Reviewer’s report

Title: Incorrect measurements and misleading conclusions in the article "Comparison of the efficacy of tooth alignment among lingual and labial brackets: an in vitro study"

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Reviewer: Dieter Dirksen

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The authors present a critical assessment of a study conducted by Alobeid et al. ("Comparison of the efficacy of tooth alignment among lingual and labial brackets: an in vitro study", Eur J Orthod 2018) in which the efficacy of tooth alignment using conventional labial and lingual orthodontic bracket systems was assessed. The main criticism that the authors raise refers to the experimental design of the study. Its basic concept consists in simulating the initial stage of orthodontic treatment in vitro on an acrylic resin model of a maxillary arch with one of the upper incisors removed. A NiTi arch-wire is then ligated to brackets and moved labially and gingivally for 2 mm at the position of the missing incisor. In case of the original study by Alobeid et al. this is carried out with a so-called orthodontic measurement and simulation system (OMSS), which is a force sensor mounted to a 3-axis translation stage driven by stepper motors that is attached to the wire. Measurements are then performed by moving the wire via the translation stage on a calculated trajectory in small increments and measuring the force acting on the sensor after each increment. Wiechmann et al. repeated this experiment with a comparable arrangement of a dental arch model, in which they moved the wire labially 2 mm at the position of the removed tooth. When releasing the wire, they observed that it remained in its position. They concluded that both the results and the conclusions drawn by Alobeid et al. are wrong. As a consequence they suggest that the assessed paper should be retracted.

Comments

It is certainly a rare event that 17 renowned authors together express such fundamental criticism of a published study. The fact that so many colleagues are seriously concerned about the study alone is a sufficient reason to address this issue. The main question is, whether the experimental setup of Alobeid et al. properly reflects the clinical situation. Wiechmann et al. concluded that there is no autonomous return of the displaced wire to the initial state after it was released, as it is held in position by friction at the ligatures. The restoring force of the arch-wire is effected by random chewing forces mediated by the mobility of the teeth and by the saliva. In the experiment of Alobeid et al. a forced movement is applied to the wire by the stepping motor at a certain point. Thus, it is questionable, whether this approach describes the clinical situation and what is the meaning of the measured forces. In my opinion Wiechmann et al. made a valid point when criticising this approach. Thus, this issue deserves a public discussion.

Nevertheless, there remain some issues in their paper which should be addressed. First, the authors should use a more neutral language. Comments like the ones on page 3 line 11-13, page 4 line 21-22 and line 42 should be avoided. Second, the criticism of the used statistical test is somewhat misleading. The Mann-Whitney test merely checks whether two distributions are different, without a rating of the magnitude of the difference. As proposed by Wiechmann et al., it should only be applied to the difference between measured values and desired optimum values. Third, it is misleading when the authors speak of "reality" ("...differences between the measured results and reality...", page 3, line 5).
Here the term "clinical situation" would be more precise. It would be helpful if the authors could comment on the role of friction with respect to the behaviour of the arch-wire and provide some references.

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