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Individual Tooth Anatomy For Esthetic Rehabilitation

Giuseppe Romeo*

Clinical Assistant Professor, Division of Restorative Sciences, Herman Ostrow School of Dentistry, University of Southern California, USA

***Corresponding Author:** Giuseppe Romeo, Clinical Assistant Professor, Division of Restorative Sciences, Herman Ostrow School of Dentistry, University of Southern California, USA.

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To create an esthetic dental rehabilitation is undoubtedly a complex operation. Numerous factors need to be studied and evaluated when modeling a restoration, including tooth alignment, dimensions of the clinical crown and occlusion. A correct understanding of all these anatomical parameters is essential to create an esthetic restoration that is as harmonious as possible [1-5]. For the construction of a tooth we need numerous requirements that may make the composition somewhat difficult, but at the same time we feel that some complexity is necessary to enrich the beauty of the result.

This article is aimed tocodify these steps so as to simplify and clarify the procedures, using a new and simple systemthat will enable the dental professional to go beyond the usual uninteresting creative standardsin esthetic rehabilitation. In the fist part the principal tooth forms, their characteristics, and the relationship between surfaces will be analyzed. This will create the base for the introduction of a new tooth form classification guide, called Dental Anatomical Combinations. By sectioning the three principal forms of teeth and recombining their individual characteristics new tooth forms can be created. Then, the numerous possibilities for anatomical tooth reproduction, in order to achieve the most suitable form for each particular case, are highlighted. Application of the new system will be demonstrated in a clinical case.

The three basic forms of tooth anatomy

Different facial and dental forms exist in nature, and some scholars of the past have proposed these types as the starting-point on which to base the rehabilitation of patients requiring a fixed or removable restoration [6-8]. Various concepts have been introduced describing correlations between dental form and other factors, such as gender, [9] face, [10,11] shape of the maxillary arch, [11] constitutional type, [12] or personality [9,13]. Even though these concepts have been disproven, [10,14-16] today some professionals still consider these theoriesapplicable to anterior restorations. However, we doubt whether application of this mathematical rules can provide a predictable outcome, since it tends to annul the creative approach and penalize the result of the final rehabilitation [17,18].

The literature tells us that there are three basic tooth forms in nature: the Square form (type A), the Ovoid form (type B) and the Triangular form (type C). [10,19,20].

Square: The mesial and distal proximal surfaces are parallel and perpendicular to the incisal edge and present a cervical area that is a wide U-shape. The vestibulo-distal transitional ridge may be slightly curved; the incisal edge is straight or slightly curved. The incisal edge is longer in the mesio-distal direction than in the oval form and almost the same length as that of the triangular form.

Ovoid: The incisal edge has a central protuberance; its length in the mesio-distal sense is the shortest of the basic anatomic forms.The mesial and distal transition line angles are rounded and converge at the incisal and cervical. The U-shaped cervical line is more oval than in the square type.

Triangular: The distal ridge is not parallel to the mesial ridge, but markedly inclined defining a very narrow V-shaped cervical zone with a convexity at the center of the crown. The incisal edge is wide in the mesio-distal sense and may have a slight curve at the center or a mere convexity. The incisal angles are slightly acute.

Outline and Form

During the design stage all forms must be evaluated from an incisal, a cervical, and frontal view with a right-lateral and left-lateral projection, grasping the overall organization of the tooth and the relationship between the anatomic parts [21,22].

The three principal types of tooth form include numerous variations and these do not only involve the shape but also the form of the teeth [23]. In this context the word "form" indicates all the macro-characteristics such as the outline of the tooth, development of the ridge, depth of grooves, difference between mesial and distal incisal angles [24,25]. Another element that is closely linked to the anatomical qualities of the tooth is the surface texture or micro-characteristics.

The physical form of an object is determined by its outline, comprising the incisal border, proximal ridges and cervical line. These linesdictate the path of the ridges and the shape of the lobes; these interconnected characteristics determine the volume and at the same time the form we are interested in creating. Thus the tooth should not immediately be studied in three dimensions; rather we should first consider the outline.

