SHORT COMMUNICATION

O-24. FIRST STEPS OF EXPERIMENTAL VALIDATION OF A NUMERICAL MODEL ABOUT MECHANICAL BEHAVIOR OF NITI ENDODONTIC INSTRUMENTS

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Key words
NiTi endodontic instruments, finite element analysis, experimental tests, validation of mechanical model

Introduction
Since a few years, numerical modelling and analysis have grown up and constitutes a complementary way to study mechanical behaviour of endodontic files[1]. It can allow evaluating the behaviour of future instruments before prototyping.
However, these numerical data must be compared with experimental tests in order to allow the validation of the models and their use in safe conditions.

Materials and Method
Parts of NiTi wires, manual NiTi finger-spreaders (4%-tapered Revos® finger-spreader) and NiTi instruments (diameter of 0.25 mm and 6%-tapered) have been modelled according to the information provided by the manufacturer Micro-Mega (Besançon, France). They have been numerically created using the Castem® software (Commissariat Energie Atomique, Saclay, France) based on the finite element method. A bending loading path has been numerically applied to the meshing with an ad-hoc model[2] for superelasticity of SMA which has been implemented in Castem®. In the same way, experimental tests with the same limit conditions (fig.1) have been carried on the different structures of growing complexity (wires, spreaders, instruments) by recording the bending effort versus displacement

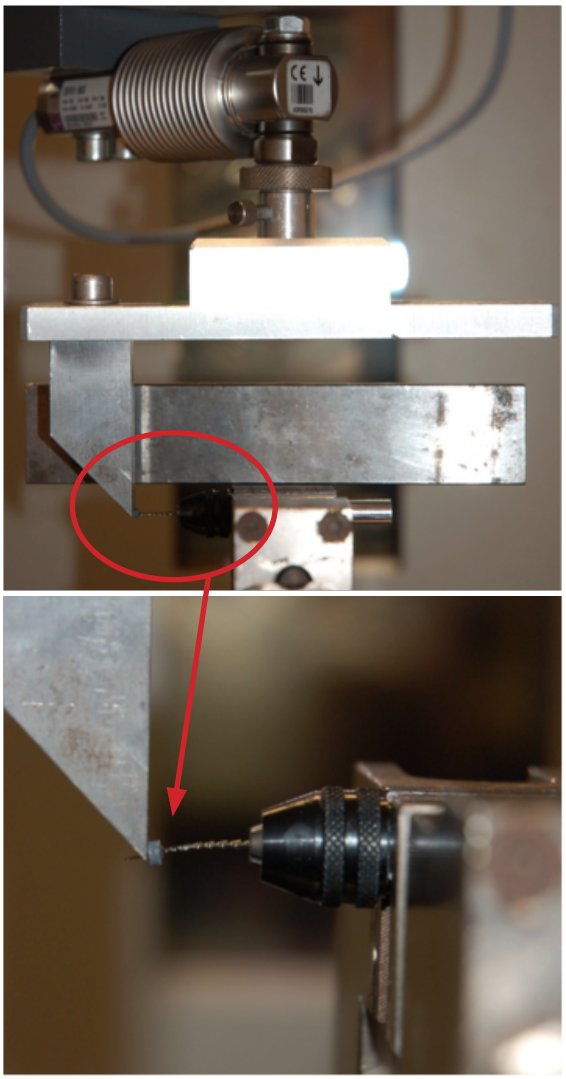

Fig. 1: Set-up of bending tests on instruments

Results

The comparison between simulations and experimental results is hopeful. The orders of magnitude are similar (fig.2) even if a little difference exits concerning some of the instruments.

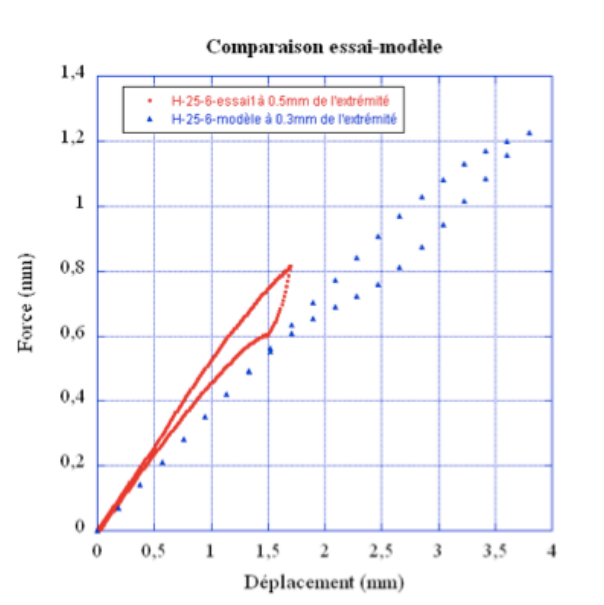

Fig. 2: Tests-model comparison under bending for Hero® instrument (diameter 0.25 mm et 6% tapered)

Discussion

A few points can be improved: the accuracy of numerical meshing and the material parameters of NiTi. After the step of bending validation, torsion tests must be developed to allow the validation under torsion. A torsion set-up is just about to be finalized.

Conclusions

The comparison between simulations and experimental results is promising and must be pursued in order to improve and validate this model.

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References

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