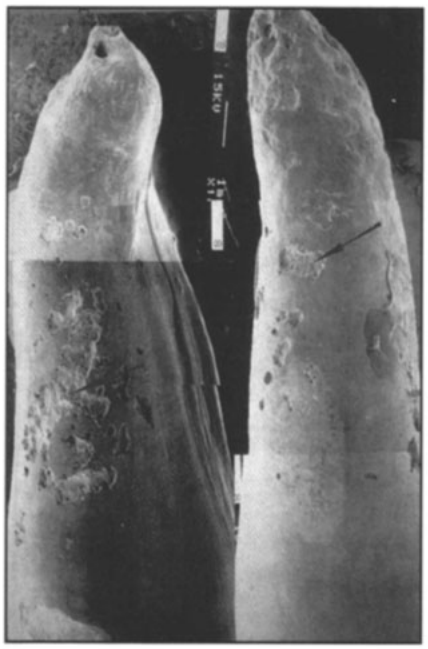

Figure 9
Left: Continuous force side
Right: Discontinuous force side. Arrows show extensive resorptive lesions on both sides (X16)

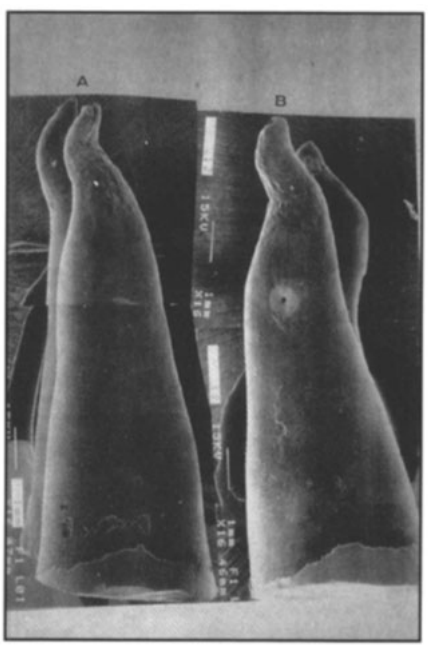

Figure 10
Left: Continuous force side
Right: Discontinuous force side. Although this individual received the same treatment as the others, root surfaces and apices seemed unaffected with the exception of a few superficial lesions on the cervical regions (X16)

as a continuous force. Further experiments are necessary to show whether this effect can be achieved in humans, too. In that event, it would be tempting to think that discontinuous forces, producing the same amount of movement as a continuous force and causing less root resorption, would be a better choice during orthodontic treatment.

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Commentary: Continuous vs. discontinuous force application and root resorption

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This study compares the extent of root resorption occurring in response to continuous and discontinuous force application and concludes that discontinuous force causes less root resorption. This issue is of some clinical significance to orthodontists because orthodontic treatment places patients at risk for root resorption. Clearly, the causes and mechanisms of root resorption are multifactorial, and orthodontic treatment is only one part of the picture. Some have argued that, despite its prevalence in patients, most orthodontic root resorption is minimal and has few clinical consequences. However, some patients (about 10%) seem to be highly susceptible to extensive root resorption. Factors other than orthodontic biomechanics may come into play because susceptible patients often show pre-existing root loss and root anomalies. Developing a means to identify these unusually suscep-

tible individuals would seem to be important. Currently, there are no good methods to do this.

Another issue of some significance is our understanding of the relationship between orthodontic biomechanics and root resorption. This would be especially critical for these highly susceptible patients because the clinician could adopt root-sparing biomechanics for their treatment. The authors correctly note that the relationship between various orthodontic biomechanics and root resorption remains controversial. Some researchers have hypothesized that providing frequent rest periods during orthodontic treatment may limit the extent of root resorption. This study attempts to test that hypothesis in humans and concludes that the idea has merit.

Unfortunately, this study does not assess tooth movement. This is important because, if clinicians elect to adopt root-sparing biomechanics, they should understand the effects the techniques will have on treatment results and duration. There is much clinical information available suggesting that less than full-time force application can move teeth (headgear, for example). Attempts have been made in some animal studies to quantify these differences, but little human data exist on this issue.

The appliance used in this study probably does not simply intrude the teeth, but instead creates uncontrolled tipping. This may not be particularly important because the comparisons are still between like-appliances. However, the appliance does rely on subject compliance, and this study has no method for assessing compliance. Also, the use of elastics is somewhat less than ideal because they do not deliver forces as reliably as other means, such as coil springs.

The experimental design presents some statistical problems because it assumes that all teeth are equivalent and represent independent observations. There is some evidence in the literature that different tooth types respond differently to root resorption. Therefore, treating maxillary premolars as equivalent to mandibular ones may not be valid. Also, the approach to data handling treats premolar pairs from three subjects (i.e., those with four premolars extracted) as independent observations. We cannot assume that premolar pairs taken from a single patient are totally independent observations. We actually have eight totally independent observations in this study (i.e., eight patients), not the 11 suggested by the table. Despite substantial reductions in all 11 observations in the discontinuous force group, the authors should analyze their data statistically.

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