Dental and Paradental Disciplines Essential for Comprehensive Treatment Planning: A Literature Review

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Rafi Romano, DMD, MSc

Rafi Romano, DMD, MSc

Rafi Romano is a specialist in orthodontics and dentofacial orthopedics. He maintains a private practice in Tel Aviv, Israel, limited to orthodontics with an emphasis on adult and esthetic orthodontics. He is also a clinical instructor in the Department of Orthodontics, Tel-Hashomer Hospital, IDF, Israel. Dr Romano is past president of the Israeli Orthodontic Society and past secretary-treasurer of the International Federation of Esthetic Dentistry. He is the former editor of the *Journal of the Israeli Orthodontic Society*, and the editor of 2 books: *Lingual Orthodontics*, (Decker, 1998) and *The Art of the Smile* (Quintessence, 2005).

Dr Romano is an active member of the European Academy of Aesthetic Dentistry, the American Association of Orthodontists, and the World Federation of Orthodontists. He lectures all over the world on esthetic orthodontics and adult multidisciplinary orthodontic treatment and delivers courses around the globe.

Email: rafi@drromano.com

Although most of any dental professional's career focuses on matters of esthetics and pain relief rather than general health issues, the current trends of each dental discipline (eg, prosthodontics, periodontics, orthodontics, endodontics, pedodontics, oral health) render clinicians more knowledgeable in their specific fields but almost completely ignorant of current practices in other fields.

Essential procedures for every case have evolved to include an interdisciplinary diagnosis and treatment plan, especially now that patients have more awareness of their general well-being, routine checkups, and recourse to second and third opinions for every problem. Modern patients are defined by paradental problems such as breathing difficulties, temporomandibular disorders (TMDs), functional aberrations, and harmful habits, combined with psychological factors, that may affect how the underlying problem and proposed solution is perceived. These patients expect clinicians to solve not only the specific complaint with which they present at the dental clinic but also the multifactorial aspects that surround the problem.

Long-term maintenance and stability of a treatment has also become an important issue nowadays. Patients expect results that last a lifetime and an unlimited guarantee from the treating clinician. Although an unstable result usually stems from peripheral factors, not directly from imperfect dental care, patients tend to blame the clinician for not monitoring the problem and preventing it.

Proper dissemination of knowledge in the dental specialties is currently one of the biggest challenges to consistent improvement in care. The Internet is widely used by patients and clinicians, and information is easily accessed. Although conventions and meetings within the dental field aim to collect relevant and reliable information for clinicians who strive for continuing education, the amount of information is huge. Numerous innovations in techniques and dental materials constantly appear on a daily basis.

Fashion also plays an important role in treatment strategies, and beauty standards change occasionally. Tooth whitening, for example, is a relatively new trend that has affected the entire process of color selection for prosthetic restorations.

This chapter attempts to survey the innovations and updated trends in dental and paradental diagnosis. These trends should be taken into consideration when forming a comprehensive multidisciplinary treatment plan.

Face and Smile Analysis

Clinicians tend to rely too heavily on measurements and standards. For years orthodontists were required, in their postgraduate programs and

later board exams, to strive for an "ideal" dental and skeletal relationship. Recent studies show that no objective measure of the smile predicts whether that smile will be subjectively judged as attractive or unattractive.[1] Yet, an esthetic smile has become the main focus of many patients. In an effort to find the ultimate keys to a perfect smile, a French group tried to establish an analysis of 17 keys that guide the clinician to position the teeth in the face to build a harmonious, well-balanced, and attractive smile.[2] Unfortunately, this process remains a utopian concept since most patients are unlikely to fulfill every requirement for perfect alignment. Very rarely do the tooth anatomy, lip shape and thickness, mouth size, and ratios of all elements really match. Clinicians today understand the importance of the dynamic diagnosis versus the static one that was very common until a few years ago. Spontaneous smile can be completely different from the posed smile that is frequently used for the dental records. A posed smile displays a lower lipline and less tooth display and smile width. These features can affect the diagnostics of lipline height, smile arc, buccal corridors, and plane of occlusion. Videos are now recommended to record the true dynamic nature of a patient's spontaneous smile.[3]

More attention is given today to the effect of age on the smile. One study aimed to identify a consistent pattern in lip-line height during various functions. This was accomplished through analysis of lip-line heights and the effect of age in an adult male population. Subjects from three age groups (20 to 25 years, 35 to 40 years, and 50 to 55 years) were compared during spontaneous smiling, speech, and tooth display in the natural rest position. The study showed that upper lip length increased significantly (by almost 4 mm) in older subjects, an effect that must be considered by all dental specialists.[4] These results should be of particular interest to the orthodontist, who sometimes intrudes the upper central incisors, which will slowly disappear behind an aging patient's "falling" upper lip; the periodontist, who adds connective tissue graft to recessed gingiva; and the prosthodontist, who designs the length and shape of the teeth in this dynamic environment.

