Letters to the editor*

Forces and moments generated by removable thermoplastic aligners

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There are some mistakes in the article "Forces and moments generated by removable thermoplastic aligners: Incisor torque, premolar derotation, and molar distalization" (Simon M, Keilig L, Schwarze J, Jung BA, Bourauel C. Am J Orthod Dentofacial Orthop 2014;145:728-36). Mistake 1 is the labeling of the coordinate system, and mistake 2 is the unit of force.

Mistake 1 (p. 730 and 732). As published, the article states that the "coordinate system was set up: the positive x-axis describes extrusive forces…parallel to the long axis of the tooth…For a molar, the positive y-axis describes buccal movements,…the positive z-axis describes mesial movements…For a maxillary incisor, the positive y-axis describes distal movements,…the positive z-axis describes buccal movements…(Fig 3)." On Figure 3, the z-axis is labeled correctly, but the y-axis is incorrect. Viewing Figure 3, we see the following: the positive x-axis (+x) is coming out of the page, the positive y-axis (+y) is horizontal and points to the right, and the positive z-axis (+z) is vertical and points upward. The coordinate system obeys the right-hand rule correctly. Just the labeling of the y-axis is wrong in Figure 3.

Mistake 2 (p. 732). The equation was published as "1 N = 1/9.81 kg = 102 g." It should be written as "1 N = 1/9.81 kgf = 102 gf."

In MKS (meter-kg-second) of the metric system, "kg" is the unit of mass, and "N" is the unit of force. In Newtonian mechanics, force = mass × acceleration and weight = mass × gravity. On earth's surface, gravity is 9.81 m/s^2. If the mass m is 1 kg, its weight W is

$$W = m \times g = 1kg \times 9.81\ m/s^2 = 9.81\ N.$$

Some people call this weight as 1 kgf. Thus, if the mass m is 1 kg, its weight W (on earth) is 9.81 N, or 1 kgf. So, the conversion is 1 N = 1/9.81 kgf. But it is wrong to say 1 N = 1/9.81 kg, since kg is a unit of mass, whereas N is a unit of force. This usage of kgf, however, is not good science because gravity is 9.81 m/s^2 only on earth's surface; it is different elsewhere. For example, gravity on the surface of the moon is 1/6 of 9.81 m/s^2.

*The viewpoints expressed are solely those of the author(s) and do not reflect those of the editor(s), publisher(s), or Association.

Author's response

Thank you very much for reading our article so carefully.

Indeed, the labeling of the y-axis is incorrect in Figure 3. This happened because of some revisions, and it is a miserable fact that no one noticed the mistake during the revisions and typesetting. We have submitted a Correction for publication in the Journal.

Regarding the second item mentioned by Dr Vu, there is no need for a discussion of masses in the earth's or the moon's fields of gravity! Formally, Dr Vu might be right, and in our first manuscript version, we stated "when forces dropped below 0.2 N (1 N equals 100 gf)" in the respective passage. If a physically correct formulation should be used, this is the correct term. However, a reviewer wanted a concretion of "N," and this was a formulation he accepted. In fact, kgf or gf is not an official unit of measurement in any system of units. If a correct unit in the "cgs" system had been used, we would have used p and not g or gf. However, the *AJO-DO* does not have a clear rule for the use of N, g, gf, or similar symbols for forces. And moreover, orthodontists around the world are still using g as a unit for the force, although we prefer using N.

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Is "long face" a misnomer?

I read with interest the article by Ha et al,[1] particularly their discussion of the terminology related to "long face deformity" and "long face syndrome." At the expense of being pedantic, one has to ask whether the term "long" is accurate or even the correct use of English in such instances.