INTERVERTEBRAL DISC PRESSURES DURING TRACTION

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ABSTRACT. **Pressures in the third lumbar discs were measured *in vivo* during active and passive traction. During active traction an increase in pressure was always recorded, with larger increases corresponding to larger traction forces. During passive traction the pressure remained close to the resting pressure; sometimes slight increases were recorded, sometimes slight decreases. It is concluded that when traction is applied so that the back muscles contract, then disc pressures will increase.**

Key words: Low back pain, disc pressures, traction, back muscles, biomechanics.

Traction in various forms is frequently used in the treatment of patients with low back pain and/or sciatica. In spite of an extensive literature on the subject there seems to be no agreement as to what effects traction has, either physically on the spine or clinically on pain.

There are several theories on why traction might be effective. Cyriax (3), for example, states that the vertebrae in the spine are distracted and a negative pressure develops in the disc which sucks back a protrusion. Calliet (2) ascribes the effects of traction to flattening of the lumbar lordosis. Wyke (13) suggests that the stretch imposed by traction influences the mechano-receptors of the disc, ligaments and apophyseal joints. Others believe that traction restores normal movements in the apophyseal joints. Relief of muscle spasm has also been suggested as a clinical rationale.

It is well known that a positive pressure exists at rest within the disc in healthy subjects (9, 10). Whether the pressure is increased, decreased or unchanged in patients with back symptoms is not known. It is also unknown whether traction in any form influences disc pressure.

Radiographic studies during traction have shown that the disc space can increase in height (4, 5), but such changes are difficult to measure clinically (1). Epidurograms have shown that a lumbar disc protrusion can be reduced, at least temporarily, during traction (5, 7, 8). Myelographic evidence of disc herniation has also been found to disappear after traction (6).

The purpose of the present paper was to study in vivo the effects of active (subject induced) and passive body traction on the pressure within a lumbar intervertebral disc. The study was part of a larger study of loads on the spine (12), and therefore was limited to a few observations.

MATERIALS AND METHODS

The pressure within the nucleus of the L3 disc was measured in four volunteers; three women and one man. Their ages ranged from nineteen to twenty-three years (mean 21.8 years). Their heights ranged from 185 to 187 centimeters (mean, 174 centimeters) and

their weights from fifty-six to seventy-six kilograms (mean, 62.8 kilograms). They were all in good health and none had a history of back injury or significant back pain. No abnormalities were found on routine clinical orthopedic examination.

Intradiscal pressure was measured by means of a subminiature pressure transducer built into the tip of a needle (10). The transducer signals were conditioned in a bridge-amplifier and fed to a chart recorder. A guiding cannula for the transducer was inserted from the right posteriorly into the center of the third lumbar disc, the course being followed by fluoroscopy. When the tip of the cannula had penetrated the annulus fibrosus, a mandrel in the cannula was withdrawn and the transducer needle was inserted. Zero balancing of the transducer was performed after a few minutes when temperature equilibrium was reached, and from time to time during the experiments.

Traction was applied in two ways; active and passive. In active traction the subject's pelvis was fitted with a harness attached to a spring force scale, which in turn was attached to a solid metal frame at the foot end of the traction table. The subject applied traction by pulling with the arms on another frame at the head end of the table. This auto-traction table has been previously described by Lind (6). The subjects were lying on their left side to avoid interference with the needle. The subjects were asked to pull with slowly increasing force up to 500 N on the spring force scale, and then to maintain that force for 2 minutes.

Passive traction was applied to the patient lying on the same table by two of the investigators. One pulled on the pelvis, the other under the arms. The traction period was 30 s. All tests were once repeated. Values reported are the means of the two trials.

Disc pressure data were recorded on a chart recorder. Pressure amplitudes were measured directly from the recording. Not all tests could be performed on all subjects, for technical reasons.

RESULTS

During active traction (auto-traction) the disc pressure increased considerably, and in tandem with the traction force (Table I; Fig. 1). These increased pressures sustained over a two minute period. During passive traction, pressures generally remained at the resting levels, but sometimes were increased and other times were reduced slightly from resting pressure (Table I). Negative gauge pressures were not observed under any test conditions.

Table I. Mean disc pressure values recorded during traction.

Task	Pressure (kPa)
Standing	270
Lying	110
Active Traction	540
Passive Traction	280

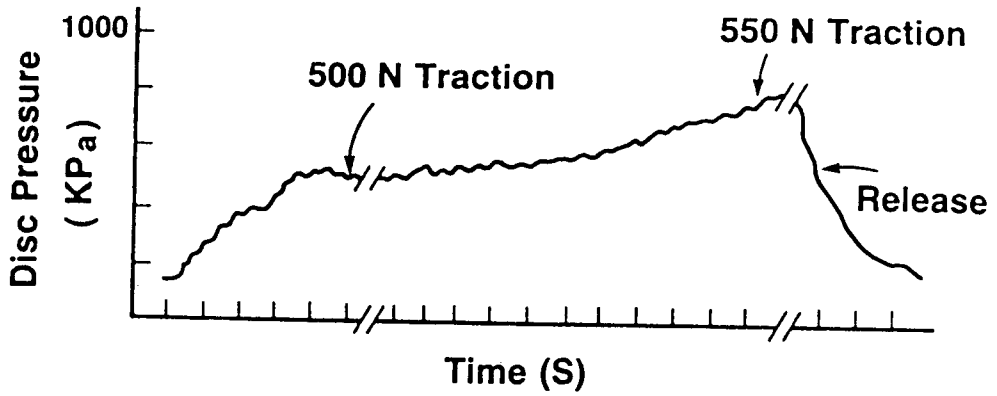

Fig. 1. Disc pressure changes during traction as a function of time and traction force.

DISCUSSION

Over the short periods of our observations, active traction increased disc pressure considerably and passive traction had little effect on disc pressure. Biomechanical studies (12, for example) show that the main factor that raises disc compression force and therefore disc pressure, is contraction of trunk muscles crossing the level of the motion segment. Active traction in this study increased disc pressure, presumably because it was accompanied by strong contractions of the trunk muscles. A study by Neal et al. (11) using electromyography to record muscle activity during traction reports that passive traction initially increased trunk muscle myoelectric activity, but that activity dropped to pre-traction levels after some time. This was the case when either intermittent or continuous traction was applied.

Physically, if the purpose of spine traction is to reduce pressures within the disc, and/or to open up the disc space, then traction has to be administered in a way which allows the trunk muscles to relax. Biofeedback or passive traction over long periods of time perhaps might accomplish that. Active traction, on the other hand, seems less likely to do so. Clinically, it remains to be determined when, in whom and what kinds of traction therapy are beneficial.

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