Advances in shoulder replacement surgery

DR MARCUS **CHIA** *MBBS (HONS) BAPPSC (PHYSIO) FRACS (ORTH) FAORTHA*

Dr Marcus Chia is an Orthopaedic Surgeon specialising in shoulder and elbow surgery. Utilising his surgical expertise coupled with his prior Physiotherapy training, his practice specialises in restoring function via surgical and non-surgical management of patients.

P: 02 8014 4252 W: www.drmarcuschia.com

Shoulder replacement surgery, otherwise known as shoulder arthroplasty, is a successful procedure for treating arthritis of the shoulder. More recently, shoulder arthroplasty has become an option for irreparable rotator cuff tears and proximal humerus fractures.

HISTORY OF SHOULDER ARTHROPLASTY

Themistocles Gluck likely designed the first shoulder arthroplasty in the late 1800s but never published his results[1]. The first reported shoulder arthroplasty was performed by French surgeon Jules Emile Péan in 1893 after debriding tuberculous arthritis of the shoulder in a 37-year-old baker[2]. Modern shoulder arthroplasty was pioneered by Charles Neer who published on proximal humerus arthroplasty for fracture in 1955 and subsequently for the treatment of osteoarthritis in 1974[3,4].

Total shoulder arthroplasty designs in the 1970s reversed the normal anatomy by placing the 'socket' in the humerus and the 'ball' on the glenoid. These designs aimed to improve motion and strength without the increased risk of dislocation and loosening. The design created by Paul Grammont in 1985 forms the basis for many of the current reverse shoulder arthroplasty systems[5] which have only become widely available in the early 2000s.

INDICATIONS FOR SHOULDER ARTHROPLASTY

There is limited role for the use of arthroscopy in the treatment of arthritis. Arthroscopic debridement, with or without capsular release, may provide short-term relief of pain but deterioration over time can be expected for most patients.

Non-operative management of shoulder arthritis

- Rest
- Activity modification
- Anti-inflammatory medications (oral and injected)
- Physiotherapy
  - Increase joint range of motion
  - Strengthen shoulder girdle musculature

Table 1. Non-operative management of shoulder

The most common indication for shoulder arthroplasty is arthritis that cannot be controlled with non-operative management (Table 1). Reverse shoulder arthroplasty is primarily indicated for rotator cuff arthropathy and irreparable rotator cuff tears, but may also be used for proximal humerus fractures, revision of failed shoulder arthroplasty and glenoid bone deficiency.

REVERSE TOTAL SHOULDER ARTHROPLASTY

Conventional total shoulder arthroplasty aims to restore the normal anatomy of the glenohumeral joint and relies on a well functioning rotator cuff to restore shoulder function. With large rotator cuff tears unopposed deltoid contraction superiorly displaces the humeral head towards the acromion causing acromial erosion and glenohumeral joint arthritis, so called cuff tear arthropathy (Figure 1).

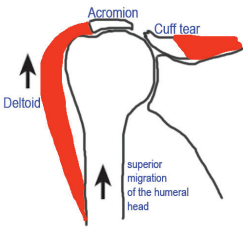

Figure 1. Cuff tear arthropathy

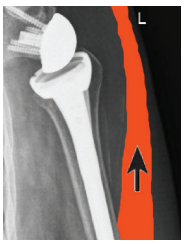

Figure 2. Deltoid action with reverse shoulder arthroplasty

The advantage of the reverse shoulder arthroplasty is that the centre of rotation of the joint is moved inferiorly and medially allowing the deltoid muscle an improved mechanical advantage to substitute for the deficient rotator cuff muscles and provide shoulder elevation (Figure 2).

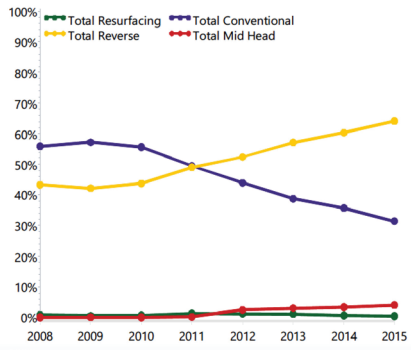

Figure 3. Proportion of primary total shoulder replacement by class

The reverse shoulder arthroplasty represents one of the most significant advances in shoulder surgery in recent years and has increased from 43.3% of all total shoulder replacements in 2008 to 64.1% in 2015 (Figure 3)[6].

PATIENT SPECIFIC INSTRUMENTATION

Shoulder arthroplasty has evolved over the last decade with improvements in implant design and surgical instrumentation but despite these advances positioning of the glenoid implant continues to be a difficult problem. Recent advances in 3-D imaging techniques and computer planning software has allowed for patient specific instrumentation (Figure 4) that may allow improved accuracy of glenoid component positioning compared to using standard instrumentation.

COMPUTER-ASSISTED NAVIGATION

Computer assisted navigation is the latest technology available in an attempt to improve accuracy in glenoid component positioning. An advantage of computer navigation is a reduced turn-around time from 3-D imaging to surgery as patient specific instrumentation typically takes around a month to be manufactured. This is particularly beneficial in the treatment of proximal humerus fractures. Furthermore, computer navigation can help in maximising the purchase of the fixation screws that dictate the initial stability of the glenoid component.

Figure 4. Patient specific instrumentation

FUTURE DIRECTIONS

Recent studies report improved anatomic placement of glenoid components using computer planning, patient specific instrumentation and computer-assisted navigation. Robotic shoulder replacement surgery is not yet available but is on the horizon. Clinical data supporting improved outcomes and implant longevity are lacking but whilst the lack of data is expected for new technology, further study is needed in this area.

Future treatment modalities involving biologics and tissue engineering hold further promise that may delay or negate the need for shoulder arthroplasty.

References available on request.