

Computerized three-dimensional templating for shoulder joint arthroplasty

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Introduction: Replicating normal anatomy of the shoulder is an important principle in the arthroplasty of the shoulder joint. It is thought that a more anatomic reconstruction will better achieve optimal function after total shoulder arthroplasty. Knowing the normal anatomy and its pathologic change is the first step to build the strategy to replicate the normal geometry for the shoulder arthroplasty. Accurate measurement of sizes of the prostheses to be inserted is the basic for this step. It is not easy, however, to measure or determine the exact size of the prosthetic stem and head which is fit to its normal anatomy by using the conventional 2-Dimensional (2-D) templating on plain X-rays before surgery. The computerized 3-D templating was used on preoperative planning and evaluated for its efficacy.

Methods: Ten patients undergone total shoulder arthroplasty using 3-D templating preoperatively were enrolled in this study. A specialized computer program was applied to reconstruct the 3-dimensional images of the shoulder from the CT-images. The 3-Dimensional (3-D) images of various sizes of the prostheses are used as the template in the surgical planning of the shoulder arthroplasty. The size of the glenoid, humeral head and stem measured on 3-D templating were compared with those used on actual operation. Anatomical parameters, such as humeral head size, glenoid component size, radius of curvature and greater tuberosity to humeral head distance of the replaced shoulder were measured and compared with those of the contralateral normal shoulder.

Results: There were 100%, 70%, 70% and 80% match between the glenoid size, head size, head thickness and stem size determined preoperatively by 3-D templating and those used on operation. The difference in millimeters between replaced and contralateral shoulder of humeral head size, radius of curvature and greater tuberosity to humeral head distance were 1.31, 0.87 and 1.17, respectively. Anatomical reconstruction of the shoulder was possible with this computer program.

Discussion: Total shoulder arthroplasty using 3-D templating seems to enable accurate measurement of sizes of the prostheses to be inserted and replicate the normal anatomy. In addition, this study provides possible solutions to avoid errors in reconstructing the normal anatomy of the shoulder during the prosthetic joint replacement by using 3-dimensional surgical templating and simulation program.

References

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