Carpal tunnel expansion by palmarly directed forces to the transverse carpal ligament

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This study investigated the expansion of the carpal tunnel resulting from the application of palmarly directed forces to the transverse carpal ligament (TCL) from inside the carpal tunnel. Ten fresh-frozen cadaveric hands were dissected to evacuate the carpal tunnel, and thus to expose the TCL. A custom lever device was built to apply forces, ranging from 10 N to 200 N, to the TCL. Without force application, the carpal tunnel area was 148.4+/-36.8 mm(2). The force application caused the TCL to form arches with an increase in cross-sectional areas of 33.3+/-5.6 mm(2) at 10 N and 48.7+/-11.4 mm(2) at 200 N, representing respective increases of 22.4% and 32.8% relative to the initial carpal tunnel area. The TCL length remained constant under the applied forces. It was found that the TCL arch formation was due to the narrowing of the arch width, which resulted from the migration of the bony insertion sites of the TCL. A geometrical model of the carpal tunnel was then developed to elucidate the relationships among the arch width, TCL length, arch height, and arch area. The model illustrated the effectiveness of carpal tunnel expansion by TCL elongation or arch width narrowing.

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