Objective Grading System (OGS) used by the ABO is that many of these grading criteria rely on anatomical landmarks such as incisal edges, cusp tips, marginal ridges, and central grooves to evaluate the final position of teeth. These landmarks are not easily identified in an adult dentition exhibiting worn incisal edges and cusp tips, restorations, and/or missing teeth.

The landmarks for the OGS may not only be difficult to identify in patients with a mutilated dentition, but certain components like marginal ridge height are actually treatment planned differently for these patients. Patients with an intact and periodontally healthy dentition may be treated by aligning the marginal ridges to establish even contact

of posterior teeth when they are in occlusion and to level the interproximal bone between adjacent teeth. Patients with a mutilated dentition often have interproximal bone loss and uneven wear on posterior teeth, which may require the orthodontist to level the bone and reshape teeth to maintain occlusal contacts (Mathews & Kokich, 1997).

Emi Chaison studied orthodontic treatment outcome in the adult patient. Her thesis results indicate that orthodontic examiners mainly used factors of the OGS to decide whether or not a case was well-treated, with intercuspation serving as the most important factor (Chaison, Liu, & Tuncay, 2011). The OGS places a great emphasis on the final occlusion of a case. While the optimal occlusal result certainly provides functional and dentally esthetic benefits, it does not ensure stability (Little, 2009; Nett & Huang, 2005). It has been found that settling occurs after the completion of orthodontic treatment. There is a regression toward the mean during posttreatment settling. Well-finished cases tend to get worse and acceptable or poorly finished cases tend to improve long-term (Nett & Huang, 2005). To account for these findings, the ABO may want to consider using a weighting system similar to that used in the PAR Index. The final occlusal result may be weighted less since this criterion has been found to self-correct during the posttreatment period.

The OGS is considered reliable and valid for assessment of posttreatment outcomes in terms of objective occlusal features as appraised by experienced orthodontists, but the OGS fails to account for soft tissue measures, facial profile changes, smile esthetics, and restorability of the case. A recently published study reported detecting no correlation between components of the ABO OGS and smile

esthetics (Schabel et al., 2008). Additionally, numerous investigators have speculated about the interaction between occlusal outcomes and esthetics and it has been suggested that perfect occlusion does not necessarily result in desirable dental and facial esthetics (Ackerman, Ackerman, Brensinger, & Landis, 1998; Riedel, 1950). Another limitation of the OGS is that objective criteria are used to judge the esthetics of the treatment outcome, which are often subjective in nature.

The general population mostly judges treatment success based on the resulting smile, so it would seem essential to strive to establish optimal smile and facial esthetics along with optimal occlusal outcomes that maximally benefit the patient (Ackerman, Proffit, & Sarver, 1999; Espeland & Stenvik, 1991). Successful orthodontic treatment has also been defined as achieving the objective and subjective goals identified by the practitioner and patient before treatment is initiated (Buttke & Proffit, 1999). Ultimately, the patient must receive the best possible outcome from orthodontic treatment and patient satisfaction must be achieved.

CHAPTER 3

AIMS OF THE INVESTIGATION

The aims of this investigation were as follows:

1. To determine the relationship between orthodontic treatment outcome assessment ratings of practicing orthodontists, periodontists, and restorative dentists.
2. To determine if the outcome of orthodontic treatment is evaluated consistently by individual examiners.
3. To determine which factors are considered most important for the evaluation of the quality of adult orthodontic treatment outcome of patients with a mutilated dentition by practicing orthodontists, periodontists, and restorative dentists.

CHAPTER 4

MATERIALS AND METHODS

4.1 Subject Selection

The subjects were selected from the existing records of consecutively treated patients who finished treatment at Temple University Kornberg School of Dentistry in the Department of Orthodontics within the last three years. The records were accessed in the Podray Orthodontic Clinic. Inclusion criteria were:

- i. 18 years of age or older at the onset of orthodontic treatment
- ii. Possessed a mutilated dentition prior to the start of orthodontic treatment (two or more missing teeth)
- iii. No active periodontitis
- iv. Exhibited good cooperation during treatment
- v. Pretreatment and posttreatment intraoral photographs and plaster study models available for analysis

The minimum age of 18 years was set because the target population for this study was adults. The ABO considers an adult to be 18 years of age and older (Grubb et al., 2008). Subjects were selected if they had two or more missing teeth at the start of orthodontic treatment, indicating a mutilated dentition. Patients with active periodontal disease and records indicating poor cooperation during orthodontic treatment were excluded from the study because an objective of the study was to evaluate the final orthodontic outcome separate from patient-specific factors. The treatment finish date was determined to be roughly within the last two years to ensure that patient records would be readily available and the most current treatment methods were used. Finally, all patients considered for use as subjects in this study were required to have pretreatment and

posttreatment intraoral photographs and plaster study models available for comprehensive analysis.

The selection of only minimal components of orthodontic records (intraoral photographs and plaster study models) was favorable in this study to prevent overloading the evaluator with information and control which information the evaluator used for assessment purposes. The series of digital intraoral color photographs is the same set required for presentation to the ABO for Board certification. The set of five photographs included: a maxillary occlusal view, mandibular occlusal view, frontal view in maximum intercuspation, right lateral view in maximum intercuspation, and left lateral view in maximum intercuspation (ABO, 2010). Although many publications describe the use of a single intraoral photograph of the frontal view in maximum intercuspation for analysis purposes, it was also necessary to show the lateral views to properly rate the incisor overjet (Brook & Shaw, 1989). Maxillary and mandibular occlusal photographs were also shown to give the evaluator a more complete view of the edentulous regions.

Intraoral photographs were taken by different orthodontic providers who possessed variable levels of photography experience. Unfortunately, a tightly controlled and consistent method for intraoral photography was not used. Camera type and the angulation of photographs were inconsistent. Since these factors could influence the presentation of the case, plaster study models were used to verify what was shown in the clinical photographs. Plaster study models were also necessary to provide a more comprehensive case presentation so the evaluator could properly assess edentulous regions. Intraoral photographs do not always portray an accurate representation of the

height and width of an edentulous ridge, incisor overjet, incisor overbite, and posterior buccal occlusion. Most of the orthodontic evaluators regularly use plaster study models for case analysis, so use of models increased the level of comfort for those evaluators during the process of the study.

Other studies support the methods used in this study. In a study comparing the use of facial photographs and plaster study models to judge dental attractiveness and orthodontic treatment need, it was found that orthodontic examiners rated dental attractiveness higher from facial photographs and rated orthodontic treatment need higher from study models (Sherlock, Cobourne, & McDonald, 2008). Accordingly, plaster study models were used for analysis by evaluators in this study to provide the most detailed representation of the dentition and permit a critical assessment of the case. An example of the case set-up can be viewed in Appendix A.

Prior to subject selection, IRB exempt status was granted by the Temple University IRB committee. Ten patients met the inclusion criteria and were selected for evaluation. Each patient was labeled by number to maintain confidentiality. All patient sensitive information was removed from the records.

4.2 Examiner Selection

Patients with a mutilated dentition seek comprehensive dental care from a variety of specialists in order to meet their treatment needs. Educational training varies across specialty groups and this may affect the perception of orthodontic treatment outcome (Berk et al., 2002). Even though the gold standard for orthodontic treatment outcome is assessed by an orthodontist, it is still important to gain an understanding of the perception of other general dental practitioners and other dental specialists as they are also participating in comprehensive care for the patient.

The evaluators selected for this study are involved in academics at Temple University. They demonstrate excellence in their field and most are boarded in their respective specialty. In addition, the evaluators have credentials in research and publication. From Temple University Kornberg School of Dentistry, nine faculty members from the Department of Orthodontics, three faculty members from the Department of Periodontology and Implantology, and three faculty members from the Department of Restorative Dentistry were asked during a one-on-one meeting to volunteer their participation in the study. Each evaluator provided verbal consent to commit his or her participation in the study. Evaluator responses were kept anonymous.

4.3 Case Set-up and Construction of Questionnaires for Assessment by Evaluators

Pretreatment and posttreatment intraoral photographs and plaster study models for all subjects were collected in the Podray Orthodontic Clinic. Photographs were edited and presented in a standard format. All patient sensitive information was removed from the records and they were labeled by number. The records for each case were displayed and made available for analysis by evaluators at Temple University in the Department of Orthodontics. Once the study was completed, access to patient records was no longer necessary.

A questionnaire was constructed to allow the evaluator to rate seven specific orthodontic outcome criteria using a continuous visual analogue scale (VAS) for each the cases. The orthodontic evaluators were asked an additional question to determine if they rated the overall result based on ABO standards or by what is reasonably achievable for the patient. The VAS allows quantifiable subjective ratings to be gathered quickly. A continuous scale permits the evaluator to rate an item by placing a single mark along a horizontal line. Each end of the scale was anchored with a label to describe the extremes of the item being rated. The VAS has been used in research for several reasons. It requires little motivation or effort from the evaluator which increases compliance. It also allows careful discrimination of values. In addition, the VAS serves as a rapid means of gathering ratings (Marsh-Richard, Hatzis, Mathias, Venditti, & Dougherty, 2009).

The questionnaire including the VAS was entitled, "Evaluator Questionnaire for Individual Case Assessment of the Adult Mutilated Dentition." Each questionnaire was numbered by case so the response could be matched to the specific case. A second type

of questionnaire, entitled “Final Case Assessment Questionnaire,” was constructed to obtain qualitative data from the evaluators using open ended questions. The orthodontist group was required to answer an additional question regarding their Board certification status. All questionnaires can be viewed in Appendix B.

4.4 Execution, Distribution, and Collection of Questionnaires

Qualtrics was used as the survey instrument for this study. Qualtrics provides custom designed surveys and methods for evaluation of results. In order to evaluate consistency among examiners, twenty percent of the cases were repeated. Cases one and two were repeated and also served as cases eleven and twelve. Each evaluator was provided online access to Qualtrics and completed one “Evaluator Questionnaire for Individual Case Assessment of the Adult Mutilated Dentition” for each of the twelve cases. Following completion of assessment of all cases, the evaluator completed the “Final Case Assessment Questionnaire.” Evaluators were not aware of the “Final Case Assessment Questionnaire” prior to its distribution. All completed questionnaires were retained by Qualtrics until the completion of the study. The quantitative responses were recorded in Microsoft Excel spreadsheets.

4.5 Analysis of Data

This study was approached from both a quantitative and qualitative perspective. Microsoft Excel was used for analysis of the quantitative data. The mean and deviation were used to compare groups and determine consistency among individual evaluators. Judging the final esthetic outcome of orthodontic treatment involves an esthetic component that is subjective in nature. The open ended questions offered insight into the factors deemed most important for assessment of orthodontic treatment outcome.

CHAPTER 5

RESULTS

5.1 Quantitative Results

Quantitative results were collected using Qualtrics and recorded in Microsoft Excel. Mean values and standard deviations were calculated, and graphs were created using Excel. All quantitative data can be found in Appendix C.

5.1.1. Examiner Consistency

Consistency among individual examiners was measured by recording the absolute value of the difference between ratings for each question by each examiner for identical cases. The evaluators are separated by group so consistency can be compared among orthodontists, periodontists, and restorative dentists.

