Appendix 1: Sirius arthroplasty surgery

The joint is approached by a caudolateral curvilinear skin incision. The anconeus muscle is incised and a lateral epicondylar osteotomy is performed to allow luxation of the elbow joint. The humeral medullary canal is opened by drilling a 5.5mm hole in a retrograde fashion along the axis of the humerus, starting at the proximal olecranon fossa and then reamed to the appropriate size. The humeral cutting block is attached to the reamer. Once aligned, the cutting block bears a guide tube through which a 2.5mm hole was drilled into the centre of rotation of the humeral condyle, which then allows insertion of a humeral spigot pin. The humeral cutting block is then removed, the elbow reduced, and the radio-ulnar cut is performed by placement of a curvilinear reciprocating saw that rotates around the spigot pin, centred in the humeral condyle. After completion of the radio-ulnar cut the humeral cutting block is refitted in the original position, using the spigot pin and reamer as relocation guides. A total of seven humeral cuts are performed through the slots in the cutting block using an oscillating saw blade. In addition, two rows of 2.5mm holes are drilled in a semi-circular chain-drilling fashion through corresponding guide holes in the cutting block corresponding to the shape of ‘shoulders’ of the humeral component. Subsequently the humeral component, of which its bone-contacting surfaces are grit-blasted except for the polished articular surface, is implanted by press-fit on the humeral condyle and cement for the humeral stem within the canal. The stem length varies depended on size of the implant between 45mm (small), 50mm (medium) and 55 mm (large). The humeral stem is straight and tapering over its length and has a square cross-sectional shape with radiused corners, resulting in an almost circular sectional shape near its tip.

The bone-contacting surfaces of the radio-ulnar tray are coated with porous titanium and hydroxyapatite to encourage bone in-growth for long-term fixation. The radio-ulnar component is fixed by inserting four screws, of which two are seated in the ulna and two into the radius. The osteomized epicondyle is replaced by insertion of a 3.5mm cortical lag screw. The ancillary procedures to achieve long term stability by promoting synostosis between the radius and ulnar, including a proximal radio-ulnar screw, distal ulna osteotomy (5-8 mm) at the level of the distal third with screw or butterfly plate application and bone grafting the interosseous space between radius and ulna, are then performed. The soft tissues are apposed in a routine three-layer closure. Following arthroplasty, orthogonal radiographic views are obtained to ascertain correct implant positioning.