Implementation of all the above considerations into the treatment plan is likely to lead to miscorrelations between smile esthetics and the components of the objective grading system developed by the American Board of Orthodontics (ABO). Additional criteria should be incorporated into the assessment of overall orthodontic treatment outcomes, including variables that evaluate the smile.[5]

Although smile therapy is a relatively new specialty, society already has significant expectations for dental professionals' correct evaluation and treatment of the smile. Orthodontists and other specialists should be able to address this challenge and acquire the skills to identify various smile patterns, which will lead to better rehabilitation of all patients' smiles. Therefore, it is essential to understand that the smile is perceived

differently by different observers. One study asked groups, composed of orthodontic residents, operative dentistry residents, art students, or laypeople, to evaluate the attractiveness of a smile subjected to computerized variations. It was found that a smile that was medium-broad to broad, included a full incisor display with 2 mm of gingival exposure, and had a consonant smile arc was generally preferred in women. A broad smile with full incisor display and a flat smile arc was generally preferred in men. Variations in incisor angulations were judged as more acceptable than a midline deviation.[6] In other research, it was found that the threshold of orthodontists and prosthodontists to distinguish asymmetries of the maxillary central incisors' gingival margin was 0.5 mm, but laypeople were unable to distinguish asymmetry until the difference was 2.0 mm. Midline shifts were perceptible to orthodontists when equal to or greater than 1.0 mm, and to prosthodontists when equal to or greater than 3.0 mm; laypersons saw no alteration at these measurements. Perceptions of attractiveness in patients must be considered along with their esthetic expectations when planning treatment.[7]

The creation of a smile that is perfectly esthetic for a given individual is a challenge that requires precise treatment planning and cooperation between multiple specialties. Since esthetics is subjective and depends upon the perceptions of the patient and the clinician, it is a challenge to create specific guidelines or a systematic approach that leads to consistent results.[8]

What is the effect of each facial element (ie, lips, chin, and nose) on the attractiveness of the smile? The vertical dimension of the upper lip has been shown to have the greatest impact on smile esthetics. Any orthodontic treatment plan needs to consider the relationship of the maxillary incisors to the vertical thickness of the vermilion border of the upper lip if esthetic results are to be obtained.[9]

Many clinicians mention the "black triangles" in the corner of the mouth as responsible for the unattractiveness of the smile. Which hard and soft tissue factors are related to the amount of buccal corridor area (BCA) during a posed smile? The esthetic elements with the most influence on the amount of BCA are the lower anterior facial height (which defines the vertical pattern of the face), the amount of maxillary incisor exposure, and the sum of the tooth material. Minimal BCA will result in a more esthetic smile. No significant difference was seen in BCA between extraction and nonextraction groups, which traditionally had been named as the main variable that jeopardized the smile in this mode of treatment.[10]

The psychological factor, from observers' and patients' perspectives, probably plays the most important role in perception of smile esthetics. Recent research done in the Netherlands showed that tooth size and visibility and upper lip position were the most prevalent factors in how subjects rated the attractiveness of their own smile (social

dimension). Color of teeth and gingival display were critical factors in satisfaction with smile appearance (individual dimension). Participants who showed full maxillary teeth and partial gingiva (2 to 4 mm) upon smile perceived their smile lines as most esthetic. Smiles with disproportionate gingival display were judged negatively and were correlated with personality traits of neuroticism and low self-esteem. Visibility and position of teeth correlated with dominant personality traits.[11]

Prosthodontics, orthodontics, periodontics, restorative dentistry, and plastic and reconstructive surgery are all specialties in which factors that influence smile esthetics should be analyzed. Clinicians also need to consider how morphology differs between ethnic groups. Smile norms for one population might be unsuitable for another group in regard to diagnosis and treatment planning.[12]

Paradental Elements that Influence Morphology and Function of the Face and Smile

Breathing

It is already common knowledge that transversal discrepancies of the maxilla and oral breathing have a strong correlation. Recent studies confirm that rapid maxillary expansion (RME) could also be an effective solution to upper respiratory and sleep-disordered breathing problems in growing children.[13] A recent Brazilian study revealed that measurements of upper airway space in patients with normal nasal breathing and Class II and III skeletal patterns are not affected by the type of malocclusion. The article emphasized that diagnosis and treatment planning require evaluation of upper airway space if esthetic and functional results are to be achieved.[14] Many clinicians overlook the integral relationship between breathing, swallowing, and speech with respect to disharmony, malfunction, and malocclusion of the maxillofacial components. Treatment of these aspects can and should be performed through a combination of orthodontics and surgery.[15]

