INTRODUCTION:

The mechanical properties of bone cement are critical in determining its effectiveness in orthopedic procedures. The introduction of chemotherapeutic agents into bone cement can alter its mechanical properties, which may affect patient outcomes. The current study aimed to evaluate the effects of Taxol, a chemotherapeutic drug, on the biomechanical properties of bone cement, specifically focusing on yield stress and stiffness changes over time.

METHODS:

Ten groups (n=6) of cubical specimens (1 cm³) were prepared, with each group receiving different admixtures. The specimens were allowed to cure in molds for 72 hours before being placed in a vacuum to remove air. The specimens were then immersed in phosphate buffered saline (PBS) at 37°C for 2 weeks, with elution fluids changed weekly. The yield stress and compressive stiffness of the specimens were measured at 0, 1, and 2 weeks post-curing.

RESULTS:

The yield stress and compressive stiffness of the Taxol-added specimens were compared to control specimens. The results showed a significant increase in yield stress and stiffness over time for both groups (one-way ANOVA, t0 versus t1, p<0.05). The standard deviations of data were very small (overall average of 3.3%) indicating successful standardization of specimen preparation and testing.

DISCUSSION:

Chemotherapeutic drug admixtures in polymethylmethacrylate (PMMA) can alter the mechanical properties of bone cement, affecting its integrity and performance. The current study found a significant increase in yield stress and stiffness over time for Taxol-added specimens, with no statistical difference in yield stress between Taxol-added and control specimens at each time period. Similar results were found using antibiotic powders like vancomycin, which indicates that antibiotic powders may not significantly alter the mechanical properties of bone cement.

Table 1. Yield stress (MPa, mean±SD)

<table>
<thead>
<tr>
<th>Time (weeks)</th>
<th>Taxol</th>
<th>Blank</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>54.2±1.2</td>
<td>53.4±1.5</td>
</tr>
<tr>
<td>1</td>
<td>66.7±1.7</td>
<td>65.9±1.2</td>
</tr>
<tr>
<td>2</td>
<td>66.7±2.5</td>
<td>65.9±1.2</td>
</tr>
</tbody>
</table>

The 0-week value significantly lower than the 1- and 2-week values.

Table 2. Young's modulus (GPa, mean±SD)

<table>
<thead>
<tr>
<th>Time (weeks)</th>
<th>Taxol</th>
<th>Blank</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1.456±0.047</td>
<td>1.43±0.104</td>
</tr>
<tr>
<td>1</td>
<td>1.58±0.034</td>
<td>1.59±0.029</td>
</tr>
<tr>
<td>2</td>
<td>1.62±0.085</td>
<td>1.58±0.067</td>
</tr>
</tbody>
</table>

The 0-week value significantly lower than the 1- and 2-week values.

REFERENCES:


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ADDITIONAL AFFILIATIONS:

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