

AAO Foundation Award Final Report
(a/o 2/12/08)

Principal Investigator	Laura R. Iwasaki
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Award Type	Biomedical Research Award (B.F. Dewel Honorary Research Award)
Project Title	The <i>in vivo</i> and <i>in vitro</i> effects of known mechanical systems on tooth movement and periodontal ligament cell biology.
Project Year	2000 (Project timeline: July 1, 2000 - June 30, 2003)
Institution	University of Nebraska Medical Center, College of Dentistry
Summary/Abstract (250 word maximum)	<p>Introduction: Tooth movement has been studied largely with respect to the force required for tipping when pressure distribution varies along the length of the periodontal ligament. But important factors for effective canine translation include the nature and magnitude of applied stress and the patient's cell biology. The purpose of this research was to test 3 hypotheses: (1) the velocity of tooth translation (v_t) is related to applied stress and growth status, (2) a threshold of stress accounts for the lag phase, and (3) v_t is correlated with the ratio (AI) of 2 cytokines (IL-1β, IL-1RA) measured in gingival crevicular fluid (GCF) and stimulated whole blood (SWB). Methods: Continuous maxillary canine retraction stresses of 13 kPa and 4, 26, or 52 kPa were applied bilaterally in 6 growing and 4 adult subjects for 84 days. Dental models and GCF samples were collected at 1- to 14-day intervals. Cytokines were measured in GCF and SWB cell cultures. Results: V_t was positively related to stress and was higher in growing subjects ($P=0.001$). It was also related to AIGCF in growers ($R^2=0.56$) and nongrowers ($R^2=0.72$). Canines moved with 52 kPa showed a lag phase, and postlag phase AI_{GCF} was twice that of lag phase AI_{GCF}. Mean v_t and associated AI_{GCF} during the postlag phase were nearly double the values for canines moved with 13 and 26 kPa. SWB production of cytokines was dose-dependent. For growing subjects, SWB IL-1RA was correlated with v_t ($R=0.70-0.72$), and AI_{SWB} and IL-1β concentrations were correlated with AI_{GCF} ($R=0.73-0.78$). Conclusions: V_t varied with growth status and stresses ≤ 52 kPa; stresses of <52 kPa showed no lag phase; and equivalent stresses yielded subject-dependent differences in v_t, which correlated with cytokines in GCF and SWB. (Am J Orthod Dentofacial Orthop 2005;128:483-91)</p>

<p>Were the original, specific aims of the proposal realized?</p>	<p>Yes</p>
<p>Were the results published? If not, are there plans to publish? If not, why not?</p>	<p>Results were published in:</p> <p>Iwasaki LR, Crouch LD, Tutor AW, Gibson SW, Hukmani N, Marx D, Nickel JC (2005): Relationship of tooth movement and cytokines and whole blood in growing and non-growing humans. <i>Am J Orthod Dentofac Orthoped</i> 128:483-491.</p> <p>Iwasaki LR, Crouch LD, Reinhardt RA, Nickel JC (2004): The velocity of human orthodontic tooth movement is related to stress magnitude, growth status, and the ratio of cytokines in gingival crevicular fluid. Chapter 14 in <i>Biological Mechanisms of Tooth Movement and Craniofacial Adaptation</i>, Davidovitch Z and Mah J (eds), Harvard Society for the Advancement of Orthodontics, Boston, pp. 133-143.</p>
<p>Have the results of this proposal been presented? If so, when and where? If not, are there plans to do so? If not, why not?</p>	<p>Results have been presented:</p> <p>Dec. 11, 2003 “Mechanical and biological factors pertinent to orthodontic tooth movement,” University of California at San Francisco School of Dentistry, San Francisco, California.</p> <p>Sept. 8, 2003 “Biological and mechanical factors pertinent to orthodontic tooth movement,” Pre-congreso Internacional de Ortodoncia, Sociedad Colombiana de Ortodoncia, Bogota, Colombia.</p> <p>Aug. 18, 2003 “Tooth movement in response to known orthodontic stress is related to the ratio of cytokines in gingival crevicular fluid,” 4th International Conference on the Biological Mechanisms of Tooth Movement and Craniofacial Adaptation, New York University, New York, New York.</p> <p>June 2003 "Human tooth movement velocity is related to stress magnitude and GCF cytokines," Annual General Session of the IADR, Gothenburg, Sweden.</p>

	Apr. 21, 2003	“Controlled orthodontic tooth movement and cytokine secretion in gingival crevicular fluid,” Department of Orthodontics, School of Dental Medicine, University at Buffalo, Buffalo, New York.
	Oct. 24, 2002	“Controlled orthodontic tooth movement and cytokine secretion in gingival crevicular fluid,” School of Dentistry, University of Minnesota, Minneapolis, Minnesota.
	Oct. 3, 2002	“Controlled orthodontic tooth movement and cytokine secretion in gingival crevicular fluid,” Department of Dentistry, Faculty of Medicine and Dentistry, University of Alberta, Edmonton, Canada.
	Sep. 11, 2002	“Controlled orthodontic tooth movement and cytokine secretion in gingival crevicular fluid,” Faculty of Dentistry, University of Toronto, Toronto, Canada.
	Apr. 17, 2002	“Controlled orthodontic tooth movement and cytokine secretion in gingival crevicular fluid,” Section de Medecin Dentaire, Division of Physiopathologie Buccale et Parodontie, University of Geneva, Geneva, Switzerland.