Bony adaptation after expansion with light-to-moderate continuous forces

Colin D. Kraus, Phillip M. Campbell, Robert Spears, Reginald W. Taylor, Peter H. Buschang

Received: February 2013; Received in revised form: January 2014; Accepted: January 2014;

DOI: http://dx.doi.org/10.1016/j.ajodo.2014.01.017

Abstract

Introduction
The purpose of this study was to evaluate the biologic response of dentoskeletal bone to archwire expansion with light-to-moderate continuous forces.

Methods
With a split-mouth experimental design, the maxillary right second premolars of 7 adult male dogs were expanded for 9 weeks using passive self-ligating brackets ( Damon Q; Ormco, Orange, Calif) and 2 sequential archwires (0.016 × 0.022-in copper-nickel-titanium alloy, followed by 0.019 × 0.025-in copper-nickel-titanium alloy), intraoral and radiographic measurements were made to evaluate tooth movements and tipping associated with expansion; archwire forces were measured using a force gauge. Microradiography was used to compare buccal bone height, total tooth height, total root height, and buccal bone thickness. Bone formation was evaluated histologically using tritiated thymidine and calcein fluorochrome labels and hematoxylin and eosin stains.

Results
Buccal expansion was produced by forces between 73 and 178 g. Compared with the control side, which showed no tooth movement, the experimental second premolars were expanded by 3.5 ± 0.9 mm and tipped by 15.4°. Buccal bone thickness was significantly thinner (about 0.2 mm) in the coronal aspect and significantly thicker (about 0.9 mm) in the apical aspect over the mesial roots. The tipping and expansion significantly (P < 0.05) reduced buccal bone height (65.5°, caused dehiscences) at the mesial (about 3.8 mm) and distal (about 1.2 mm) roots. Bone apposition occurred on the trailing edges of tooth movement and on the leading edges of the second premolar apices. The axial microcomputed tomography slices indicated, and the bone histomorphometry and histology demonstrated, newly laid-down bone on the periosteal side of the buccal cortical surfaces. Osteoblast aggregation was also evident on the periosteal surfaces of buccal bone, just cervical to the apparent center of rotation of the tooth. Roots and root heights showed no significant differences between the experimental and control second premolars.

Conclusions
Buccal expansion with light-to-moderate continuous forces produced 3.5 mm of tooth movement, uncontrolled tipping, and bone dehiscence, but no root resorption. Bone formation on the periosteal surfaces of cortical bone indicates that apposition is possible on the leading edge of tooth movements.

To access this article, please choose from the options below

Log In

Purchase access to this article
You must be logged in to purchase this article.

Claim Access
If you are a current subscriber with Society Membership or an Account Number, claim your access now.

Subscribe to this title