EFFECT OF SURFACE WETTABILITY ON THE KINETIC AND MECHANICAL PROPERTIES OF COLLAGEN LATTICE CONTRACTION BY FIBROBLASTS

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INTRODUCTION
Fibroblasts can condense a hydrated collagen lattice to a tissue-like structure. When the gel is mechanically constrained, the collagen fibrils align in the direction of constraint, and a highly aligned compacted collagenous structure can thus be fabricated. The purpose of this study was to evaluate the effect of cell culture surfaces varying in wettability on fibroblast populated collagen lattice contraction kinetics and mechanical properties. We hypothesized that more hydrophobic culture substrata would increase collagen contraction and strengthen mechanical properties.

METHODS
Clear polystyrene (Bacteriological grade polystyrene: BGPS) and surface modified polystyrene (Tissue culture polystyrene; TCPS) were used as substrates for incubation of fibroblast populated collagen lattices. Wettability of the polystyrene surfaces was measured in 12 dishes of each type by the static sessile contact angle method (Fig.1).

RESULTS
Canine endotenon-derived fibroblasts were cast into collagen lattices in each of 6 dishes of each type to make final concentrations of 1.0 mg/ml collagen and a cell density of 1×10⁶ cells/ml in a total volume of 2 ml. Collagen lattice contraction (Fig. 2) was recorded for 2 weeks. All collagen lattices were mechanically (Fig. 3) tested at 2 weeks with incremental stress-relaxation tests.

DISCUSSION
The more hydrophilic TCPS dishes favored protein adsorption and subsequent cell adhesion. The more hydrophobic BGPS had lower adhesion strength, which favored a more rapid contraction of the collagen lattice and stronger mechanical properties. We conclude that it is possible to affect the material properties of a tissue engineered matrix by controlling the wettability of the surface on which the matrix is cultured.

REFERENCES

**Orthopedic Department, Taichung Hospital, China Medial University, Taiwan

Table 1: Contact angle

<table>
<thead>
<tr>
<th>Materials</th>
<th>Contact Angle (degrees)</th>
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<tr>
<td></td>
<td>Water</td>
</tr>
<tr>
<td>BGPS</td>
<td>84.92±1.52</td>
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<tr>
<td>TCPS</td>
<td>53.44±3.93</td>
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</tbody>
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Fig. 1 Contact angle
Fig. 2 Serial photographs of lattice ring contraction on BGPS and TCPS plates
Fig. 3 Microtester
Fig. 4 Contraction of collagen lattice for culture plates with different wettability
Fig. 5 Ultimate stress of collagen lattices
Fig. 6 Instantaneous and equilibrium modulus of collagen lattice, incubated in BGPS and TCPS plates

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