Figure 1. Cumulative Percentage Difference between Reponses by Evaluators on Identical Cases

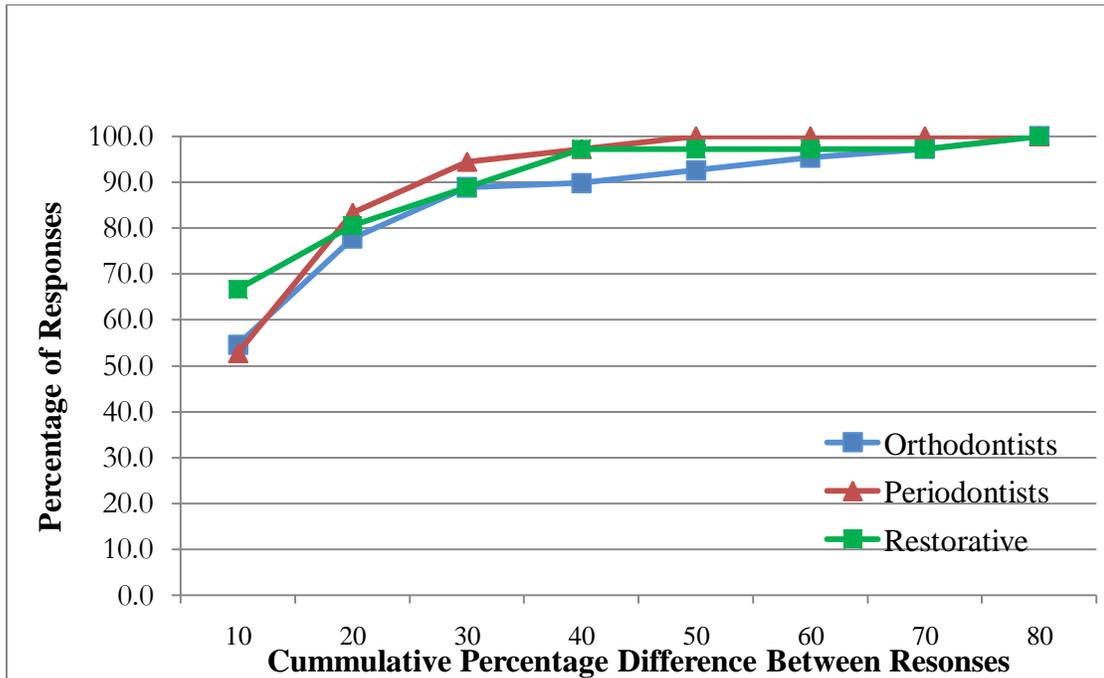
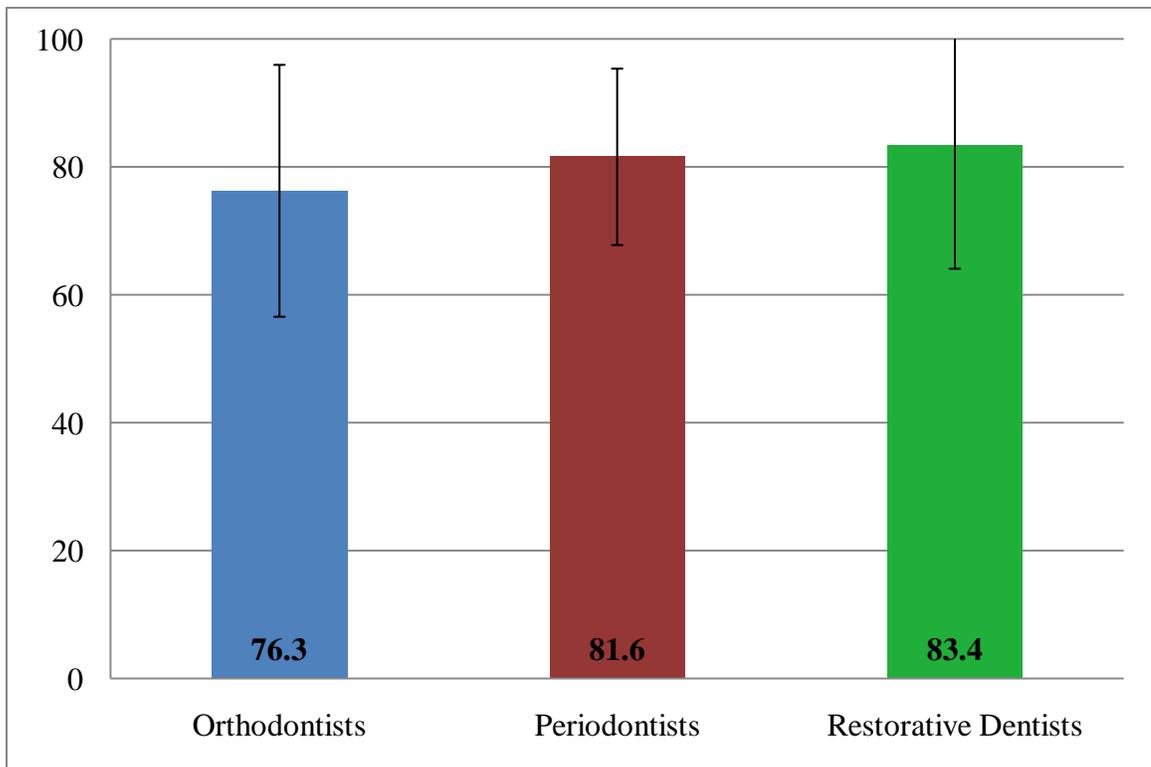


Figure 1 shows the amount of discrepancy between responses by evaluators for identical cases. When looking at reliability among evaluators, evaluator groups were consistent within ten points when judging identical cases approximately half of the time. However, the range needed to be increased to 30 points in order to include approximately 90 percent of the data. Outliers existed up to a difference of 79 points.

5.1.2. Responses Recorded for Questions One Through Seven from the “Evaluator Questionnaire for Individual Case Assessment of the Adult Mutilated Dentition”

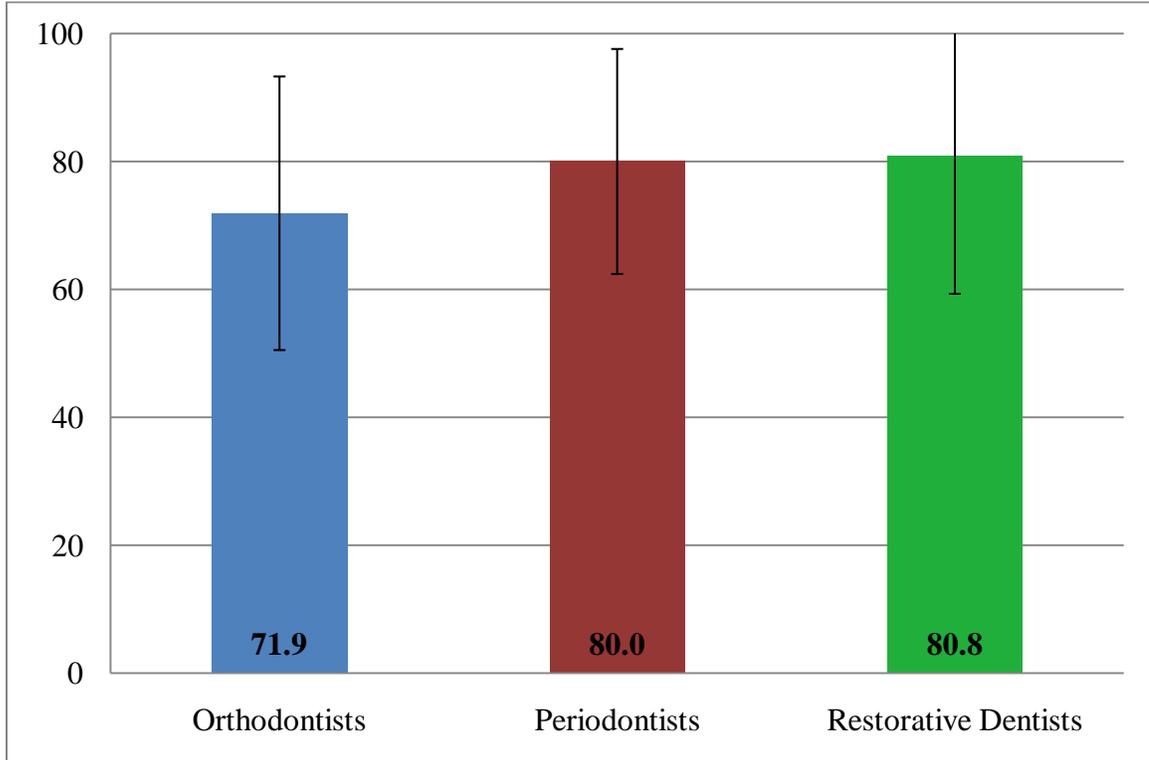
The following figures show the mean and standard deviation for ratings of questions one through seven from the “Evaluator Questionnaire for Individual Case Assessment of the Adult Mutilated Dentition.” Each question is described with the corresponding figure. Questionnaires can be found in Appendix B.

Figure 2. Rating the Overall Result of Orthodontic Treatment – Question One



Question one asked the examiners to rate the overall treatment result. Figure 2 shows that orthodontists rated the overall orthodontic treatment result more critically than periodontists and restorative dentists.

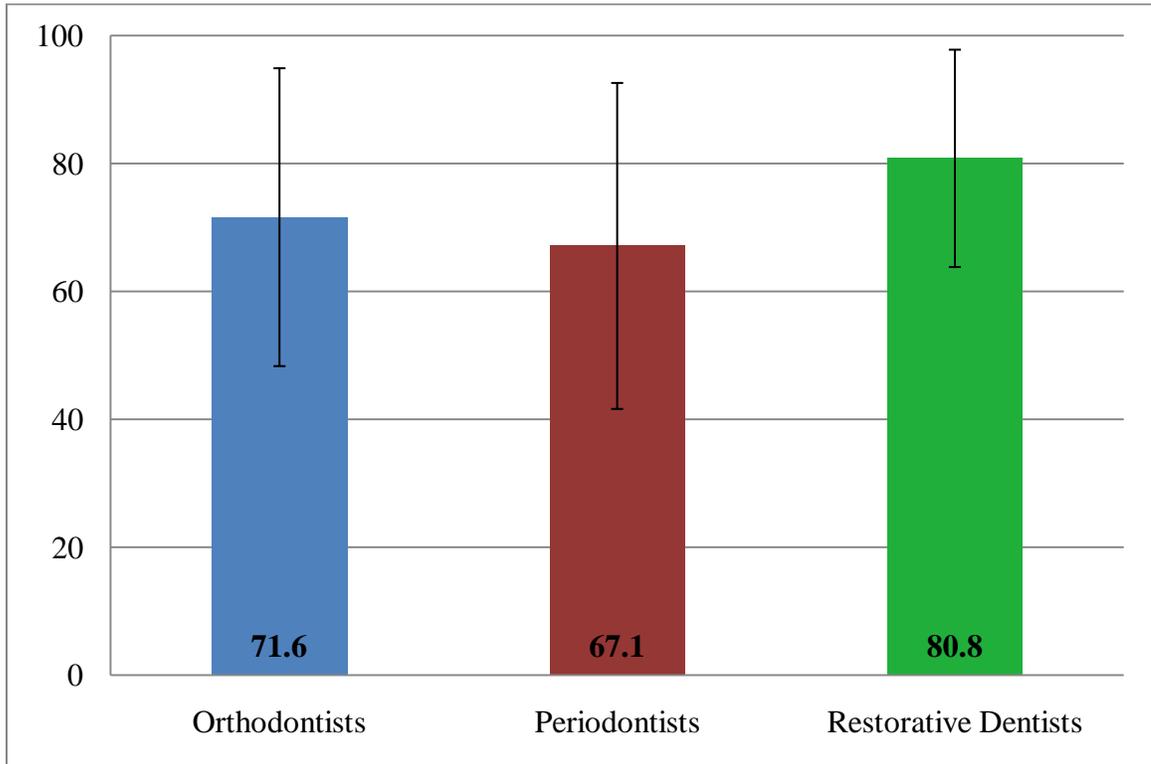
Figure 3. Rating the Posttreatment Occlusion – Question Two



Question two asked the examiners to rate the posttreatment occlusion based on interdigitation, incisor overjet, and incisor overbite. Figure 3 shows that orthodontists rated the posttreatment occlusion more critically than periodontists and restorative dentists.

