

Before We Continue: Une Pause

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In two different editorials having an identical title, Turpin¹ and Isaacson² discussed evidence-based orthodontics. *Evidence-based orthodontics* means to translate valid³ research into judicious clinical orthodontics. In other words, decode the established reality into the practiced actuality. This translation requires hard work to create a vision to accomplish identifiable orthodontic aims for the ultimate goal of growth and protection of our beloved specialty. To create this vision, we should know the nitty-gritty orthodontic facts, and cross the barrier into thinking.

Before we continue, we must pause and think. The scientific basis of various important clinical orthodontic problems is overlooked. Some of these problems will be presented in the light of the most recent investigations. The hope is to prioritize research issues and to stimulate genuine evidenced-based treatment strategies. When we stop and deliberate, these four questions arise:

1. Are we becoming more patient-centered?
2. Are we more prospective than retrospective?
3. Are we moving teeth faster and with more control?
4. Are we minimizing iatrogenesis?

Are We Becoming More Patient-centered?

Do we know the layperson's preferences for facial attractiveness? Considerable research on facial esthetics has defined norms for what is attractive or preferred. However, very little work has attempted to determine the regions of the face that are consistently correlated with esthetic judgments. El-Mangoury et al⁴ developed a reasonable coherent picture for the attractiveness of the lower third of the facial profile via a macroscopic multilevel approach. The most important results of their study are summarized in Table 1. Contrary to one's expectations, the chin plays the most important role for the esthetic judgment of the lower third of the facial profile (Fig 1).⁴ The lower and upper lips occupy the second and the third most important spots respectively.⁴

A patient-centered approach could be achieved if we know where we want the chin, lower lip, and upper lip. We can implement a strategic diagnostic tactic whereby our treatment plan and mechanotherapy are based on a clear vision of the desired posttreatment outcome satisfying the physiologic and esthetic requirements for our patients.

Table 1 Facial profile attractiveness as evaluated by the laypersons

Regions	Most Attractive		Least Attractive	
	Female Profile	Male Profile	Female Profile	Male Profile
Upper Lip	Slight Protrusion	Normal	Slight Retrusion	Extreme Protrusion
Lower Lip	Slight Retrusion	Slight Retrusion	Extreme Protrusion	Extreme Protrusion
Chin	Normal	Slight Protrusion	Extreme Retrusion	Extreme Retrusion

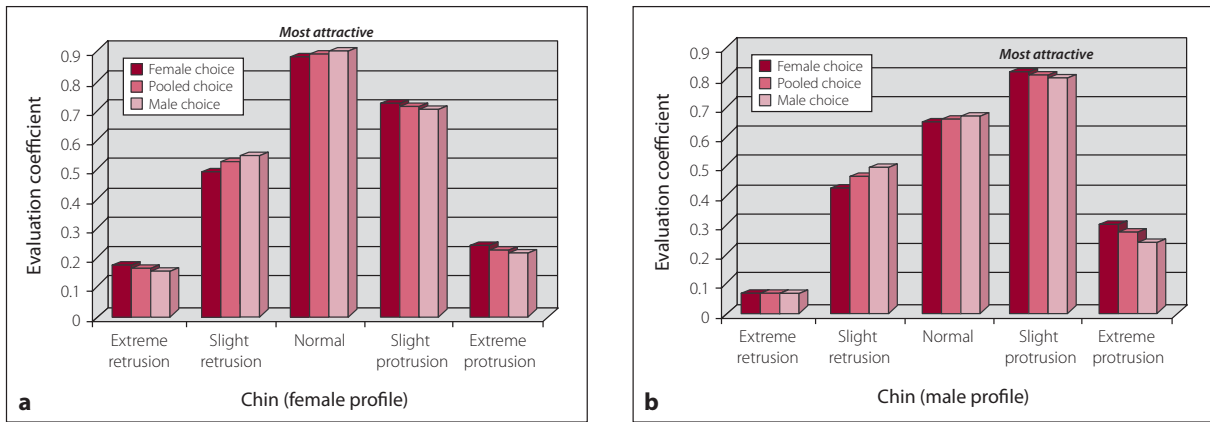


Fig 1 Chin attractiveness. Note that the higher the evaluation coefficient, the more attractive the chin. For female profiles (a), normal chins were the most attractive. For male profiles (b), the most attractive chins were slightly protruded. Extremely retruded chins were the most rejected chins for both female and male profiles.

Are We More Prospective Than Retrospective?

By applying the diagnostic approach specified above, a prospective treatment analysis (PTA) might be achieved in contrast with the current retrospective analysis. Briefly, the PTA produces the desired posttreatment vision (which could be represented through the desired posttreatment digital image, as will be explained later).

The complex nature of the PTA necessitated the diagnostic adoption of the automated two-dimensional (2-D) and three-dimensional (3-D) cephalometrics. Mostafa and colleagues⁵ explored an approach that fully exploits the power of computers through image-processing algorithms eliminating manual landmark identification. Saäd⁶ developed a complete automatic 2-D and 3-D cephalometric analysis system. Three main modules exist in this system: identification of landmarks,⁷⁻¹⁰ 2-D cephalometric analysis with complete tracings of both the hard tissues and soft tissues, and 3-D cephalometric analysis based on the 3-D reconstruction of the computerized tomographic (CT) slices.

For the automated 2-D cephalometrics (Fig 2), a hybrid replica of the active appearance model¹¹ and the active shape model was used in a multiresolution pyramid. The active appearance model is a statistical pattern for landmark location. A set of manual annotated cephalograms were employed during the model building phase. The resultant parameters were applied for fitting the model to the unseen image in an optimized iterative way. The average error was 1.3 mm for the automatic identification of 23 landmarks.⁶

For the 3-D cephalometrics (Fig 3), a 3-D entire skull reconstruction from the CT slices in DICOM (Digital Imaging and Communication in Medicine) format was made on the basis of the texture mapping technique.⁶ In this man-

ner, the actual digital image of all layers of the patient's craniofacial complex could be seen through the automated 2-D and 3-D cephalometrics. It is evident that the actual digital image is applicable for all orthodontic phases (observation, pretreatment, progress, posttreatment, retention, and postretention).

