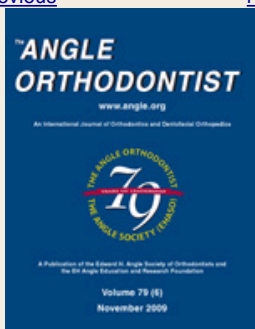


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Original Article

## Molecular Markers of Early Orthodontic Tooth Movement

Patricia Joyce Brooks<sup>a</sup>, Dorrin Nilforoushan<sup>b</sup>, Morris Frank Manolson<sup>c</sup>, Craig A. Simmons<sup>d</sup>, and Siew-Ging Gong<sup>e</sup>

### Abstract

**Objective:** To understand the molecular basis of early orthodontic tooth movement by looking at the expression of KI-67, runt-related transcription factor 2 (Runx2), and tumor necrosis factor ligand superfamily member 11 (RANKL) proteins.

**Materials and Methods:** We employed a rat model of early orthodontic tooth movement using a split-mouth design (where contralateral side serves as a control) and performed immunohistochemical staining to map the spatial expression patterns of three proteins at 3 and 24 hours after appliance insertion.

**Results:** We observed increased expression of KI-67, a proliferation marker, and RANKL, a molecule associated with osteoclastic differentiation, in the compression sites of the periodontal ligament subjected to 3 hours of force. In contrast, there was increased expression of KI-67 and Runx2, a marker of osteoblast precursors, in tension areas after 24 hours of force. Decreased KI-67 expression in the mesial and distal regions of the periodontal ligament was observed at the midpoint of the tooth root.

**Conclusions:** The early RANKL expression indicates that at this early stage cells are involved in osteoclast precursor signaling. Also, decreased KI-67 expression found near the midpoint of the tooth root is believed to represent the center of rotation, providing a molecular means of visualizing mechanical loading patterns.

**Keywords:** [Orthodontic tooth movement](#), [Periodontal ligament](#), [Precursor cells](#), [Mice](#), [Proliferation](#)

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<sup>a</sup> Graduate MS student, Orthodontic Department, Faculty of Dentistry, University of Toronto, Toronto, Canada

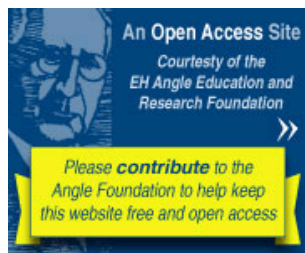
<sup>b</sup> Graduate PhD student, Orthodontic Department, Faculty of Dentistry, University of Toronto, Toronto, Canada

<sup>c</sup> Associate Professor, Faculty of Dentistry/Faculty of Medicine, University of Toronto, Toronto, Canada

<sup>d</sup> Assistant Professor, Faculty of Dentistry/Faculty of Mechanical and Industrial Engineering, University of Toronto, Toronto, Canada

<sup>e</sup> Associate Professor, Orthodontic Department, Faculty of Dentistry, University of Toronto, Toronto, Canada

Corresponding author: Dr Siew-Ging Gong, Faculty of Dentistry, University of Toronto, 124 Edward Street, Toronto, Ontario M5G 1G6, Canada ([sg.gong@dentistry.utoronto.ca](mailto:sg.gong@dentistry.utoronto.ca))



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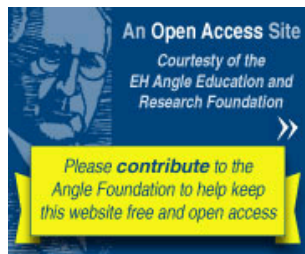
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