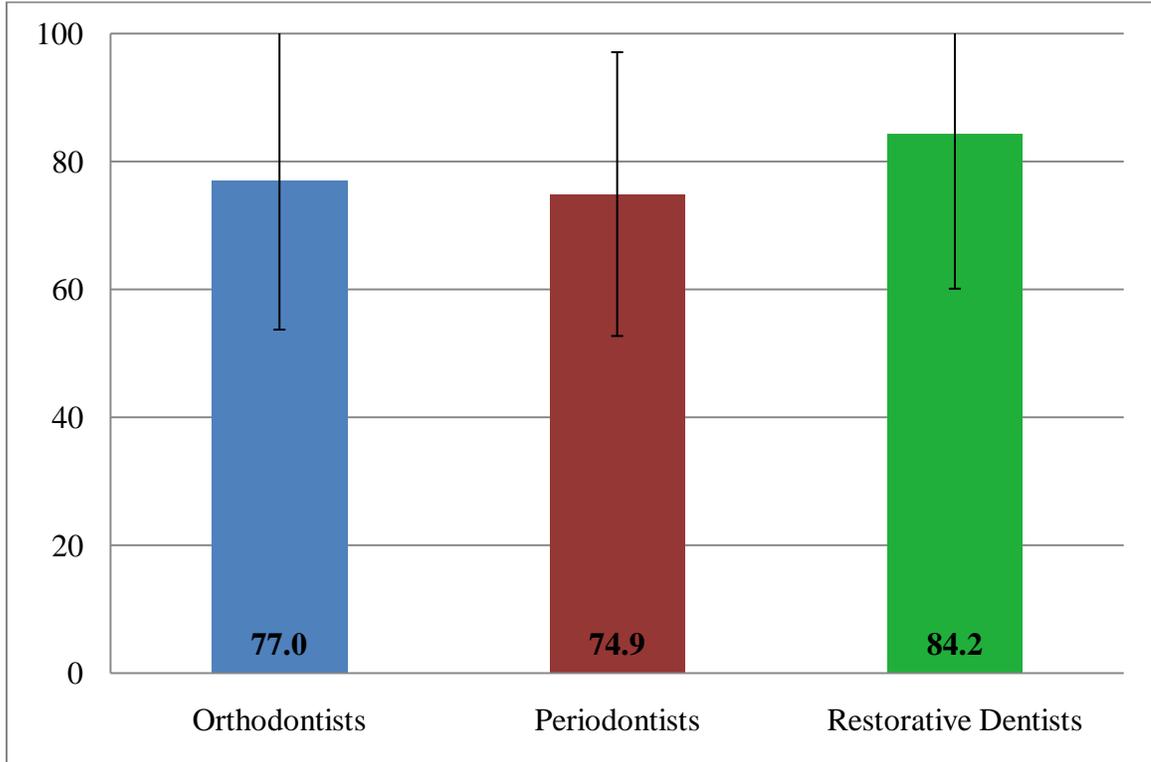
Question three asked the examiners to rate the resulting quality of the buccal bone height. For this question, the majority of evaluators checked the box, “Unable to Decide,” for evaluation of the buccal bone height, so this question was omitted from analysis. Results are separated by examiner group.

Figure 4. Rating the Posttreatment Periodontal Health – Question Four



Question four asked the examiners to rate the posttreatment periodontal tissue contours and periodontal health. Figure 4 shows that periodontists rated the posttreatment periodontal health more critically than orthodontists and restorative dentists.

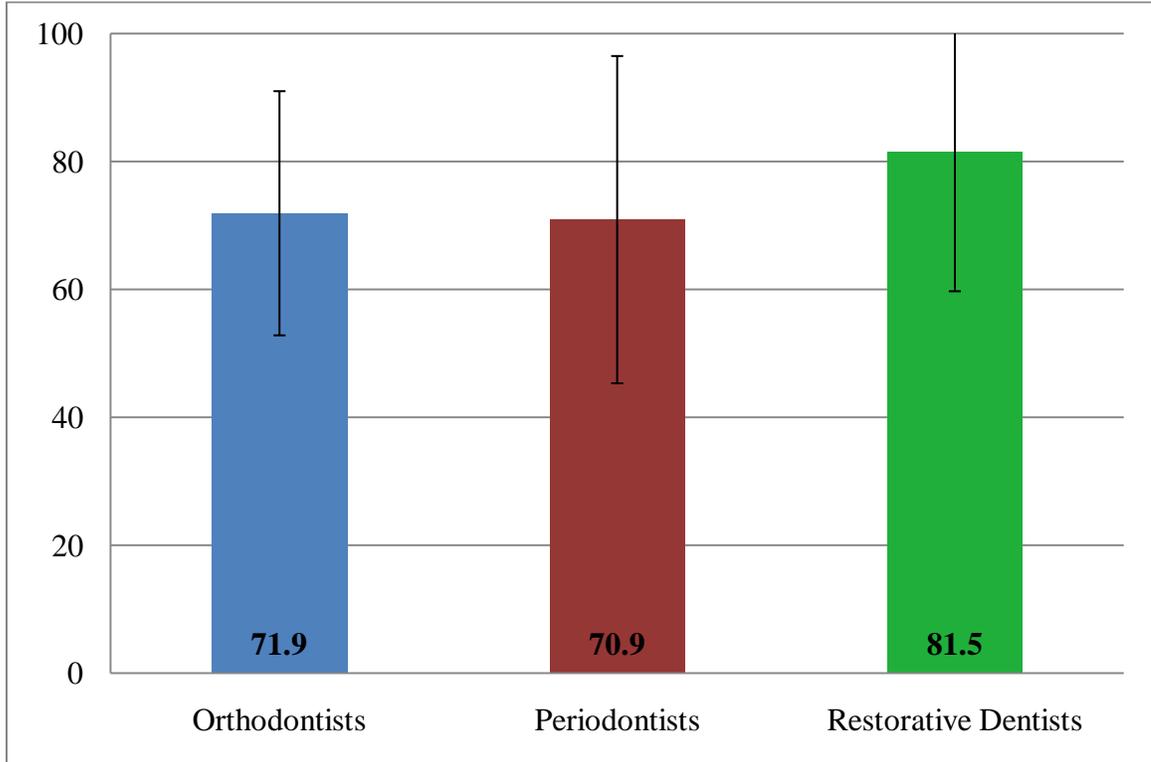
Figure 5. Rating the Posttreatment Restorability – Question Five



Question five asked the examiners to rate the restorability of the final result.

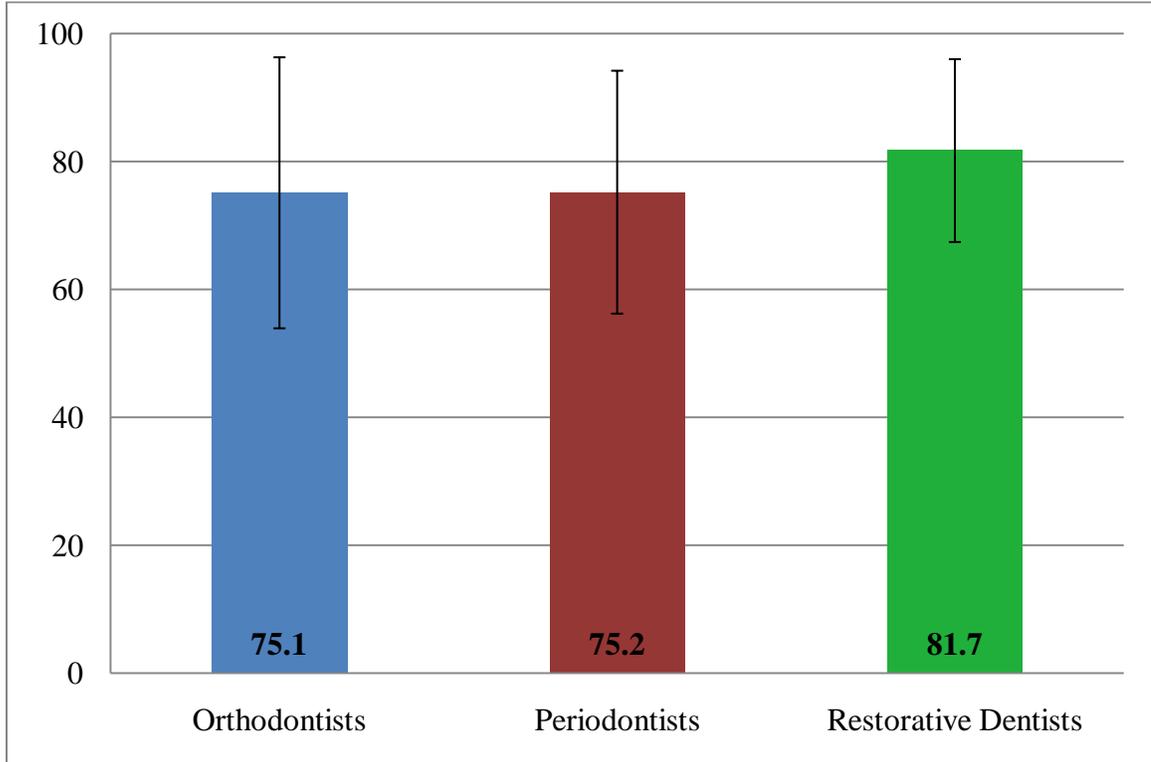
Figure 5 shows that restorative dentists rated the level of posttreatment restorability higher than orthodontists and periodontists.

Figure 6. Rating the Posttreatment Stability – Question Six



Question six asked the examiners to rate their prediction for stability of the final result. Figure 6 shows that orthodontists and periodontists are more critical at rating long-term stability of orthodontic treatment compared to restorative dentists.

