Poly-Tape: Strength and stiffness of polyester tapes

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Introduction

Poly-Tapes are sterile non-absorbable implantable tapes made from poly(ethylene terephthalate) fibres (polyester). The standard tapes are flat tapes with an open weave structure to encourage tissue integration. They are available in two lengths (500 mm and 800 mm) and a range of widths from 10-40 mm [data presented in this report are for Poly-Tapes ranging from 10-40 mm].

These tapes may be used for tissue approximation in a wide variety of indications. The selection of tape will depend on the patient's anatomy and the load to which it will be subjected in the body during rehabilitation. The wider the tape, the stronger and stiffer it is.

Objectives

The purpose of this investigation was to determine the mechanical properties (strength and stiffness) of the range of tapes, and to relate this to the width of the tapes.

Methods and Results

A single strand of tape was secured between two rubber-lined clamps with a gauge length of 40 mm. It was tested at a physiologically relevant rate of 20 mm/s (50%/s) to failure using an Instron 8500 materials testing machine. Each test was repeated at least three times.

The ultimate tensile strength (UTS) is the maximum load experienced by the tape. The overall stiffness is the maximum load divided by the extension to reach that load. The linear stiffness is the slope of the initial linear region of the curve of load against extension.

Figure 1
Mean UTS of flat open weave tapes:

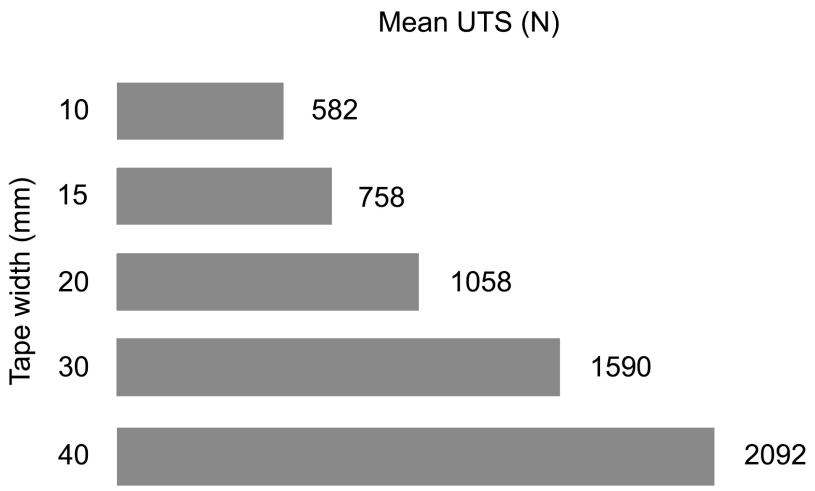

Figure 1 shows the UTS of the flat tapes. The 10 mm tape has a UTS of 582 N and the UTS increases with increasing tape width to 2092 N for 40 mm tape.

The UTS is that of a single strand of the tape. Where tapes are used double, the strength will be higher; however if the tape is fastened by a knot, this will usually be the weakest point.

Figure 2
Stiffness of flat open weave tapes:

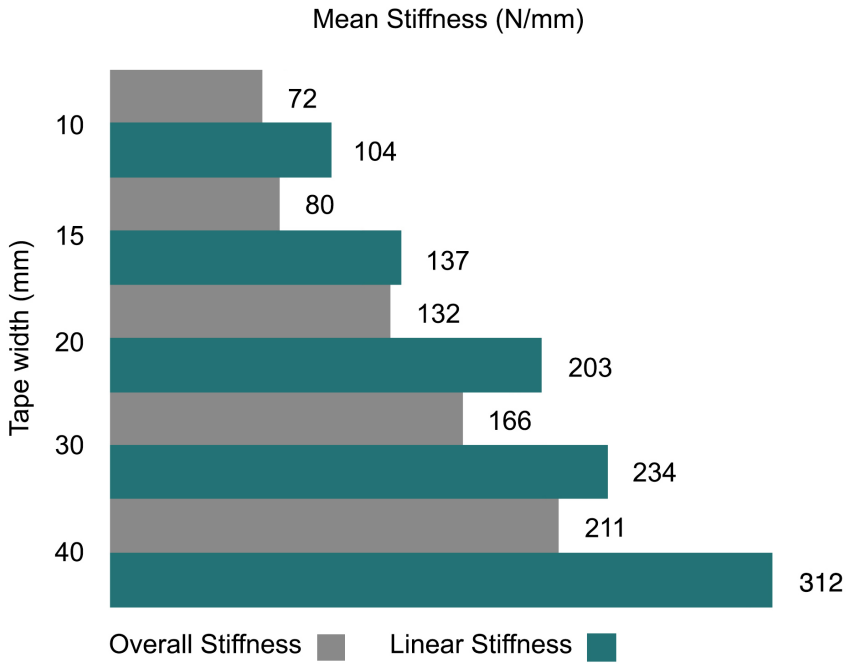

Figure 2 shows the overall stiffness and the linear stiffness of a 40 mm length of the flat tapes. The linear stiffness, which represents the deformation of the tape when a relatively low load is applied, increases from 104 N/mm for 10 mm tape to 312 N/mm for 40 mm tape. The overall stiffness is typically about 35% less than the linear stiffness.

The stiffness of a tape depends on the free length which is loaded. A shorter length will be stiffer, while a longer length is less stiff. If the tape is used double, then the effect will be to increase the stiffness, up to double that of the single strand.

Conclusions
The UTS and stiffness of a flat open weave **Poly-Tape** depends on its width, with the wider tapes being stronger and stiffer.

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