

Patient specific cutting guides for distal femoral osteotomies: a low cost method of producing accurate results

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Introduction: Distal femoral osteotomy is a procedure, which requires considerable surgical skill and 3-dimensional awareness. When the same knee also requires an arthroplasty, this is a particularly challenging undertaking to be done at the same time.

Robot assisted surgery can help, but requires equipment which is not available in every hospital. The health and cost implications of performing the surgery sub-optimally are considerable. One must consider all technical options available which may reduce the risk of requiring revision surgery. We describe a new application of technology in a patient with pre- and post-operative functional and radiographic results.

Methods: We describe a technique of 3- dimensional planning, producing and using patient specific cutting guides to successfully perform a femoral osteotomy and guide the extent of distraction required. We also demonstrate how successful implantation of a unicompartamental knee arthroplasty can be safely undertaken at the same sitting.

We first obtained a 3D reconstruction from a CT scan of our patient's knee. The hip and ankle also scanned to help guide orientation. CT scans were then segmented and reconstructed to form 3-dimensional models. We then used design software to create a virtual osteotomy at the desired location. We were able to adjust the pivot point of the osteotomy and the amount of distraction required to reconstruct a more normal knee joint below.

We then designed a patient specific guide, which would only fit to the patient's distal femur in one specific place. This guide was designed to orientate the surgeons exact entry point and angle at which to perform the osteotomy. The guide also showed the amount of distraction required to reproduce the preoperative plans. This guide was rapid prototyped and sterilized to be used intra-operatively. Once performed the osteotomy was fixed in situ with an "off the shelf" distal femoral plate. Image intensifiers were used to confirm the surgery had followed the preoperative plans. A unicompartamental knee arthroplasty was then performed in the usual manner. This technique of performing a medial opening femoral with unicompartamental joint replacement has never been described previously.

Results: We present the pre- and post-operative functional results obtained from a gait analysis laboratory and encouraging early radiographic follow up of a patient having undergone such a procedure.

Prior to surgery the patient was mobilizing independently but with an obvious limp. His walking distance was quite restricted as was his top walking speed. We show how this procedure and application of technology has significantly improved his gait, as measured by his top walking speed on an instrumented treadmill.

We also present his post-operative radiographs and demonstrate how well they correspond with our pre-operative plans. These radiographs also demonstrate that the osteotomy has maintained in the early post-operative period.

Conclusion: We present a relatively low cost, patient specific technique to potentially improving the accuracy of this technically demanding procedure. This technique and application of technology has never been described previously in such a patient requiring osteotomy and unicompartamental joint replacement. Whilst the results presented are only early they are encouraging. This study will need to

be strengthened with further case results and retrospective analysis to ensure results are maintained in the longer term.