Figure 7. Rating the Level of Case Difficulty – Question Seven

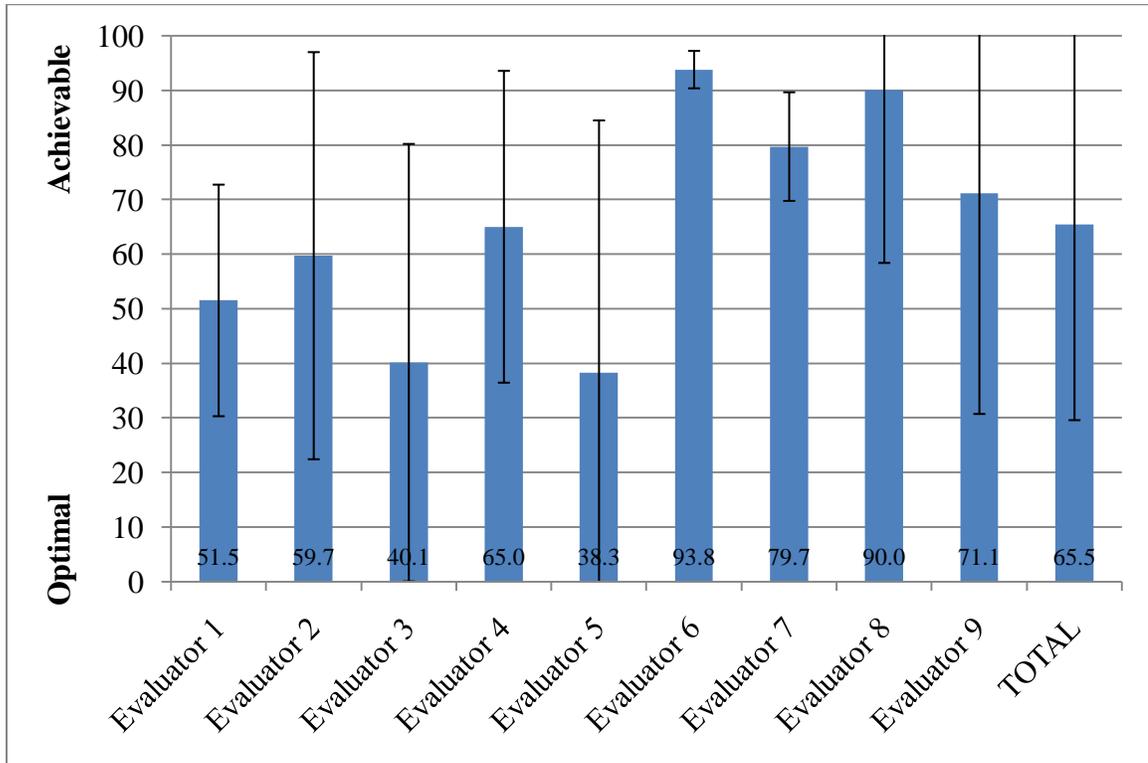


Finally, question seven asked the examiners to rate the level of difficulty of the case. Orthodontists, periodontists, and restorative dentists agree on the level of difficulty of orthodontic cases.

5.1.3. Orthodontist Responses Recorded for Question Eight from the “Evaluator Questionnaire for Individual Case Assessment of the Adult Mutilated Dentition”

The following figures show the mean and standard deviation for the orthodontist responses to question eight. This question asked the examiners to rate the extent that their decision is influenced by ABO standards representing optimal treatment outcome or by what is reasonably achievable for the patient. Results are separated by individual examiner and case.

Figure 8. Mean Value of Responses of Individual Orthodontist Evaluators for Question Eight from the “Evaluator Questionnaire for Individual Case Assessment of the Adult Mutilated Dentition”



There was a mixed response by evaluators indicating that orthodontists judge posttreatment orthodontic outcome differently for the same set of cases. In some cases, orthodontists compare the result to what is optimal as described by the ABO grading criteria while in other cases they compare the result to what is reasonably achievable for the patient. On average, orthodontists tended to blend the ABO standards with what is reasonably achievable.

Figure 9. Mean Value of Responses to Question Eight by Orthodontist Evaluators for Each Case from the “Evaluator Questionnaire for Individual Case Assessment of the Adult Mutilated Dentition”

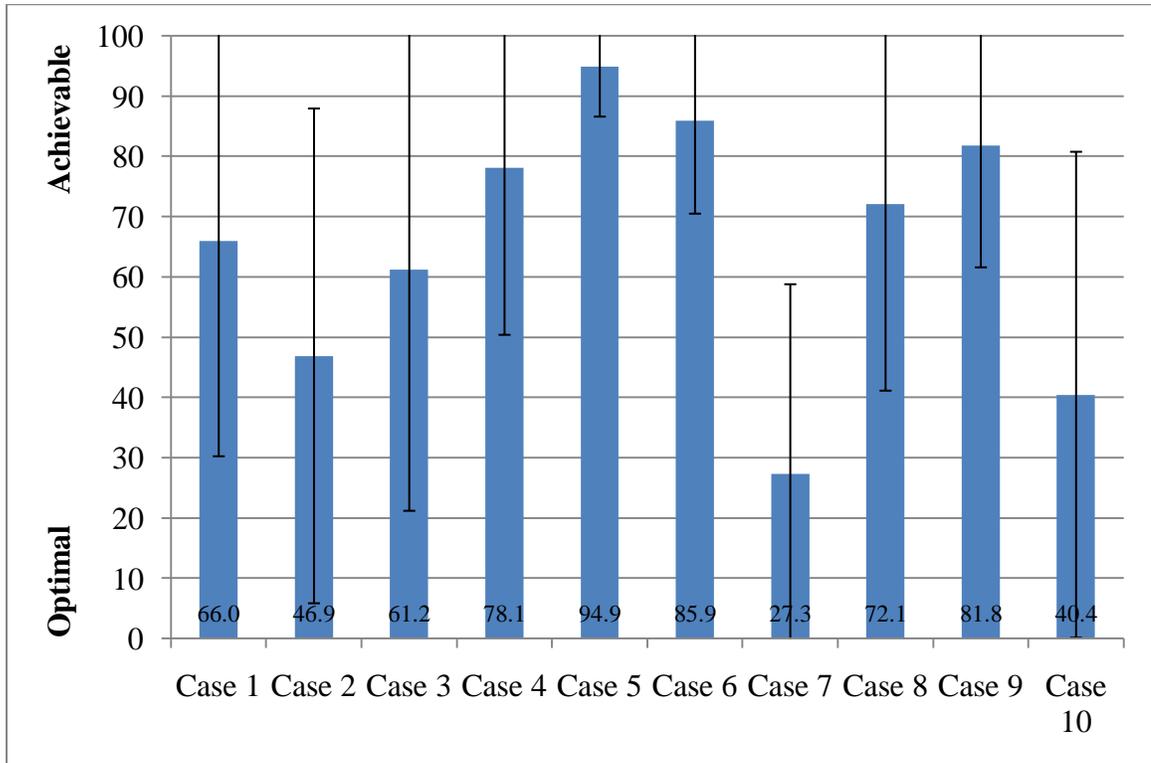


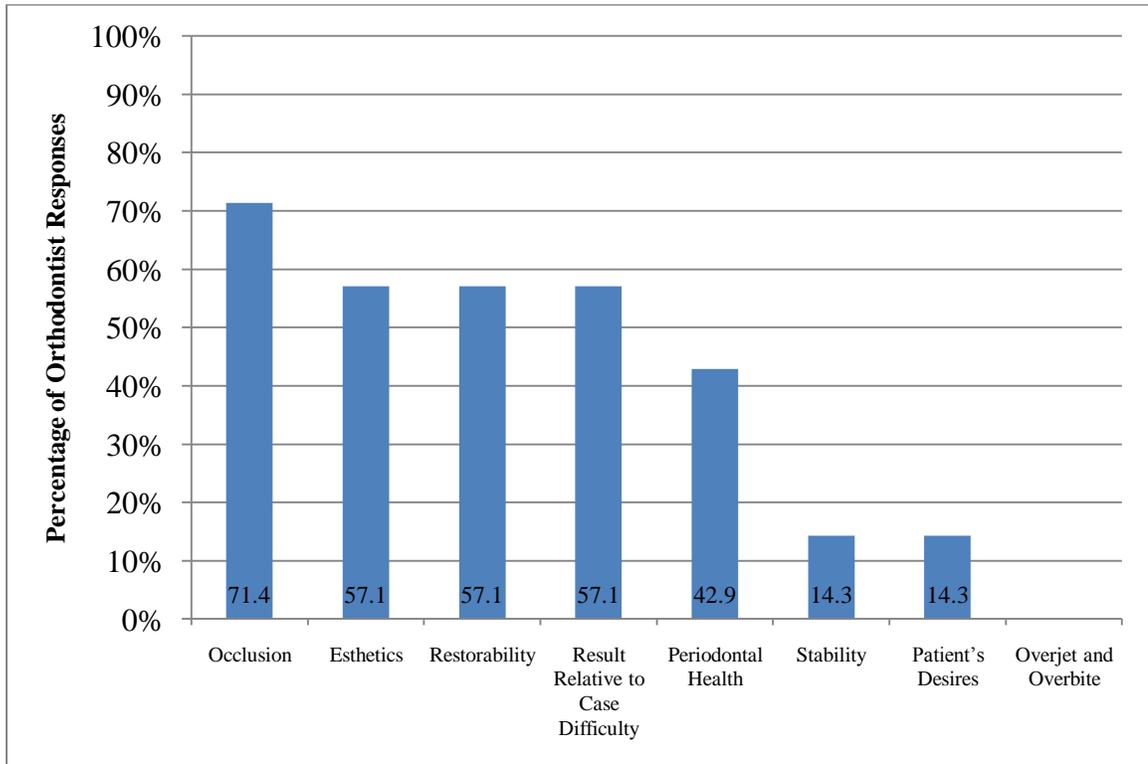
Figure 9 indicates that orthodontists judge posttreatment outcome differently for individual cases depending on the level of pretreatment difficulty and realistic posttreatment goals. Case seven represents a fairly straightforward case with a low level of difficulty, and orthodontists use ABO standards to judge the posttreatment result for this case. Case five, on the other hand, represents a case with several viable treatment options and a high level of difficulty. Orthodontists judge the posttreatment result for this case based on what is reasonably achievable.

5.2 Qualitative Responses Recorded from the “Final Case Assessment Questionnaire”

The following figures and tables represent the qualitative data collected.

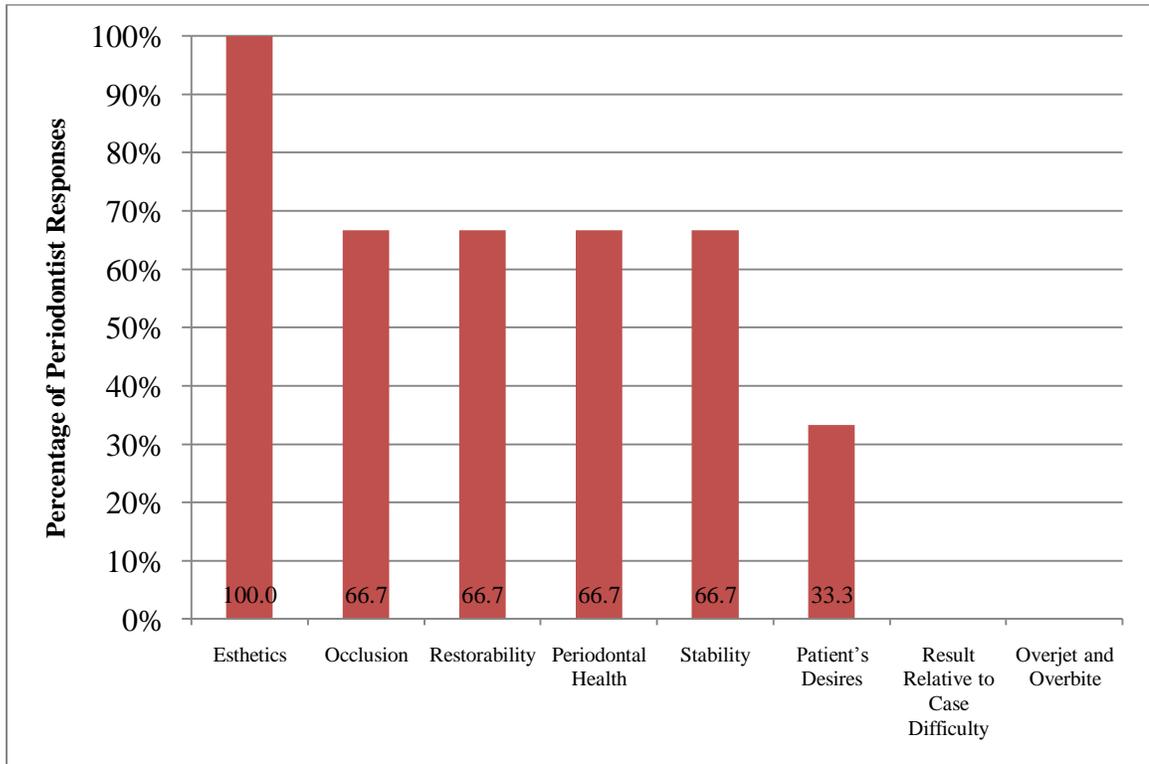
Responses to the open ended questions were coded based on key words or phrases provided. Results are separated by examiner group. The raw data can be found in Appendix D.

