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## **Upper incisor to Soft Tissue Plane (UI-STP): A new reference for diagnosis and planning in dentofacial deformities**

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### **Abstract**

Planning in orthognathic surgery has been and still is an open issue. We have evolved from 2D classical cephalometric hard-tissue planning to 2D soft tissue planning, and finally to 3D and hard and soft tissue evaluation. This, to our knowledge, is the first description of a new Soft Tissue Plane (STP) and its relationship with the anterior position of the upper incisor (UI). Profile photographs of 110 "attractive individuals" with lips at rest or smiling and with upper incisor shown were used. The photographs used were of 65 professional models from two international agencies and 45 individuals considered most attractive in the internet forums, which included catwalk models and actors. In 86 cases (78.18 %), the incisor was located in front of the STP (A). In 15 cases (13.63%), it was on the plane (N); and in the remaining 9 cases (8.18%), it was behind (P). Despite the limitations of this study and based on our series, we can conclude that the upper incisor is located at or in front of the Soft Tissue Plane (STP) in 91.81% of the attractive facial profiles studied. On the other hand, the relative position of the upper incisor to the soft tissue plane (UI-STP) could be a useful diagnostic and planning tool in orthodontic and surgical management of dentofacial deformities.

**Key words:** Cephalometry, orthognathic surgery, facial soft tissue, upper incisor, facial analysis.

### **Introduction**

Planning in orthognathic surgery has been and still is an open issue. We have evolved from 2D classical cephalometric hard-tissue planning, to 2D soft tissue planning, and finally to 3D and hard and soft tissue evaluation (1). In all cases the goal has been to establish normative data that could be used by clinicians to diagnose and treatment plan for facial deformities.

There are two important limitations. Most of the "classic" cephalometric analyses reflect a norm derived from a limited number of average individuals –not necessarily attractive- with normal occlusions. In the other hand,

when different cephalometric analyses are applied to a particular individual, diagnosis and thus treatment plan may vary between them (2). These analyses can at best enhance orthodontic diagnosis and treatment planning. But they are used mainly for descriptive purposes. Individual tracings are compared to an average facial pattern and the difference between them requires considerable interpretation.

The works by Farkas et al. (3) and the posterior developments by authors like Holdaway (4,5), Merrifield (6) and Arnett et al. (7,8) brought the attention to soft tissues (facial mask) in aesthetic diagnosis and planning

for patients with dentofacial deformities. Sarver et al. (9) introduced the concept of centripetal construction of the face so that the soft tissues should guide skeletal correction.

One of the key points in diagnosis and planning for dentofacial deformities is the 3D position of the upper incisor (UI). In fact authors like Wolford start their Visual Treatment Objective at this point (10).

There is enough literature and consensus regarding the vertical position of the incisor with relation to the upper lip both at rest and during the smile. Also there are guidelines regarding the sagittal position of the UI related to skeletal landmarks (11-14). However, to our knowledge, no previous analysis has established the relationship between the upper incisor and a soft tissue reference like the Soft Tissue Plane.

When planning orthognathic cases in our practice, we subjectively considered that the upper incisor should be in front of a line (plane) passing through the soft tissue nasion perpendicular to the floor with the head in the natural rest position. Our aim with this study was to establish a rational for this approach by evaluating this Upper Incisor to –what we call- Soft Tissue Plane in a group of uber-attractive individuals.

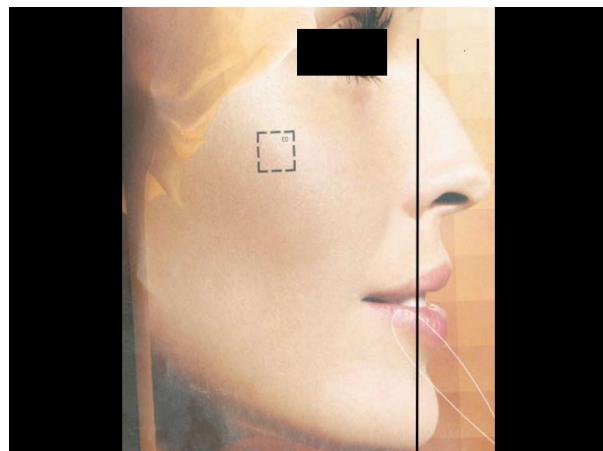
## Material and Method

Profile photographs of 110 “attractive persons” with lips at rest or smiling and with upper incisor show were used. Photographs belonged to 65 professional models from two international agencies and 45 persons considered as most attractive in the internet forums, and included catwalk models, and actors.

Inclusion criteria were race (caucasian and hispanic) and age (20 to 50).

Exclusion criteria were pictures were poor quality could not clearly yield the soft tissue nasion (N') or the anterior limit of the upper incisor.

