

## University of Western Ontario

### AN IN-VITRO STUDY EVALUATING THE FRACTURE RESISTANCE OF COMMONLY USED SELF-DRILLING MINI-IMPLANTS UPON INSERTION INTO SYNTHETIC HIGH DENSITY MANDIBULAR BONE

Angie L. Smith\*<sup>1</sup>, Yara K. Hosein<sup>2</sup>, Ali Tassi<sup>1</sup>, Cynthia E. Dunning<sup>2,3</sup>

<sup>1</sup> Graduate Orthodontics Program, <sup>2</sup> Biomedical Engineering Graduate Program,

<sup>3</sup> Department of Materials & Mechanical Engineering, The University of Western Ontario

**Introduction:** Self-drilling mini-implants are commonly used in orthodontics, but there is little information regarding their fracture resistance in areas of high density bone.

**Purpose:** To determine the peak fracture torques of six commonly used self-drilling mini-implants, and compare with measurements of peak torques obtained from mini-implant insertion into synthetic mandibular bone.

**Materials and Methods:** Fifteen mini-implants from six different manufacturers were drilled into Plexiglas blocks using a custom-made insertion device incorporating a 6-DOF load cell for torque measurements. Peak fracture torques were recorded and compared for each of the six manufacturers. Additionally, ten mini-implants from each manufacturer were inserted into non pre-drilled mandibular bone substitutes (Sawbones®), and measures of peak insertion torque for each manufacturer were compared to their respective fracture torques. Groups that experienced fracture upon insertion into the bone substitutes underwent further testing of insertion torques, specifically following their manufacturer pre-drilling recommendations.

**Results:** Statistical analysis revealed significant differences ( $p < 0.05$ ) in the peak fracture torques among all manufacturer mini-implants, as well as between fracture and insertion torques for Unitek, Vector, Dual Top and OrthoEasy. Tomas and Aarhus experienced fractures during insertion into the non-pre-drilled bone substitutes. When manufacturer's pre-drilling recommendations were followed, Aarhus continued to experience fractures during insertion.

**Conclusions:** Based on the results of this in-vitro study, Unitek, Vector TAS, Dual Top, and Ortho Easy can be safely inserted into areas of thick and dense cortical bone without pre-drilling. Tomas-Pin can be safely inserted provided manufacturer pre-drilling recommendations are adhered to. The manufacturer's recommendations for the use of Aarhus in areas of thick cortical bone may need to be modified.

**Keywords:** Orthodontics, anchorage, mini-implant, miniscrew, TAD, temporary anchorage device, fracture, insertion torque, pre-drilling, pilot-hole, high density bone, cortical bone thickness.