Figure 10. Factors Used by Orthodontists to Define the Gold Standard of Orthodontic Treatment



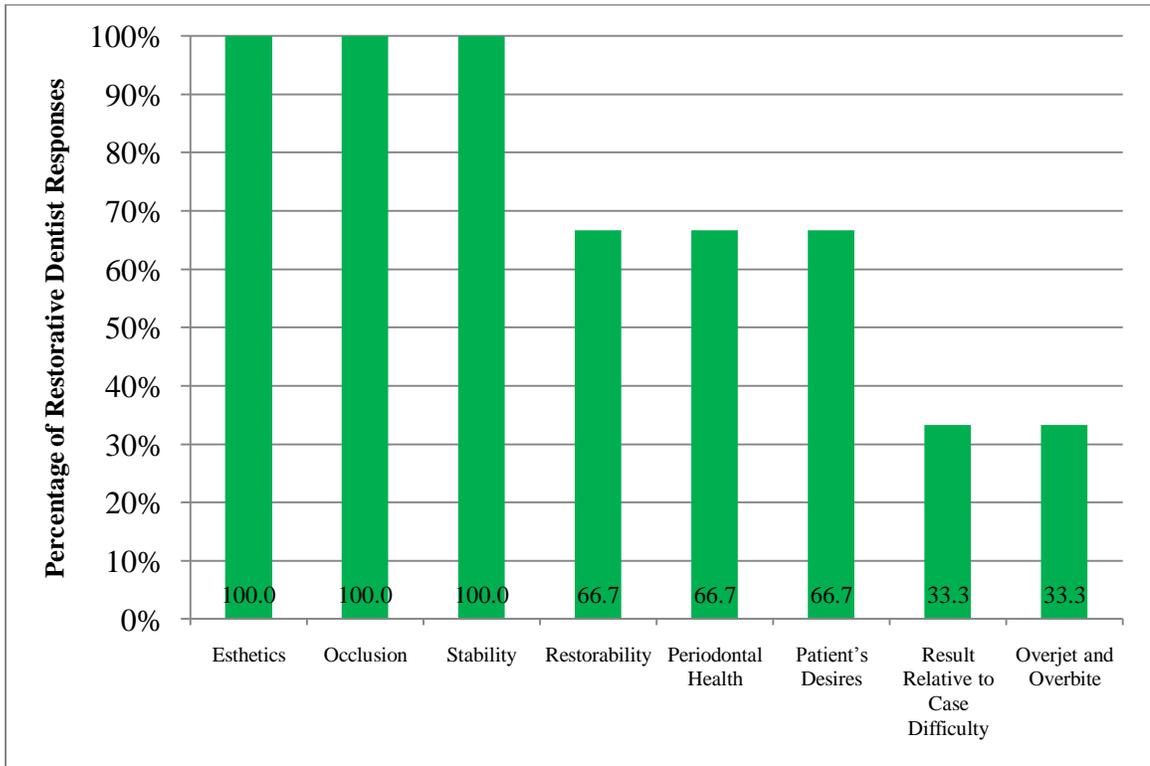
Occlusion was the most commonly mentioned factor used by orthodontists in the definition of the gold standard of orthodontic treatment. Other factors that were included in the definition by over half of the orthodontists are: esthetics, restorability, and judging the result relative to the level of case difficulty.

Figure 11. Factors Used by Periodontists to Define the Gold Standard of Orthodontic Treatment



All three periodontists included esthetics in their definition of the gold standard of orthodontic treatment. Other factors such as occlusion, restorability, periodontal health, and stability were also included in the definition by most evaluators.

Figure 12. Factors Used by Restorative Dentists to Define the Gold Standard of Orthodontic Treatment



Esthetics, occlusion, and stability were included in the definition of the gold standard of orthodontic treatment by all three restorative dentists. Restorability, periodontal health, and the patient's desires were also commonly mentioned.

The following tables show the frequency of response for specific factors relating to orthodontic treatment outcome based on the open-ended responses. The results have been combined for all groups as well as divided by examiner group.

Table 1. Factors Deemed Most Important by Practitioners for Evaluation of Posttreatment Orthodontic Outcome of the Adult Patient with a Mutilated Dentition

Characteristics	All Groups	Orthodontists	Periodontists	Restorative Dentists
Occlusion	69.2%	71.4%	66.7%	66.7%
Esthetics	61.5%	57.1%	66.7%	66.7%
Restorability	61.5%	57.1%	66.7%	66.7%
Periodontal Health	46.2%	42.9%	66.7%	33.3%
Stability	38.5%	14.3%	33.3%	100%
Patient's Desires	30.8%	28.6%	33.3%	33.3%
Overjet and Overbite	23.1%	28.6%	33.3%	0%
Result Relative to Case Difficulty/Realistic Expectations	7.7%	14.3%	0%	0%

Table 2. The Order of Importance of Factors Used to Judge Posttreatment Orthodontic Outcome in the Adult Patient with a Mutilated Dentition

Characteristics	All Groups	Orthodontists	Periodontists	Restorative Dentists
Esthetics	53.8%	28.6%	100%	66.7%
Restorability	46.2%	28.6%	66.7%	66.7%
Occlusion	38.5%	42.9%	66.7%	66.7%
Periodontal Health	38.5%	28.6%	66.7%	33.3%
Stability	38.5%	14.3%	33.3%	100%
Patient's Desires	7.7%	0%	0%	33.3%
Result Relative to Case Difficulty/Realistic Expectations	7.7%	14.3%	0%	0%

Table 3. Factors Used to Describe the Gold Standard of Orthodontic Treatment for the Adult Patient with a Mutilated Dentition

Characteristics	All Groups	Orthodontists	Periodontists	Restorative Dentists
Esthetics	76.9%	57.1%	100%	100%
Occlusion	76.9%	71.4%	66.7%	100%
Restorability	61.5%	57.1%	66.7%	66.7%
Periodontal Health	53.8%	42.9%	66.7%	66.7%
Stability	46.2%	14.3%	66.7%	100%
Result Relative to Case Difficulty/Realistic Expectations	38.5%	57.1%	0%	33.3%
Patient's Desires	30.8%	14.3%	33.3%	66.7%
Overjet and Overbite	7.7%	0%	0%	33.3%

CHAPTER 6

DISCUSSION

The cases selected for use in this study were finished with orthodontic treatment within the last three years at Temple University in the Department of Orthodontics. There was a variety of case types selected and a wide spectrum of quality of case finish. Among the cases selected, all classifications of malocclusion were represented including cases with the following characteristics: several missing posterior teeth, missing maxillary central incisor, large central diastema, severe periodontal involvement of a lower incisor, and surgical treatment. Highly trained orthodontists, periodontists, and restorative dentists offered a considerable amount of input when describing how they judged the cases.

Overall, there was consistency among individual examiners when judging identical cases. Each group showed unique priorities when judging specific factors related to orthodontic case finish.

Orthodontists were more critical than periodontists and restorative dentists when judging the overall result and posttreatment occlusion. This is not surprising because orthodontists hold their specialty to a high standard. Orthodontists were careful to give a high rating only to the best treated cases. It is possible that periodontists and restorative dentists treat a greater number of patients in the mutilated dentition in their practices compared to orthodontists. These patients typically report to have been functioning successfully with their malocclusion for years, so perhaps that is the reason why

periodontists and restorative dentists were less critical when judging posttreatment occlusion.

There was a lot of variability in ranking the overall result of two specific cases. It seemed difficult for evaluators to judge case four, where the patient is missing several posterior teeth and has a Class I canine relationship on the right side and Class II canine relationship on the left side. Case five also generated variable responses due to the level of case complexity. The evaluators commented that the final result must be reasonably achievable for the patient due to the difficulty level of the case. It is clear that evaluation of posttreatment results must be customized to each individual.

Periodontists were the most critical group when evaluating the posttreatment periodontal condition. Periodontists possess the best skills to diagnose periodontal health and may have noticed periodontal issues that were missed by the other groups. This is in line with the findings of Kook Lee. In his thesis studying root resorption, he found that there are contradicting perspectives among specialists. He found that orthodontists were the most cavalier when confronted with root resorption in comparison to other groups including periodontists and restorative dentists. Periodontists were the most conservative among the groups (Lee & Tuncay, 2001).

When rating restorability, on average the restorative dentists gave the highest rating. Perhaps the advanced skill set and experience of the restorative dentists who evaluated the cases gives them more confidence in their ability to restore the posttreatment result compared to orthodontists and periodontists. The restorative treatment plan agreed to by the general dentist and patient must be adhered to during

orthodontic treatment. If the orthodontist changes the restorative treatment plan without consulting with the general dentist and patient, the patient's teeth may be placed in a position where optimal restorability is not possible or the patient may not be able to afford the new restorative treatment plan. Also, good communication between the orthodontist and restorative dentist is important because the occlusion may need to be altered to facilitate the restorative care (Kokich & Spear, 1997).

Orthodontists and periodontists are more critical at rating long-term stability of orthodontic treatment compared to restorative dentists. Perhaps orthodontists are more critical when assessing how their work holds up over time. Orthodontists, periodontists, and restorative dentists agree on the level of difficulty of orthodontic cases, with the restorative dentists rating the level of difficulty slightly higher than the other two groups.

In some cases, orthodontists compared the posttreatment result to what is optimal as described by the ABO grading criteria while in other cases they compared the result to what is reasonably achievable for the patient. On average, orthodontists tended to blend the ABO standards with what is most realistic for the patient.

Orthodontists, periodontists, and restorative dentists rate the following five factors to be most important when evaluating orthodontic treatment outcome: esthetics, occlusion, restorability, periodontal health, and stability. This finding was expected, as these factors are commonly used when setting treatment goals.

Esthetics was the most desired outcome cited by orthodontists, periodontists, and restorative dentists. This is consistent with the chief complaint of most patients.

Esthetics is an immeasurable quality that has a different meaning to every person. While

it is nice to have an objective grading system like the ABO, a number score cannot be given for esthetics. The ABO grading criteria excludes one of the most desired criteria. Perhaps asking the patient to complete a satisfaction survey at the completion of treatment will allow orthodontists to know if they met the patient's esthetic expectations.

