The use of CAOS in complex cases of hip and knee arthroplasty: experience from a developing country

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The technology of computer assisted orthopaedic surgery (CAOS) has been used in many developed countries for the last 2 decades. Initially, it was thought that CAOS will be the standard in surgical practice but so far its clinical application has been limited due to the involved cost and complexity. The cost effectiveness of CAOS techniques has also been questioned. Therefore, it is expected that the application of CAOS in developing countries would be more limited due to the same reasons of cost and complexity. The author presents the surgical experience of using different CAOS techniques in Egypt.

Computer assisted templating software was used in complex and neglected cases of hip arthritis and in cases of leg length discrepancy. Navigation techniques were employed in knee arthroplasty in patients with extraarticular deformities. Computer assisted patient specific instruments were used for bilateral simultaneous knee arthroplasty in medically unfit patients and in patients with severe articular deformities. Contrary to what is expected, this experience proved that CAOS is more useful and possibly cost effective when used in hip and knee arthroplasty for complex and neglected cases in developing countries. Digital templating for the adjustment of leg length discrepancy in THA

In this study, digital templating software system (Merge Ortho, Cedara, Netherland) was preoperatively applied to complex cases of THA and to patients who have leg length discrepancy. In this study, a 6-step technique11 for digital templating was used. This technique includes; radiographic assessment, correction of magnification, measuring leg length discrepancy, templating acetabular component, templating femoral component, correction of leg length discrepancy and measuring length of neck resection. Intraoperatively, the femoral neck osteotomy was done at the level determined by preoperative templating.

Postoperatively, the leg length was measured and compared to the preoperative leg length. Preoperatively, the leg length discrepancy ranged from 5 to 30 mm. In all cases, the leg was short on the side of THA (ipsilateral). Leg length discrepancy was adjusted in all THA cases. Postoperatively, the accuracy of the correction was found to be within 5 millimeters i.e. less than 5mm of shortening or lengthening). Intraoperatively, the level of femoral neck cut ranged from 1 to 44 mm. Digital templating for the Figure 1 is showing a radiograph of a 57 year old male patient who initially had a fracture left neck of femur that was treated by hemiarthroplasty (Austen Moore). This has failed in 2 years time. He presented with pain, limping, stiffness and shortening. The preoperative planning measured a shortening of the left side of 3.57 mm. This was corrected during THA and a postoperative radiograph is displayed.

Digital templating for complex cases of THA: Figure 2 is a radiograph of 23 year old female who had bilateral developmental dysplasia of the hips (DDH) and had unsuccessful surgery on both sides during childhood at age four. She lived with fused hips during the childhood and adolescence. She was not able to sit down either in bed, chair, toilet or on the floor due to the inability to bend the trunk over the lower limbs. She was not able to left her legs and to move them forward during walking, alternatively, she was able to slide the body as one mass and move side to side very slowly, in addition to a leg length discrepancy with a short left leg. The patient had bilateral patella-femoral abnormality with recurrent dislocation of the patellae. Also, she had equines deformity in her right ankle. The preoperative radiograph showed fused hips with disorganized anatomy absence of important landmarks and extensive osteophytosis. She recovered from these major operations and she was able to sit down, walk with a better gait, and move her legs in any direction she wants. She found herself taller with equal leg length. She had altered sensation over the leg and foot and weakness of big toe

extension i.e. along the course of the right sciatic nerve. The postoperative nerve conduction study and electromyography was not conclusive. The patient recovered from these symptoms after one year.

Navigation for TKA in patients with extraarticular deformities: The navigation technique was used in selected cases of knee arthritis that were associated with extraarticular deformities. Deformities were corrected at the level of the knee joint during TKA without prior osteotomies. Using navigation, it was possible to indirectly correct shaft deformities by adjusting the inclination of bone cuts at the level of the knee joint. The amount of bone cutting at distal femur and proximal tibia were variable depending on the location and direction of the deformity. There was no compromise of collateral ligaments or patellar tendons. Postoperative long leg radiographs were used to assess coronal alignment. Navigational techniques eliminated the use of both intramedullary and extramedullary guides. The improved accuracy with navigational techniques led to better alignment that can improve functional and survival outcome of similar cases of TKA.

Figure 3 shows a bilateral deformity of femurs in the form of excessive bowing in a 60 year old female with knee OA. Technically, it was expected that conventional instrumentation would be difficult to use and the risk of errors in alignment and implant positioning would be higher, particularly, femoral intramedullary guides. Navigation system (CI, BrainLab, Heimstetten, Germany) with passive optical tracking system was used. The surgery went well with no complication and the postoperative alignment was satisfactory with less than 3˚of errors in alignment which is clinically accepted.