Guest Editorial

On Reference Points—Cartesian vs Lagrangian Eung-Kwon Pae*

In measuring an object you wish to describe, there are two ways: from the inside or from the outside. Observing and measuring an object from outside is particularly useful when one wants to describe its position and orientation as for example, by placing an object in Cartesian space and describing it by coordinates. We may call this the Cartesian method.

In contrast to the Cartesian concept is the "Lagrangian concept," which I boldly borrow from mathematics. The Lagrangian concept views an object from inside, as opposed to from the outside as in the Cartesian method. This concept is convenient for describing changes occurring within an object. It does not matter where the object is as, for instance, partial derivatives of the velocity change of a moving fluid. This concept cares only about incremental differences.

No matter whether you are an orthodontist or an oromaxillo-facial surgeon, we often confuse these concepts when using cephalometrics. Let me show you an example. It is not uncommon to see the following argument at an "ortho-surgical conference": An orthodontic resident would go first. "This patient shows a retrognathic maxilla and mandible, so he needs a two-jaw surgery." An oral surgeon could quickly interject saying, "But, . . . look at his head posture. If you position his head in a neutral or natural position, he needs only a BSSO in the mandible." This conference can go on and on, because they are discussing a matter from two different standpoints.

Since it is not easy to manipulate or to hold a head at

neutral or natural (whichever you like) position in a cephalostat machine, various methods have been developed, as for instance, leveling devices using a bubble, mirror, musculovisual feedback, electronic sensor, and so forth. Despite all the help from these devices, our cephalometric analyses are still confusing because the confusion originates from using two concepts in 'cocktail.' We have not hesitated to mix those two views, perhaps because clinically it seems to be no big deal or we do need both. For instance, the FH plane, one of the most important cephalometric reference planes, has as long or even longer history as does the cephalometric machine, is a typical example that can be greatly influenced by head posture change. Patients can appear to be biting anywhere from a skeletal Class II to Class III in varying degrees at their will by changing their head posture.^{1,2} An interesting fact though, is that the size or shape of the face did not change at all! Are we trying to fix the face itself or are we trying to fix how they hold up the face in space?

The orthodontist at the conference in the above example appears to live up to the Lagrangian concept. S/He is only interested in the shape and size of the face, so s/he uses the cranial base as a reference to check the facial form. For the oral surgeon, on the other hand, the patient's head posture is so critical that the surgeon would not like to give up the vertical line dropped from the patient's forehead and measures the size and shape of the face with respect to that vertical line. So, this surgeon wants to be a Cartesian disciple. In reality, however, we have to negotiate both concepts and create the best harmonizing face. The important fact to remember is that cephalometric analyses employ both concepts that are dealing with two different matters, ie, shape and size of the face, and orientation of the face, and that they are mutually influential.

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