Ideas and Innovations

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Searching for alternatives to silicone rods in staged tendon reconstruction

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Abstract Silicone rod tendon implants originally introduced by Hunter have been widely used for staged tendon reconstructions since 1971. Unfortunately, these implants are difficult to obtain and too expensive for most patients living in the developing countries. In this paper, we present an experimental study on the rat comparing the silicone rod with three other materials that could be used for the same purpose. The conclusion was that a 100% medical grade silicone urinary catheter could be an alternative to the commercial silicone rod tendon implant.

Key words Silicone · Implants · Alternatives

Introduction

Staged tendon reconstruction is considered to be the best treatment method for cases having extensive second zone tendon injury and a badly damaged pulley system. Conventional tendon grafting often cannot produce successful results in patients who have such injuries.

Silicone rods, initially advocated by Hunter, are clinically proven materials for staged tendon reconstruction; but these rods are not easily available because of the “silicone conflict” especially in USA. When they are available, they are expensive. For these reasons, a study was planned to find out if there were alternative materials to silicone rods that could be used for staged tendon reconstructions.

Materials and methods

An experimental study on Albino Wistar rats was designed to compare the silicone rod tendon implant with three other medical materials frequently used during routine clinical practice: (1) 100% silicone urinary catheter (SUC), (2) rubber urinary catheter (RUC), and (3) angiocatheter. All of the materials were 3 mm thick and were 2 cm long.

30 rats were divided into two groups of 15. In the first group, 4 skin pockets were prepared on the dorsum of each rat; and the 3 different materials and the silicone tendon implant having the same width and length were separately inserted into these distinct pockets. In the second group, four flexor surfaces of each rat (bilateral axillary regions and the groins) were dissected and the same 4 materials of the same size were inserted into these subcutaneous pockets. All material was kept in places for 2 months, at that time the rats were sacrificed. At that time biopsies of the material and the surrounding capsular tissue were obtained for histological examination. The specimens were fixed with tamponed 10% formaldehyde, sections 0.3 mm thick were prepared and examined.

Lymphocyte and polymorphonuclear lymphocyte infiltrations were classified under “10 magnification; from (–) to (++++) according to the “total cell quantity” criteria, as listed in the chart below:

<table>
<thead>
<tr>
<th>Total cell quantity</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>negative</td>
</tr>
<tr>
<td>1–5</td>
<td>(+)</td>
</tr>
<tr>
<td>6–10</td>
<td>(++)</td>
</tr>
<tr>
<td>11–30</td>
<td>(+++)</td>
</tr>
<tr>
<td>31–†</td>
<td>(++++)</td>
</tr>
</tbody>
</table>

Later on, the capsules around the inserted materials were evaluated by measuring the thinnest and the thickest areas using an ocular micrometer.

“Student-t test” was used for the statistical analysis.

Silicone rod and SUC were also tested to compare their physical characteristics since the microscopic findings showed that SUC could be an alternative for the silicon tendon implant. Surface analysis and element counts of these two materials were examined by electron microscopy. Surface microphotographs were taken; (Jeol JSM 840 Scanning Electron Microscope and Tracor Northern TN 5500 Energy Dispersive Spectrometry) and strength tests were carried out.
Microscopic evaluation showed that a pseudosheath formation was present around all of the materials examined. In almost every microscopic specimen, polymorphonuclear and lymphocyte infiltration was observed; there was congestion around all of the capillary vessels. Under ×40 magnification, the microscopic features of the SUC samples were similar to those of the silicone rod samples (Figs. 1, 2). In a sample of each material group, apart from SUC, inflamed granulation tissue was clearly noted. Statistical analysis showed that there was no significant difference between the silicone rods and the silicone urinary catheters, regarding the polymorphonuclear (p: 1), and lymphocyte cell infiltration (p: 0.08); but the rubber