Malocclusion could not be ruled out from the pictures. All photographs were digitalized and corrected subjectively to natural head position (15) by rotating them. Five independent –non professional- evaluators did the correction on each case. Using the tip of the nose as a center of rotation, evaluators were asked to rotate the picture to a position considered as natural rest position. A vertical line or Soft Tissue Plane (STP) was drawn on each case passing through the soft tissue nasion (N'), and descending perpendicular to the base of the photograph. The sagittal (Antero-posterior) relation with the anterior limit of the upper incisor was evaluated (Fig. 1). Cases were classified as A (anterior) if the incisor was anterior to the line, N (neutral) if it was coincident with the line, and P (posterior) when it was behind the line. No measurements could be taken because of lack of relative size scales in the photographs. Subjects of the study, for obvious reasons were not measured.



**Fig. 1.** A vertical line or Soft Tissue Plane (STP) is drawn passing through the soft tissue nasion (N'), and descending perpendicular to the base of the photograph. The sagittal (Antero-posterior) relation with the anterior limit of the upper incisor is evaluated.

## Results

67 women, 43 men were included. Mean age ranged between 21 and 50 (mean 28).

Evaluation of the relative sagittal position of the most anterior limit of the upper incisor and the Soft Tissue Plane (STP), yielded the following results:

In 86 cases (78,18 %) the incisor was located in front of the STP (A). In 15 cases (13,63%) it was on the plane (N), and in the remaining 9 cases (8,18%) it was behind (P). As mentioned earlier, no measurements could be taken from the photographs.

Considering gender, the results were as follows: Males (n=43) A=32, N=7, P=4. Females (n=67) A=54, N=8, P=5.

## Discussion

Previous descriptions of sagittal reference lines and planes, include the so called “true vertical line” (TVL) which is a line perpendicular to the floor which passes through the subnasale (SN) and travels perpendicular to the floor (with the patient in natural rest position. (7,8). Arnett has to be commended for being the first author who truly systematized a comprehensive soft tissue analysis both in the frontal and sagittal planes. However, the normative data for Arnett's analysis were drawn from a rather small sample of “attractive” subjects according to the author. In the other hand this line does not constitute an stable reference considering that a great number of disharmonic surgical patients have varying degrees of maxillary hypoplasia (92% in our 1600 cases experience). These facts prevent the use of this line as an absolute reference.

This is the first description to our knowledge of a new Soft Tissue Plane (STP), and its relation with the ante-

rior position of the upper incisor (UI). It is unique in that it relates a soft tissue reference, with a hard tissue landmark. Moreover, this correlation, allows for clinical profile evaluation without the need of a radiograph.

Numerous attempts at measuring beauty have failed. Human faces have one thing in common: They're all different. Variation is the norm and should be embraced. However we can set some 3D references obtained from attractive individuals that help to reduce subjectivity. Our upper incisor to Soft Tissue Plane relation could be one of them.

We strongly believe that -when diagnosing and planning for dentofacial deformities- one should bear in mind that occlusal and frontal parameters are objective. In other words malocclusions and asymmetries can be precisely quantified with numbers. In the other hand vertical and anteroposterior parameters are subjective and it has no sense trying to quantify them to the millimeter. These parameters are responsible for the "artistic" and individualized treatment plan that each patient deserves.

Treatment planning should be based on achieving optimal aesthetics and function for each patient rather than following anatomical norms of occlusion and facial balance. In order to have a real set of norms that could be really helpful we should implement a gigantic database with thousands of individuals classified by age, sex, and race. Only in this scenario normative data could be trusted. But even in this case final tuning of the treatment plan in the vertical and anteroposterior dimensions should rely on a subjective approach. Each patient deserves a tailored solution. Our UI-STP relationship does not establish a precise to-the-millimeter rule to plan for ortho-surgical cases. Instead it sets a tendency that should be incorporated to the subjective treatment plan.

Limitations of our study include the following: we only had profile non-calibrated photographs of the subjects of study, thus only absolute non-numeric evaluations could be done. Also there is some subjectivity in positioning the pictures with the adequate rotation. Using independent professional observators probably helped to neutralize the bias. Other limitation is the sample of subjects. However it is still bigger than most of the previous studies on facial diagnosis (7,8). A last limitation is that malocclusions were not specifically excluded. However one could assume that most of the selected –über-attractive-subjects have rather normal (treated or not) occlusions.

With the limitations of this study, we can conclude that, in our series 91,81 of the attractive facial profiles have their upper incisor at or in front of the Soft Tissue Plane (STP). In the other hand, the relative position of the upper incisor to the soft tissue plane (UI-STP) could be a useful diagnostic and planning tool in orthodontic and surgical management of dentofacial deformities.

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