In summary, adult patients in the mutilated dentition can pursue orthodontic treatment and achieve an excellent result. A thorough dental history must be given and appropriate and realistic treatment goals must be established. Treatment objectives must be realistic economically, periodontally, restoratively, and occlusally (Kokich & Spear, 1997). A team of dental professionals must be established to work towards meeting the treatment goals. A multidisciplinary approach with good team work and communication, along with patient commitment leads to great success.

CHAPTER 7
CONCLUSIONS

1. Orthodontists, periodontists, and restorative dentists are consistent in their rating of orthodontic treatment outcome.
2. Periodontists and restorative dentists rate overall case finish and posttreatment occlusion higher than orthodontists.
3. When evaluating case finish, orthodontists tend to blend what is optimal as described by the guidelines of the American Board of Orthodontics with what is reasonably achievable for the patient.
4. Orthodontists, periodontists, and restorative dentists rate the following five factors to be most important when evaluating orthodontic treatment outcome: esthetics, occlusion, restorability, periodontal health, and stability.
5. Orthodontists, periodontists, and restorative dentists rate esthetics as the most important factor to evaluate orthodontic treatment outcome.

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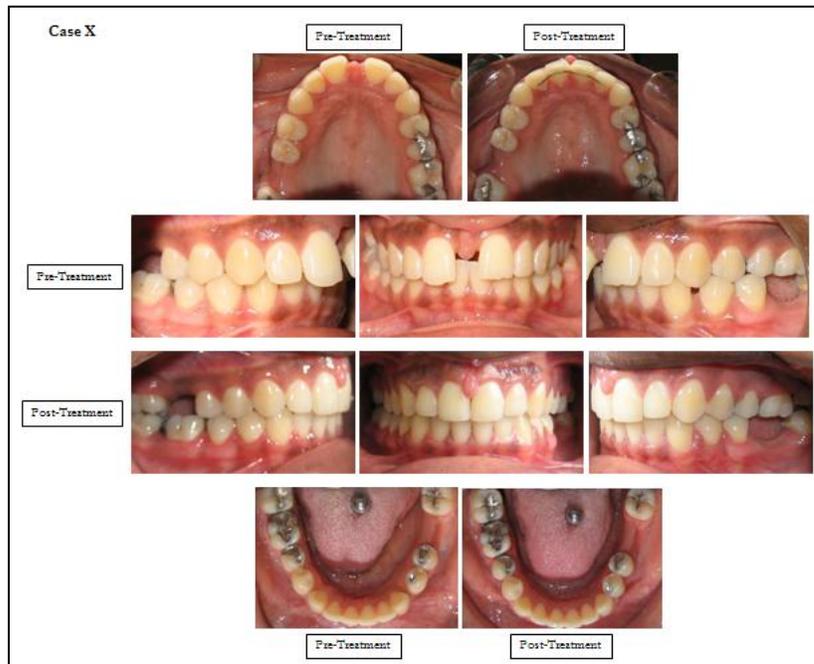
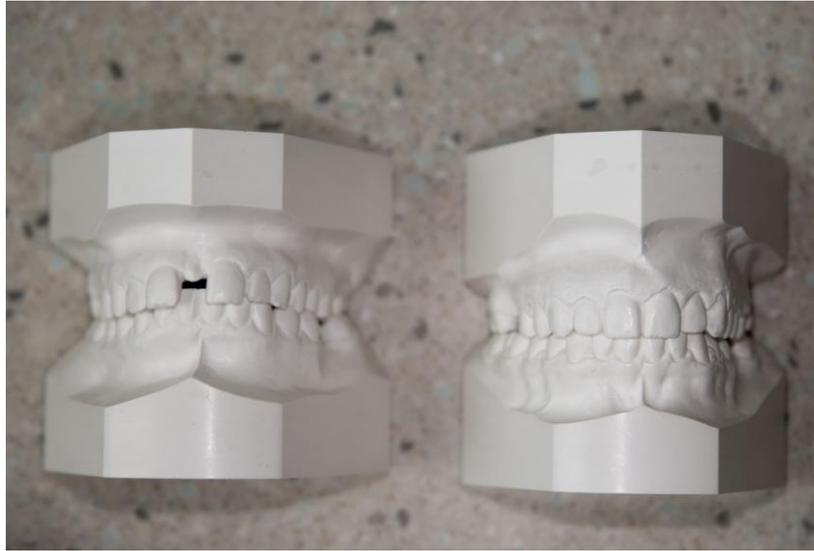
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APPENDICES

APPENDIX A
Example Case Set-Up



APPENDIX B Questionnaires

Orthodontist Evaluator Questionnaire for Individual Case Assessment of the Adult Mutilated Dentition



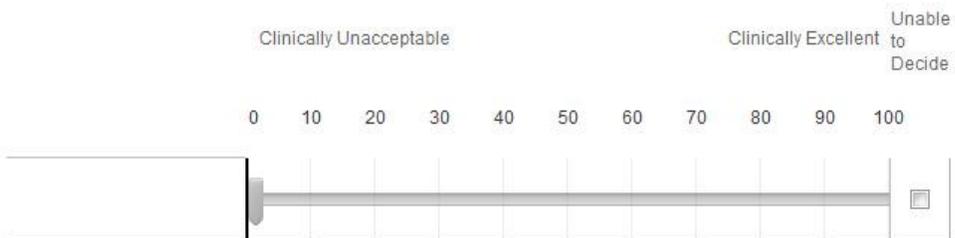
1. Rate the goodness of treatment result from start to finish (overall result).



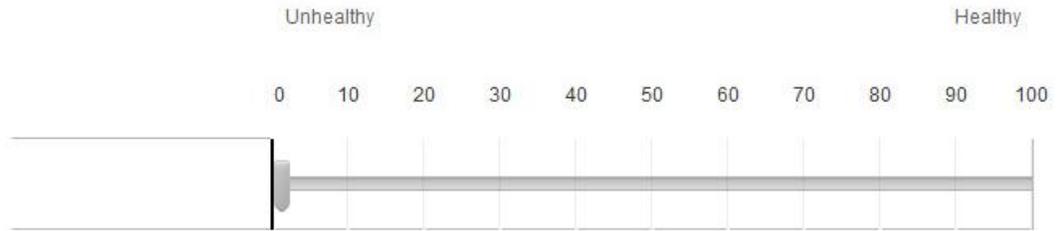
2. Rate the occlusion based on interdigitation, incisor overjet, and incisor overbite.



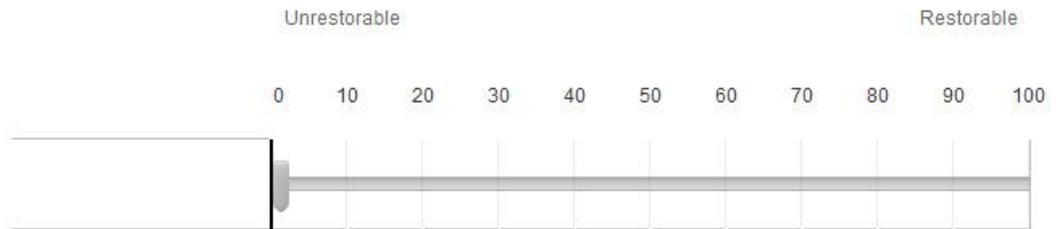
3. Rate the quality of the buccal bone height.



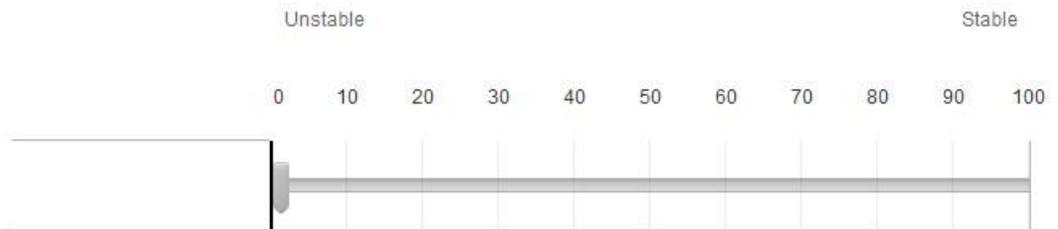
4. Rate the periodontal tissue contours and periodontal health.



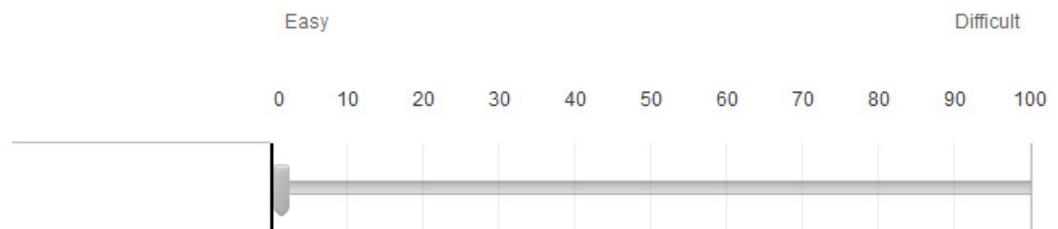
5. Rate the restorability of the final result.



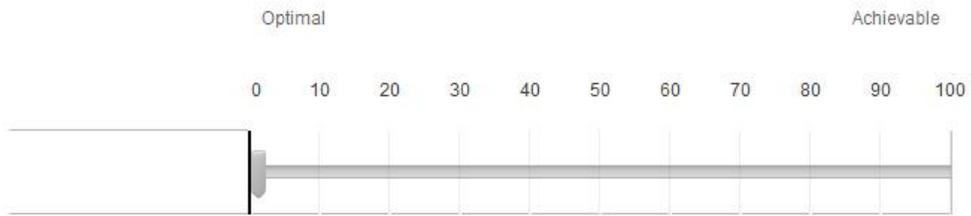
6. Rate your prediction for stability of the final result.



7. Rate the level of difficulty of the case.



8. When evaluating case finish, to what extent is your decision influenced by the guidelines of the American Board of Orthodontics (ABO) representing optimal treatment results... or by what is reasonably achievable for this patient?



Periodontist Evaluator Questionnaire for Individual Case Assessment of the Adult Mutilated Dentition



1. Rate the goodness of treatment result from start to finish (overall result).



2. Rate the occlusion based on interdigitation, incisor overjet, and incisor overbite.



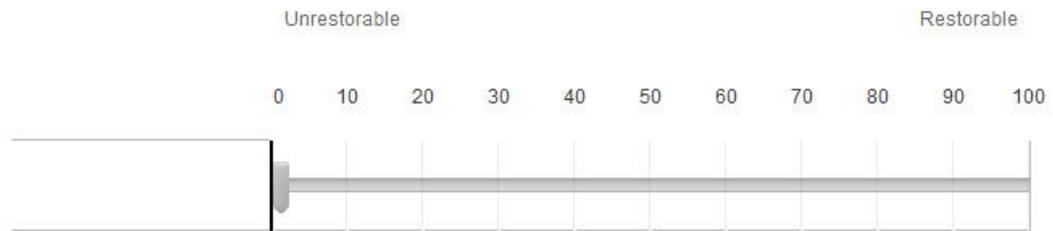
3. Rate the quality of the buccal bone height.