Tongue

The tongue has active functions (during swallowing and speech) in addition to passive functions (in rest position). Tongue habits can create an anterior open bite or may occur alongside skeletal open bites as a factor that maintains or aggravates the condition. At times, tongue habits are a result of parafunctional habits such as thumb sucking. Unfortunately, tongue thrust habits are also responsible for relapses in many completed orthodontic treatments that were otherwise apparently successful.[16] Tongue thrust may contribute to poor occlusal intercuspation during

and after orthodontic treatment. On occasion, it appears that tongue thrust habits may actually develop as a result of the shifting spaces and tooth arrangements that occur during orthodontic therapy.[17]

The term *tongue thrust* is used rather than *tongue thrust swallow* because this is a habit generally associated less with the act of swallowing and more with the normal resting posture of the tongue. Because the tongue is held in a rest position the majority of time, it may be more destructive to the occlusion and maxillomandibular relationship compared to the force of the tongue during active behaviors like swallowing and speech.[18]

Temporomandibular disorders

Various factors such as excessive stress or malocclusion can decrease the adaptive capacity of the stomatognathic system and lead to the occurrence of TMD. Joint sounds frequently give the first indication of a TMD, although malocclusion is believed to be a predisposing factor.[19] Although some clinicians have claimed that devices can be used regularly in practice to diagnose and interpret dysfunction or pathologies of the temporomandibular joint, scientific evidence does not support this. Instruments that record jaw movements and interferences have not been proven to differentiate consistently between symptomatic or asymptomatic patients. Therefore, the diagnostic value of jaw-tracking or other electromyography devices and standard guidelines for methodology or interpretation of the data they generate cannot be established.[20]

Oral health–related quality of life (OHRQoL) measurement tools may be the most important diagnostic tool for useful interpretation of the psychological aspects of pain perception and its effects. With the information provided by these instruments, treatment plans can be adjusted accordingly for patients who suffer from various levels of TMD pain.[21]

Facial muscles

Recent technology that provides new solutions for the aging of the face has significantly altered practices for facial rejuvenation in cosmetic surgery. Of the minimally invasive techniques and materials now available for facial rejuvenation procedures, neuromuscular blocking agents (ie, botulinum toxin) and injectable fillers are the most commonly used.[22] Many patients are influenced by plastic surgeons and by their peers to undergo dramatic changes to their appearances through face-lift, nasal reconstruction, and orthognathic procedures. A recent study showed that patients' subjective evaluation of their esthetic outcomes after nasal reconstruction surgeries was significantly higher than the evaluation of an independent professional panel.[23] These findings should be remembered when a complete face and teeth diagnosis is made, and the clinician should always attempt to strive for the ultimate esthetic result.

Psychology and patient management

Smiles are often judged by patients or laypeople as attractive or unattractive using subjective methods, and studies have shown that no objective measure of the smile can imitate this process in a way that consistently predicts a certain subjective perception.[1] Neither the Peer Assessment Rating (PAR) score nor patients' perceptions of the severity of their malocclusions have been demonstrated to have as much of an effect as a patient's overall self-concept on the perceived esthetic value of the dentofacial region.[24] However, the psychological motivation behind patients' desire for treatment may present a serious ethical dilemma for the practitioner who offers esthetic interventions: Are these surgeries superficial interventions aimed primarily at material gain and profit, or are they procedures that truly benefit patients by solving the functional disharmonies behind the esthetic problem and, therefore, play an integral role in the health care system? Esthetic surgery with a goal to promote cosmetic procedures that play to patients' senses of vanity risks losing sight of what patients truly need from treatment and what the surgeon as a healer is able to provide. Therefore, clinicians must be careful that their services are not reduced to procedures with superficial value only, rather than representative of an advanced paradental specialty that serves a functional as well as a cosmetic purpose.[25]

What Is the Future of Esthetic Dentistry?

Current trends in esthetic dentistry encourage perfection, ultimate esthetics, and outstanding smiles—where all peripheral parameters align with the original dental treatment plan—yet these intentions may collide with the growing demand for minimally invasive techniques and individualized treatment plans that respect patients' preferences and expectations. The following chapters provide clinicians with tools to reach a balanced treatment plan that meets both extremes.

The future of esthetic dentistry will most likely bring more convenient and effective technologies that improve communication with patients and colleagues and simulation options that allow the clinician to offer and discuss a variety of alternative treatment plans.

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