

Palatal expansion screws: analysis of the force expressed by 8 different configurations

The treatment of young adults and adults with transverse skeletal deficits of the upper jaw, in which skeletal maturation is too advanced to use tooth-borne solutions, is represented by miniscrew assisted rapid palatal expansion (MARPE). However, since this is an innovation of recent development, the scientific evidence to support it is poor and there are many configurations and variables to be taken into account.

The purpose of this study is to analyze some of these variables by measuring the force expressed by eight different configurations of orthodontic expansion screws, produced by Leone®, HDC® and Tiger Dental®, through an in vitro investigation.

The study used an experimental model reproducing the maxillary dental arch with the palate to fit all screws and standardize the position.

All screws tested had 1.5 mm diameter arms laser-welded to the body. To estimate the stiffness of the screws, a Zwick testing machine with a 0.5 kN load cell was used to record the forces generated by the expander. The expander was placed in the Zwick machine by gripping the arms with the upper and lower clamps of the machine, trying to keep the expander as aligned as possible in the vertical plane. The screw was activated a quarter turn (0.2 mm of expansion for the Leone® and HDC® screws) or a sixth turn (0.17 mm of expansion for the Tiger Dental® screw) and the resulting compressive force was recorded. Activations were performed by a stainless steel Leone® wrench of 1.2 mm of diameter. The test was repeated 3 times for each configuration. The results shows maximum developed force values of 184.2 N, obtained by the 11 mm Leone® TAD screw, and minimum force of 91.83 N, developed by the 12 mm Leone® standard screw.

The values obtained are lower than those of the study conducted by Camporesi et al. in 2013, which reached almost 230N with Leone® A2620 screw and just over 200N with Hyrax® screw.

The best-performing devices were found to be those with connection arms that had less distance between parallel arms on the same side and no divergent bends. The best performing device had no bends on the connection arms at the weld on the expansion screw. The new Leone® screws for TAD develop higher forces than conventional expansion screws. The device shows greater effectiveness the stiffer the structure is and consequently sees the bends in the connection arms as its weakest point.