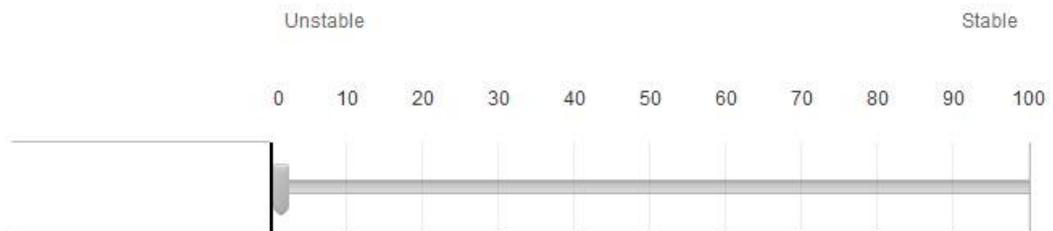
4. Rate the periodontal tissue contours and periodontal health.



5. Rate the restorability of the final result.



6. Rate your prediction for stability of the final result.



7. Rate the level of difficulty of the case.



Orthodontist Final Questionnaire



Are you certified by the American Board of Orthodontics (ABO)?

Yes

No

Describe the factors that are most important when evaluating orthodontic treatment outcome for the adult patient with a mutilated dentition.

What determines the order of importance of the factors you described above to evaluate the orthodontic treatment outcome?

Provide your definition of the gold standard for adult orthodontic treatment outcome.



Periodontist and Restorative Dentist Final Questionnaire



Describe the factors that are most important when evaluating orthodontic treatment outcome for the adult patient with a mutilated dentition.

What determines the order of importance of the factors you described above to evaluate the orthodontic treatment outcome?

Provide your definition of the gold standard for adult orthodontic treatment outcome.



APPENDIX C
Quantitative Data

Case 1	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Ortho Evaluator 1	70	70		50	71	71	85	50
Ortho Evaluator 2	81	71		74	100	82	82	100
Ortho Evaluator 3	81	80	65	70	50	71	70	50
Ortho Evaluator 9	70	80		71	90	80	62	26
Ortho Evaluator 5	81	81		70	81	85	95	3
Ortho Evaluator 6	90	96	91	86	92	91	81	91
Ortho Evaluator 7	90	80		45	70	77	79	74
Ortho Evaluator 8	90	100		75	100	80	80	100
Ortho Evaluator 4	85	80		86	100	86	100	100
Perio Evaluator 1	85	90		10	85	70	50	
Perio Evaluator 2	81	94		60	100	91	70	
Perio Evaluator 3	90	90		70	100	92	50	
Restorative Evaluator 1	96	100		52	100	91	81	
Restorative Evaluator 2	92	91		58	100	95	47	
Restorative Evaluator 3	79	71		39	100	19	79	

Case 2	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Ortho Evaluator 1	85	85		90	90	90	70	25
Ortho Evaluator 2	95	87		90	85	90	72	31
Ortho Evaluator 3	81	81	100	91	90	91	30	0
Ortho Evaluator 9	95	93		73	94	94	78	84
Ortho Evaluator 5	90	89		91	99	81	79	2
Ortho Evaluator 6	95	95	90	92	95	50	19	91
Ortho Evaluator 7	84	93		81	96	86	49	79
Ortho Evaluator 8	95	95		80	95	80	75	100
Ortho Evaluator 4	100	98		96	100	86	83	10
Perio Evaluator 1	80	70		30	90	60	65	
Perio Evaluator 2	98	98		86	100	91	19	
Perio Evaluator 3	90	90		90	90	90	80	
Restorative Evaluator 1	100	100		95	100	100	97	
Restorative Evaluator 2	93	92		91	100	73	60	
Restorative Evaluator 3	100	94		70	100	100	98	

Case 3	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Ortho Evaluator 1	75	75		75	80	70	65	75
Ortho Evaluator 2	89	90		91	90	91	80	30
Ortho Evaluator 3	30	19		71	100	50	19	0
Ortho Evaluator 9	50	50		79	60	65	92	83
Ortho Evaluator 5	91	92		96	96	98	76	2
Ortho Evaluator 6	80	80	70	61	71	40	61	90
Ortho Evaluator 7	39	51		60	69	70	60	71
Ortho Evaluator 8	60	70		90	65	80	75	100
Ortho Evaluator 4	90	75		100	70	74	96	100
Perio Evaluator 1	75	50		85	50	20	70	
Perio Evaluator 2	60	96		85	86	92	80	
Perio Evaluator 3	70	70		90	60	80	90	
Restorative Evaluator 1	84	82		85	82	82	93	
Restorative Evaluator 2	40	80		96	48	80	80	
Restorative Evaluator 3	49	29		79	90	89	96	

Case 4	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Ortho Evaluator 1	50	61		50	70	70	60	70
Ortho Evaluator 2	30	50		61	21	30	96	90
Ortho Evaluator 3	39	51		81	100	30	71	10
Ortho Evaluator 9	43	51		40	62	62	80	80
Ortho Evaluator 5	88	90		90	91	90	86	95
Ortho Evaluator 6	95	92	81	91	92	90	80	96
Ortho Evaluator 7	71	61		60	60	90	71	71
Ortho Evaluator 8	75	50		75	75	60	100	100
Ortho Evaluator 4	85	90		91	100	50	91	91
Perio Evaluator 1	70	60		30	70	50	60	
Perio Evaluator 2	70	92		50	60	90	86	
Perio Evaluator 3	70	70		70	50	70	90	
Restorative Evaluator 1	94	100		83	83	93	82	
Restorative Evaluator 2	65	80		81	80	91	81	
Restorative Evaluator 3	76	49		78	39	39	90	

Case 5	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Ortho Evaluator 1	75	50		50	70	75	80	80
Ortho Evaluator 2	85	71		50	92	82	100	100
Ortho Evaluator 3	91	50	70	71	9	80	91	100
Ortho Evaluator 9	39	60		71	39	51	90	81
Ortho Evaluator 5	85	80		71	83	90	95	96
Ortho Evaluator 6	99	100	86	85	90	81	100	100
Ortho Evaluator 7	95	80		80	49	51	99	97
Ortho Evaluator 8	40	40		40	60	60	100	100
Ortho Evaluator 4	90	100		90	81	30	100	100
Perio Evaluator 1	75	50		60	75	40	95	
Perio Evaluator 2	90	96		76	85	100	90	
Perio Evaluator 3	90	90		85	90	70	91	
Restorative Evaluator 1	100	100		96	98	100	100	
Restorative Evaluator 2	91	95		96	95	70	95	
Restorative Evaluator 3	98	98		85	84	94	99	

Case 6	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Ortho Evaluator 1	39	50		30	35	70	90	50
Ortho Evaluator 2	55	29		50	51	31	90	91
Ortho Evaluator 3	80	39		90	40	79	80	100
Ortho Evaluator 9	33	33		50	30	41	87	83
Ortho Evaluator 5	70	70		77	77	54	95	81
Ortho Evaluator 6	92	94	50	49	94	91	92	96
Ortho Evaluator 7	50	50		41	50	49	84	91
Ortho Evaluator 8	75	50		50	75	50	100	100
Ortho Evaluator 4	81	61		81	40	66	91	81
Perio Evaluator 1	61	60		20	40	25	90	
Perio Evaluator 2	96	94		80	20	84	90	
Perio Evaluator 3	90	90		80	70	70	95	
Restorative Evaluator 1	91	94		87	93	92	91	
Restorative Evaluator 2	59	41		80	30	54	81	
Restorative Evaluator 3	70	70		61	0	48	88	

Case 7	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Ortho Evaluator 1	60	60		60	75	75	35	20
Ortho Evaluator 2	80	28		81	100	50	50	10
Ortho Evaluator 3	30	39		92	100	70	71	0
Ortho Evaluator 9	84	86		89	95	95	61	22
Ortho Evaluator 5	90	91		96	99	83	81	3
Ortho Evaluator 6	95	90	71	73	95	29	41	90
Ortho Evaluator 7	60	60		82	81	80	81	71
Ortho Evaluator 8	90	80		90	100	85	50	0
Ortho Evaluator 4	90	91		91	100	27	81	10
Perio Evaluator 1	75	65		75	70	30	70	
Perio Evaluator 2	98	96		96	100	98	80	
Perio Evaluator 3	95	80		90	95	95	50	
Restorative Evaluator 1	97	77		93	97	88	78	
Restorative Evaluator 2	21	20		92	100	79	69	
Restorative Evaluator 3	91	72		87	100	95	76	

Case 8	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Ortho Evaluator 1	39	40		50	70	75	50	65
Ortho Evaluator 2	93	30		90	95	90	80	85
Ortho Evaluator 3	60	50		81	71	91	20	50
Ortho Evaluator 9	85	88		92	94	94	64	85
Ortho Evaluator 5	47	43		67	79	71	90	2
Ortho Evaluator 6	82	81	81	87	98	41	44	92
Ortho Evaluator 7	50	30		69	60	70	71	71
Ortho Evaluator 8	75	75		80	20	80	75	100
Ortho Evaluator 4	91	87		100	100	90	86	99
Perio Evaluator 1	55	50		85	70	40	80	
Perio Evaluator 2	94	76		60	98	80	84	
Perio Evaluator 3	95	95		90	85	95	60	
Restorative Evaluator 1	96	98	87	93	93	94	93	
Restorative Evaluator 2	90	96		95	91	90	49	
Restorative Evaluator 3	91	72		87	100	95	76	

Case 9	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Ortho Evaluator 1	80	80		40	75	75	85	50
Ortho Evaluator 2	85	70		50	20	70	100	50
Ortho Evaluator 3	71	29		50	29	50	91	71
Ortho Evaluator 9	80	78		77	80	87	85	83
Ortho Evaluator 5	98	96		86	97	88	87	95
Ortho Evaluator 6	95	94	89	92	85	40	95	96
Ortho Evaluator 7	86	60		40	50	51	96	91
Ortho Evaluator 8	95	90		40	100	75	90	100
Ortho Evaluator 4	100	91		68	76	75	100	100
Perio Evaluator 1	60	55		70	80	30	95	
Perio Evaluator 2	98	98		80	50	90	92	
Perio Evaluator 3	95	95		95	90	70	95	
Restorative Evaluator 1	98	98	91	94	94	94	97	
Restorative Evaluator 2	79	70		92	92	92	86	
Restorative Evaluator 3	91	75		89	80	29	60	

Case 10	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Ortho Evaluator 1	85	80		75	85	85	30	30
Ortho Evaluator 2	60	80		30	51	90	49	10
Ortho Evaluator 3	96	96		71	100	100	40	0
Ortho Evaluator 9	86	90		40	86	90	32	23
Ortho Evaluator 5	93	90		63	99	97	79	4
Ortho Evaluator 6	90	91	91	81	92	86	30	96
Ortho Evaluator 7	60	61		50	39	70	81	81
Ortho Evaluator 8	95	95		75	95	80	75	100
Ortho Evaluator 4								
Perio Evaluator 1	60	50		15	30	30	80	
Perio Evaluator 2	98	100		30	98	94	40	
Perio Evaluator 3	85	90		70	60	90	70	
Restorative Evaluator 1	100	98	92	76	100	99	84	
Restorative Evaluator 2	82	92		30	77	86	66	
Restorative Evaluator 3	90	90		84	80	95	80	

