Assessment of Microdamage Caused by Mini-implants in Mandible and Maxilla

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Mini-implants (MIs) have become a popular skeletal anchorage device for a variety of orthodontic indications. However, studies have demonstrated poorer success rates among MIs compared to traditional dental implants. Furthermore, literature indicates that MI failures are higher in the mandible than the maxilla. Our objective is to determine the biological mechanism of MI failure. This study investigated whether microdamage is associated with MI diameter, sites of insertion, or cortical bone thickness. The sample of thirty-six MIs consisted of 1.6 x 6mm (n=16) and 2.0 x 6mm (n=20) Dentos Inc. implants. Groups of four and five MIs were randomly assigned for insertion in the maxillary and mandibular quadrants of two mongrel dogs. MIs and surrounding bone were harvested, stained with basic fuchsin, embedded in methyl methacrylate, sectioned, and ground to 200µm parallel to the MI axis. A Leica epifluorescence microscope and Bioquant software were used to measure cortical bone thickness, crack length, and crack count along the MI. Microdamage burden per surface length was calculated. Mann-Whitney and Kruskal-Wallis analyses were performed. Placement of implants in the mandible resulted in significantly more microdamage (0.980 ± 0.442µm/µm) compared to the maxilla (0.523 ± 0.299µm/µm, $p \leq 0.001$). Implant diameter non-significantly ($p=0.055$) affected microdamage accumulation, with 2.0mm implants having 47.2% more damage compared to 1.6mm implants. There was also a non-significant trend for greater microdamage in the most posterior region of the mandible. It is possible that torsion forces required to place implants in thicker mandibular bone may cause greater microdamage, leading to clinical MI failure.