As mentioned previously, the suggested PTA generates the desired posttreatment vision, which is represented through the desired posttreatment digital image. The optimum orthodontic and dentofacial orthopedic changes could be visualized by subtracting the desired posttreatment digital image from the actual pretreatment digital image.

The 3-D cephalometrics is a valuable integrated diagnostic tool that merges information from cephalometrics, panoramic radiographs, facial photographs, oral photographs, study casts, and occlusograms. Consequently, the essential database for proper orthodontic diagnosis is attainable through the medicodental history, the clinical orthodontic examination, the automated 2-D cephalometrics, and the 3-D cephalometrics. The important thing is not to stop working hard to improve our diagnostic and biomechanical capabilities. Little by little, the bird makes its nest.

Are We Moving Teeth Faster and with More Control?

Sciences and scientists have no nationality, country, or border.¹² In our one-world of orthodontics, we are performing our daily clinical chores with the assumption that they are built on scientific evidence. "Archimedes, the Greek mathematician and inventor, stated: 'Give me a firm place to stand, and I will move the earth.' To paraphrase Archimedes, the contemporary orthodontist would say, 'Give me a firm biologic basis, and I will move the teeth.'"¹³

Fig 2 (left) Automated two-dimensional cephalometrics.

Fig 3 (right) Three-dimensional cephalometrics.

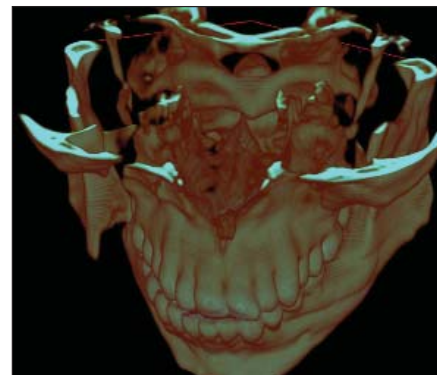
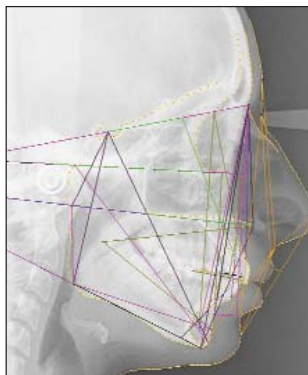


Fig 4 (left) Pretreatment frontal facial view.

Fig 5 (right) Progress frontal facial view. Note the improvement in facial esthetics.



The essence of orthodontic treatment is based on the phenomenon of tooth movement resulting from force application. Orthodontic forces are transformed into tissue reactions exhibited as tooth movements. Many researchers have tried to elucidate the biology of tooth movement. However, the exact mechanism by which these forces orchestrate tooth movement is not thoroughly understood.¹⁴ A careful review of the literature reveals that we are still lacking scientific foundations in the biology orchestrating tooth movements.

White¹⁵ pointed out that “the new and the old are not always at cross-purposes. In fact, they often complement one another and help expand professionals’ therapeutic skills.” To move the teeth faster and with more control, our team developed the amalgamated rapid technique (ART). It was formed by combining the best of each of the following three techniques: dental distraction,¹⁶ accelerated osteogenic orthodontics (AOO),¹⁷ and microimplants.¹⁸ The AOO combines corticotomy-facilitated orthodontics with periodontal alveolar augmentation. It is to be mentioned that corticotomy-facilitated orthodontics was introduced in 1985 for overerupted maxillary molars.¹⁹

In ART, dental distraction¹⁶ was used to elicit rapid canine retraction; AOO¹⁷ was employed for anterior segment intrusion and retraction; and microimplants¹⁸ were utilized for anchorage control. The patient’s tolerance was acceptable. The esthetic amelioration (Figs 4 and 5) was noticed in a very short duration (within 3 months). The results were consistent. The biologic basis of this superb response is still to be explored. The possible iatrogenic effects will be studied on a long-term basis.

ART dictates meticulous biomechanical plans and force systems to optimize tooth movements and minimize iatrogenic effects. It is important to note that the application of continuous forces for dental distraction resulted in a slower canine movement (similar or even slower than with traditional tooth movement).²⁰

Are We Minimizing Iatrogenesis?

In a cogent aphorism, Graber²¹ wrote an editorial entitled “Your word is as good as your bond.” Bonding and debonding is a daily clinical procedure that is not void of iatrogenic effects. Most of the bonding research studies have focused

mainly on one aspect: improving bond strength. Unfortunately, the iatrogenic acid-etching aspect was overlooked. It is known that acid etching has detrimental effects on enamel.

If there is a homology between teeth and hair,²² can we acid etch the teeth without damaging them? The solution for the acid-etching problem could be either to counteract the destructive effects of acid etching or to use a strong bonding material without acid etching. A recent scanning electron microscopic study revealed that phosphoprotein–calcium phosphate complexes not only remineralized etched enamel, but also converted the destructive effects of acid etching.²³ Glass-ionomer cement reinforced with Kevlar fibers resulted in a strong bonding material without the need for acid etching.²⁴

Concluding Remark

George Sand, the famous French novelist, said, “We must accept truth even if it changes our point of view.” To serve our patients in the finest manner, orthodontics should be viewed as a dental specialty searching the truth to move the tooth (and other orofacial structures) through an evidence-based approach. Is our word as good as our bond?

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