Case 11	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Ortho Evaluator 1	70	70		65	70	80	70	70
Ortho Evaluator 2	80	70		50	30	80	80	95
Ortho Evaluator 3	76	75		50	29	71	50	61
Ortho Evaluator 9	82	83		41	25	83	40	29
Ortho Evaluator 5	81	81		84	85	82	86	3
Ortho Evaluator 6	98	85	81	65	15	45	29	95
Ortho Evaluator 7	80	34		20	70	60	80	95
Ortho Evaluator 8	85	85		85	90	80	75	100
Ortho Evaluator 4	95	95		19	100	90	91	50
Perio Evaluator 1	85	80		15	70	75	75	
Perio Evaluator 2	94	100		80	100	100	40	
Perio Evaluator 3	90	80		60	95	95	90	
Restorative Evaluator 1	99	96	86	84	97	98	94	
Restorative Evaluator 2	91	84		43	100	94	39	
Restorative Evaluator 3	92	90		77	100	94	81	

Case 12	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Ortho Evaluator 1	80	85		80	85	85	50	29
Ortho Evaluator 2	90	90		70	92	91	30	50
Ortho Evaluator 3	91	91		70	100	100	19	0
Ortho Evaluator 9	95	96		63	94	96	22	16
Ortho Evaluator 5	86	86		86	90	87	79	2
Ortho Evaluator 6	96	85	86	81	87	41	41	95
Ortho Evaluator 7	85	90		60	79	81	39	61
Ortho Evaluator 8	100	95		90	100	70	60	100
Ortho Evaluator 4	100	100		90	100	7	24	2
Perio Evaluator 1	80	80		50	80	70	65	
Perio Evaluator 2	100	100		90	100	90	40	
Perio Evaluator 3	95	95		80	80	95	70	
Restorative Evaluator 1	100	98	94	91	98	98	99	
Restorative Evaluator 2	99	99		55	96	94	66	
Restorative Evaluator 3	90	94		90	100	94	76	

APPENDIX D Qualitative Data

Key

Esthetics	
Occlusion	
Restorability	
Periodontal Health	
Stability	
Patient's Desires	
Overjet and Overbite	
Result Relative to Case Difficulty	

	Describe the factors that are most important when evaluating orthodontic treatment outcome for the adult patient with a mutilated dentition.
Orthodontic Evaluator 1	Esthetics and occlusion of the teeth that are present... Ideally canines in Cl. I.
Orthodontic Evaluator 2	Restorability for the dentist to be able to achieve ideal functional and esthetic results. Functional occlusion and acceptable esthetics for the patient.
Orthodontic Evaluator 3	Bone and tissue levels as well as profile. Consideration should also be given to the coordination with the restorative dentist. Anchorage requirements.
Orthodontic Evaluator 4	Esthetics , function, occlusion , anterior OJ and OB.
Orthodontic Evaluator 5	Result relative to difficulty.
Orthodontic Evaluator 6	Overall periodontal health before and after tx, proper space management for eventual restoration , establishing a functional occlusion , creating an esthetic result that the patient is happy with.
Orthodontic Evaluator 7	Posterior Occlusion Symmetry - midlines, archforms, smile arc, gingival heights and contours , restorability - implant sites, bridge sites overjet and overbite axial inclination of the dentition periodontal health and stability.
Periodontist Evaluator 1	Correction of tooth crowding, tooth rotation, tooth tilting and closure of spacing between teeth. Establishment of a relatively level plane of occlusion with proper tooth-to-tooth marginal ridge relationships. Establishment of clinically acceptable and esthetic anterior tooth overjet and overbite . Good interdigitation of occluding teeth in an axial plane. Correction of tooth crossbites and balancing side occlusal interferences. Maintenance of periodontal health during orthodontic tooth movement, leading to clinical periodontal health and gingival tissue contours post-treatment. Fulfillment of patient esthetic desires . Attainment of a functional and restorable dentition that is likely to remain stable over time.
Periodontist Evaluator 2	1- Intercuspitation 2-Centric and eccentric relationships 3-Lack of diastemas 4-Teeth alignment.
Periodontist Evaluator 3	Final aesthetics , periodontal condition and ease of restoring the missing teeth.
Restorative Evaluator 1	Stable , physiologic occlusal scheme.
Restorative Evaluator 2	1- Achieving basic requirements for a functional and physiologic occlusion 2- Providing an excellent long-term prognosis and stability 3- Meeting patient's esthetic expectations 4- Restorability.
Restorative Evaluator 3	Periodontal health , esthetics , restorability , and stability.

	What determines the order of importance of the factors you described above to evaluate the orthodontic treatment outcome?
Orthodontic Evaluator 1	Depends what are realistic goals judging from starting dentition.
Orthodontic Evaluator 2	Functional occlusion Restorability Ideal esthetics
Orthodontic Evaluator 3	1. Tissue (soft) 2. Bone 3. Anchorage 4. Restorative
Orthodontic Evaluator 4	Practicality of above factors as treatment goals.
Orthodontic Evaluator 5	Acceptable occlusion, anterior esthetics, stability.
Orthodontic Evaluator 6	The overall dental health of the patient post treatment.
Orthodontic Evaluator 7	Underlying skeletal malocclusion Periodontal Health Status Reality of achieving orthodontic/occlusal goals.
Periodontist Evaluator 1	Most important is to attain an esthetically acceptable correction of the presenting malocclusion that will provide the patient with a functional and restorable dentition that is likely to remain stable over time.
Periodontist Evaluator 2	1- Occlusion 2-lack of interference during excursions 3- Esthetics 4- Easiness of performing oral hygiene 5- Periodontal health.
Periodontist Evaluator 3	Esthetics is of primary importance followed by the final periodontal condition and then restorability.
Restorative Evaluator 1	Stable, physiologic occlusal scheme, cleansable, esthetic.
Restorative Evaluator 2	Since the patient is most likely a long-term patient in the general dentist's practice, a final result that is stable and that meets the requirements for a physiologic occlusion are most important. If tooth positioning, pontic space, or alignment are not "perfect" from a restorative viewpoint, this can most always be managed by the general dentist. Therefore, achieving the major requirements for a stable and physiologic occlusion are most important.
Restorative Evaluator 3	Periodontal health is the foundation for anything we try to do for a patient. The esthetic outcome is the most important thing for the patient; restorability is important, both in esthetics and in long-term stability for the restorative dentist. If we achieve everything except esthetics, we have an unhappy patient!

	Provide your definition of the gold standard for adult orthodontic treatment outcome.
Orthodontic Evaluator 1	Depends what are realistic goal judging from starting dentition.
Orthodontic Evaluator 2	Correction of all crossbites and interferences while obtaining a Class I canine relationship. Maximizing gingival margins so that the final cosmetic dental outcome can be excellent. Maintenance of excellent periodontal health throughout treatment so final results/restoration are not compromised.
Orthodontic Evaluator 3	Occlusal and facial balance and harmony.
Orthodontic Evaluator 4	Try to attain the "gold standard" however, with adult mutilated dentitions, the gold standard is often unattainable - great treatment for a patient entails getting as close to that gold standard as possible, given treatment goals and presenting patient with all their limitations clinically, practically, financially and esthetically and restoratively.
Orthodontic Evaluator 5	Achieve the best possible occlusion, esthetics, setting up the case so excellent restorative procedures can be accomplished.
Orthodontic Evaluator 6	one might say that the gold standard should relate to the ABO standards. unfortunately the abo is not set up to evaluate these types of cases. Therefore, the gold standard for me is overall periodontal dental health post treatment for the patient, an occlusion that is functional and therefore might be more stable, uprighting of the roots adjacent to edentulous spaces, proper space management and root positions for implant placement. Knowing the true limits of conventional orthodontics where your goals of treatment are obtainable and match the goals of the patient. Thanks Katie it was fun.
Orthodontic Evaluator 7	The gold standard is to treat to ideal occlusion, esthetics and function. However, success can only be measured on a case by case basis. If you have an adult patient with normal skeletal parameters and crowding - you treat them to the most ideal occlusion and esthetics. If you have an adult with mutilated dentition, periodontal issues, underlying skeletal issues you attempt to treat to the best occlusion possible within the parameters of achieving good oral health, a stable and restorable dentition with the best periodontal stability and best esthetics. This many times means interdisciplinary treatment - maxillofacial surgery, periodontal surgery, prosthetic/restorative treatment in conjunction with orthodontic care.

Periodontist Evaluator 1	Establishment of an esthetically acceptable occlusion that is functional , prosthetically restorable , periodontally healthy , and capable of remaining stable over time. In evaluating the cases provided, I examined the outcome of the orthodontic care on the periodontal status, whether tooth crowding or spacing had been resolved, whether adequate tooth uprighting had been attained, whether appropriate interarch relationships were attained, whether crossbites and occlusal interferences corrected, and whether esthetic issues had been adequately addressed.
Periodontist Evaluator 2	This question is not clearly formulated. The gold standard for adult orthodontic treatment outcome is resolving the chief complaint of the patient as it relates to occlusion . There are cases where the patient is not aware of any issue with occlusion but the general dentist may have some concerns about the occlusion of the patient. Generally, in my view, the gold standard for orthodontic treatment outcome is defined as the correction of malocclusion and the restoration of a functional occlusion that is compatible with oral health and proper esthetics .
Periodontist Evaluator 3	Primary is the final aesthetics of the case. Second is the final periodontal status , which is an important aspect, as I am a periodontist. Restorability , primarily with implants is the next consideration. Finally I would look at the potential for case stability .
Restorative Evaluator 1	Stable occlusion set in centric relation - no slip from maximum intercuspation to CO - esthetic outcome that can maintained periodontally healthy .

<p>Restorative Evaluator 2</p>	<p>FEATURES FOR A PHYSIOLOGIC OCCLUSION: 1- Arch integrity 2- Axial alignment and loading of posterior teeth 3- Incisors and canines in immediate centric contact for guidance and dis-occlusion of in eccentric movements 4- Dentition properly placed over supporting alveolar bone</p> <p>ESTHETIC CONCERNS 1-Adequately addressing the patient's esthetic concerns 2- Providing a basis for the general dentist to successfully meet the patient's esthetic concerns OTHER 1- Positive impact on periodontal health 2- Adequate management and decision-making for periodontally involved teeth 3- Excellent communication regarding treatment planning as case progresses, especially when compromise is necessary 4- Efficient treatment time-wise 5- Management, communication and referral to general dentist when problems arise with oral hygiene, caries, gingivitis, etc. DECISION-MAKING PROCESS FOR THIS STUDENT. In some cases, I determined that it was not necessary to restore the case, so restorability was rated as 100%. A primary criterion was my assessment of the stability of the case, and the degree to which the case meets the requirements for a physiologic occlusion. In some cases, the overjet/overbit relationship for the final result was not "textbook", but since there were no extraoral images available, I assumed that the orthodontist met the patient's esthetic concerns in these cases. In considering "restorability", I looked at the possibility of all modalities such as implants, veneers, or bridgework and rated restorability based on the highest result from any of the reasonable choices for that case.</p>
<p>Restorative Evaluator 3</p>	<p>To provide the patient with a healthy, functional, stable, and esthetic result. I look at the final result as a patient does -- front on, and then slightly from the side. The patient asks, "Did everything I went through for the last ___ months/years make me look better?" Then I look at everything else – how "socked in" is the occlusion? Will it hold up in function? Can I restore/replace any missing teeth?</p>