Application Research of Mixed Reality Technique Assisted Operational Navigation in Hip Arthroscopy

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We have no financial conflicts to disclose.
Background

• Hip anatomical features: deep location, stenotic joint space, tensional joint capsule, etc.

• Hip arthroscopy is more difficult than other arthroscopic procedures and requires X-ray fluoroscopy to determine the extent of the surgical approach and lesion resection.

• The Mixed Reality technology can generate virtual objects that do not exist in the real environment through computer graphics technology and visualization technology, and superimpose the virtual objects into the real environment through sensing technology, and display them in the same picture or space in real time, thereby assisting the surgical navigation.
Purpose

• To apply the Mixed Reality technology to the navigation of hip arthroscopy, and to explore the feasibility and effectiveness of the technique in assisting intraoperative positioning comparing with traditional hip arthroscopy.
Method

• 10 patients underwent hip arthroscopy in our hospital were included and randomly divided into 2 groups.

• Experimental group (n=5): The positioning markers were fixed at anterior superior iliac spine and greater trochanter of the femur before surgery, perform three-dimensional CT scan of the hip joint and reconstruct the three-dimensional(3D) model of the bone. To scan the markers on patient through the Hololens MR wearing device during surgery, match the the human tissue with the 3D model, thereby assisting in establishing a surgical approach and achieving precise navigation of surgical area.

• Control group (n=5): Only conventional C-arm X-ray machine was used for navigation during surgery. Compare the number of times and time required for establishing the surgical approach, the total operation time between the two groups, and the ease of operation and accuracy of the two navigation methods.
Microsoft HoloLens
Result

• In the experimental group, the human tissue was successfully matched with the three-dimensional model during the operation, and the subsequent operations were performed under the guidance of the virtual model. The number of fluoroscopies required for establishing the surgical approach, time, and total operation time are as follows. The number and time of fluoroscopy in the MR group were significantly less than those in the control group.
## Result

<table>
<thead>
<tr>
<th></th>
<th>Control group</th>
<th>MR group</th>
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<tbody>
<tr>
<td>The number of fluoroscopies required for establishing surgical approach / time</td>
<td>3.5±1.5</td>
<td>1.5±0.5</td>
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<tr>
<td>The time required for establishing surgical approach / min</td>
<td>8.5±3.5</td>
<td>4.3±1.7</td>
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<tr>
<td>Total operation time / min</td>
<td>62±12</td>
<td>50±17</td>
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Conclusion

• Compared with traditional hip arthroscopy, arthroscopic surgery assisted with MR technology can reduce the number of intraoperative fluoroscopies, shorten the operation time, and make it easy to operate. The surgeon can observe the lesion area more clearly and get an accurate range of resection.

• However, there has slight difference in synchronous position change between the positioning markers and the bone, and the accuracy of the navigation technology needs to be improved.
Reference


