Skeletal anchored palatal expanders: primary stability analysis of three different configurations

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INTRODUCTION

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 not yet sufficient and there are many configurations and variables to be taken into account[1]: type of mini screw (shape and size), choice of insertion site of the mini screws and their inclination[2], number of mini screws (2 or 4), connections to the expansion screw and type of expansion screw used to make the expander.
The purpose of this study is to analyze some of these variables by measuring the primary stability of three different configurations of skeletal anchored expanders, through an ex vivo investigation.

EXPERIMENTAL METHODS

The study focused on the comparison of three configurations: 4 TADs and 1 expansion screw (1), 4 TADs and 2 expansion screws (2), and 2 TADs and 1 expansion screw (3). Configuration number 2, having two expansion screws in an asymmetrical position, was tested on both side A and side B. The devices were tested on pork ribs stored at -19°C and thawed 24 hours prior to testing.
The miniscrews OrthoEasy®Pal (8 x 1.7 mm) were inserted by an experienced operator after which CBCT and scanbody scanning was taken.
The application of the expansion devices was performed by the same operator (2 step protocol).
Through the use of a DMA equipment, the primary stability of the devices were carried out by measuring the force through trasducer and the displacement through a laser vibrometer[3]. The test was performed at a frequency range set from 2 to 100 Hz in 1 Hz steps, while the proportionality constant of the laser was set at 80 micron/V displacement. The length of the connection arms was made with a digital gauge.
Finally, cortical thickness and bone density were measured with Horos Mobile Software®.

RESULTS AND DISCUSSION

The results showed higher stability (lower values) in configuration 1, with a lower average distance between the axis of the TAD and the axis of the expansion screw (5.8 mm). The least stable configuration (0. 85 m/N) was 2B, with an average connection arms lenght of 9.4 mm, despite the bone into which it was inserted presented the greatest cortical thickness and medullary density[3].

	Primary stability (μ/N)	Average connection arms lenght (mm)	Cortical thickness (mm)	Medullary density (HU)
1	0,41	5,75	0,65	217
2	A)0,65 B)0,85	A) 8,10 B) 9,35	1,72	280
3	0,63	7,75	0,5	192

CONCLUSION

It is inferred that the primary stability is inversely proportional to the length of the device connection arms.
This means that not only are the characteristics of the bone and mini screws important, but the connecting elements can also play a primary role in the success of a palatal expansion.

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