Transition areas and lines

Characteristics of form are not separate entities but rather combine to form a single feature: this means that the tooth is crossed by grooves, connected logically, that determine three-dimensional anatomical areas. Natural teeth are not the result of a random cut; during their formation they produce components such as ridges and cusps, the grooves and fossae are the result of this formation. The frontal view does not provide sufficient information to reproduce the area present around a transition line. A transition line must be formed considering the three-dimensional correlations, and to achieve this we must begin to work on each transition line starting from the lingual surface. In all natural teeth, the ridges and grooves, starting from the lingual surface, are connected to the proximal and vestibular surfaces.

Torsion

There is another principle that relates to natural teeth: surface torsion. If we view the teeth from the incisal viewpoint, the distal protrusion becomes evident at the level of the cervix.Failure to understand this torsion may result in artificial incisors that appear flat or distally protruded [21]. The line of rotation starts from the vestibular face and continues in the lingual direction creating movement that can clearly be seen in the incisal view.

In the incisors torsion is gentler, in the canines it is more pronounced; however, the technician may define the extent of torsion depending on the form that is wished to impart to the esthetic rehabilitation. In more facially positioned teeth, this characteristic is more evident; however, torsion is common to all teeth to a greater or lesser extent, although the extent of rotation varies from one tooth to another.

Dental Anatomical Combinations

Based on the anatomical knowledge and three basic tooth forms, we can now introduce a new tooth form classification system, called "Dental Anatomical Combinations". This new and simple concept aims to help in the codification of a system that will enable the dental professional to produce different tooth anatomies that go beyond the standard tooth shapes.

The basic principle of this system is based on segmentation and recombination of two or even three principal tooth forms [26]. First, the perimeter of each tooth form is sectioned into smaller segments. E.g., by sectioning the tooth into three different segments a mesial, distal, and incisal segment can be obtained. If necessary these segments can be further divided in half, resulting in six half segments: mesial cervical, mesial body, mesial incisal, distal cervical, distal body, and distal incisal. To create the final form these full or half segments can be recombined, forming so called "Complementary Classes". The class numbering (1:3. 1:2, ½:3, or ½:2) indicates which segment was used (number before the colon: either full (1) or half (1/2) segment) and with how many basic tooth forms it was used for recombination (number after the colon: either 2 or 3 basic tooth shapes).

The first complementary class 1:3 uses one full segment of each of the three principal tooth forms, resulting in 6 different tooth shape combinations.

The second complementary class 1:2 uses one full segment, combining it with only two different principal tooth forms. This results in 18 different tooth shapes.

The third and fourth complementary classes ½:3 and ½:2 involve only half segments, which were combined with 3 or 2 different principal tooth shapes. By dividing the tooth vertically or obliquely into two parts of the three teeth the segments are always in contrast in the final shape, giving it a more dynamic appearance. Even though for both classes mathematically many more combinations are possible, only a selection of them is shown.

In total we have presented 48 anatomical tooth combinations, giving us more possibilities to create teeth than those offered by the usual three shapes.

These new combinations enable us to understand how the tooth can have contrasts that give the tooth a more dynamic appearance. The combination of these contrasts, both in form and in the composition of the hue, can help us to range more widely and with greater creativity in order to achieve an esthetic rehabilitation.

Segmentation is a means of composition that is particularly necessary and evident to facilitate practical orientation. In the laboratory needs, it is a visual message, thus a concrete rather than an abstract concept that allows us to understand and produce the tooth shapes that we desire.

mm. [1,21,28]. To create a cervical emergence profile that matches the one of a lateral incisor the canine needs to be reduced in width to those dimensions. On the facial surface the less convex surface of the lateral incisor compared to a canine needs to be taken into account. Insufficient preparation of the canine might result in either inadequate thickness of the ceramic or if minimum thickness of the ceramic is maintained in an over-contoured final restoration. On the other hand, over-reduction would conflict with the wish of the patient for a minimally invasive treatment and more important would compromise optimal bonding of the veneers by exposing dentin.

Considering these parameters, a preparation was simulated in the lab. Such a simulation is a useful tool in the communication between the technician and the dentist. Based on this preparation simulation and on the wax-up silicon keys were fabricated, which were delivered to the dentist as a guide during the clinical preparation [27]. Furthermore, this preparation simulation allowed the fabrication of a shell provisional.

Ceramic

To manufacture the ceramic veneers an alveolar model was fabricated, consisting of an intact soft tissue model and interchangeable dies [29]. The presence of the soft tissue is fundamental in the creation of the final rehabilitation, because it is the key in positioning transition lines, and the tissue allows to have more control over the tooth shape [17,18].

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