NASA TECH BRIEF

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Subminiature Transducers for Measuring Forces and Deformations of Heart Muscle

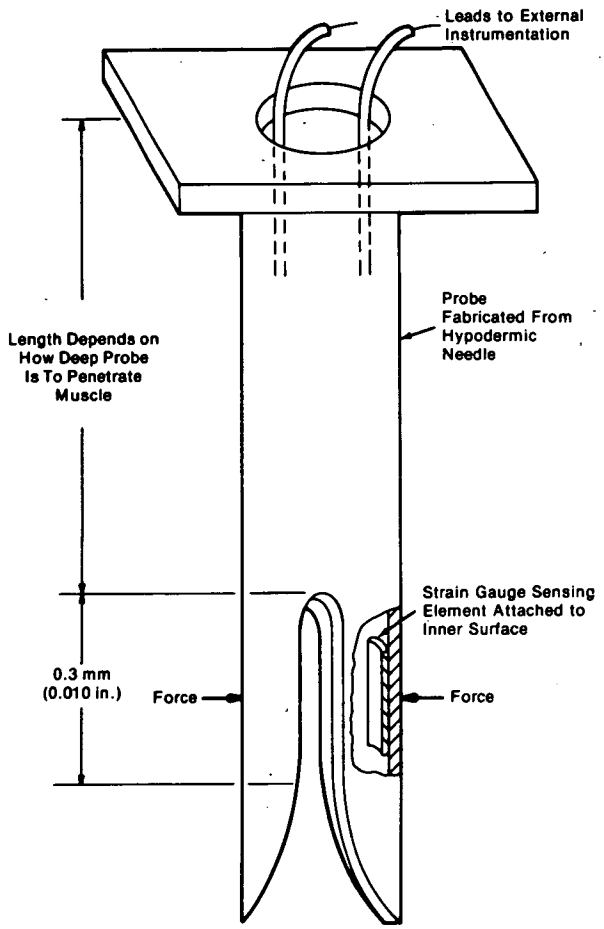

Figure 1. Force Transducer

The problem:

Forces and displacements in the heart muscles provide important data for the study of heart behavior. Typical measurements are made with transducers placed into the heart muscle. The transducers are strain gauges connected to recording equipment. Unfortunately the measurements are not too accurate because the transducers are large and interfere with the natural muscle movement.

The solution:

Two subminiature transducers, one measuring muscle forces and the other measuring muscle displacement, can be inserted into the heart muscle without interfering with it.

How it's done:

The transducer used for measuring muscle force is shown in Figure 1. It includes a probe similar to a hypodermic needle. The probe is approximately 1 mm (0.04 in.) in diameter. Because it is so thin, the probe causes no damage to the heart muscle. The probe tip includes two tines. Inside the tines are strain gauge elements. When the probe is inserted into the heart tissue, contracting muscle movements compress the tines. The resulting forces are sensed by the elements and recorded through electrical leads by external instrumentation.

The transducer is calibrated by placing standard weights on the tines and recording the electrical output. Once inserted, the probe can be rotated to different positions to measure muscle forces from various directions. Different probe lengths can be used to study the muscle at different depths.

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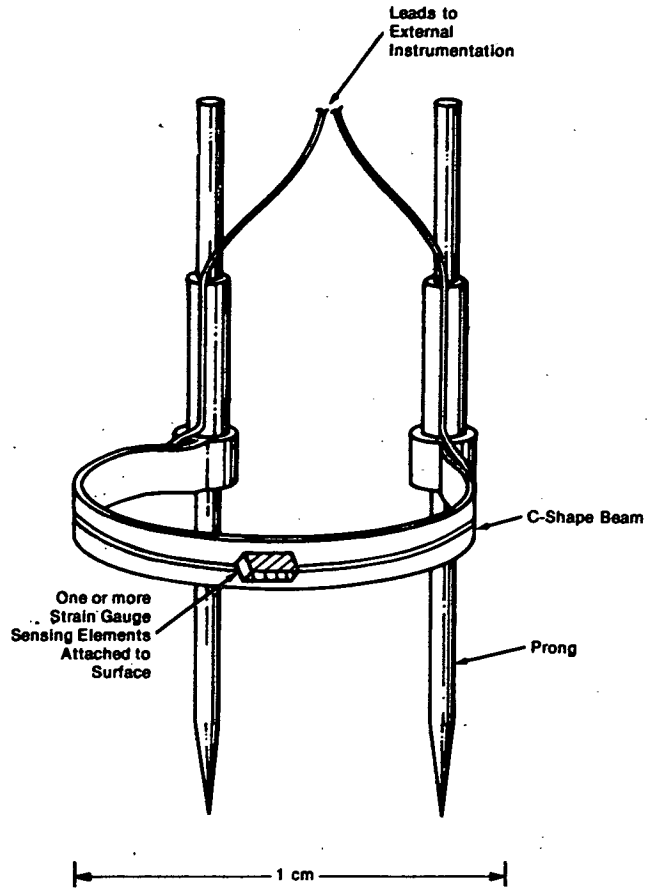

Figure 2. Displacement Transducer

A displacement transducer is shown in Figure 2. It consists of a C-shaped beam that has a strain gauge attached to its outer surface. Two, thin needle prongs are attached to the ends of the beam for insertion into the heart muscle. Displacement of the muscle fibers between the two prongs causes the C-shaped beam to bend. This is sensed by the strain gauge and transmitted by electrical leads to the external recording equipment. Deflections as small as 0.1 mm have been recorded with this transducer.

Note:

Requests for further information may be directed to:

Technology Utilization Officer
NASA Pasadena Office
4800 Oak Grove Drive
Pasadena, California 91103
Reference: TSP75-10051

Patent status:

This invention is owned by NASA, and a patent application has been filed. Inquiries concerning non-exclusive or exclusive license for its commercial development should be addressed to:

Patent Counsel
NASA Pasadena Office
4800 Oak Grove Drive
Pasadena, California 91103

Source: Cyril Feldstein, Jules V. Osher, Gilbert W. Lewis, Robert H. Silver, and Edward N. Duran of Caltech/JPL
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