NATIONAL INSTITUTE FOR HEALTH AND CLINICAL EXCELLENCE

INTERVENTIONAL PROCEDURES PROGRAMME

Interventional procedure overview of shoulder resurfacing arthroplasty

Degenerative disease (such as osteoarthritis and rheumatoid arthritis) can cause pain in the shoulder, particularly when the arm is moved.

Shoulder resurfacing involves joint replacement surgery (arthroplasty). Using open surgery, the end of the upper arm bone is reshaped, a small anchoring hole is drilled into the bone and an artificial shoulder joint is placed onto it.

Introduction

The National Institute for Health and Clinical Excellence (NICE) has prepared this overview to help members of the Interventional Procedures Advisory Committee (IPAC) make recommendations about the safety and efficacy of an interventional procedure. It is based on a rapid review of the medical literature and specialist opinion. It should not be regarded as a definitive assessment of the procedure.

Date prepared

This overview was prepared in December 2009.

Procedure name

- Shoulder resurfacing arthroplasty

Specialty societies

- British Elbow and Shoulder Society (subgroup of the British Orthopaedic Association)

Description

Indications and current treatment

The humeral head may degenerate as a result of a range of conditions, most commonly osteoarthritis, rheumatoid arthritis, or avascular necrosis. The

whole or only part of the articular surface of the humeral head may be affected.

Depending on the underlying condition, conservative treatment may include physical therapy, pharmacological treatments (including pain relief and topical or oral non-steroidal anti-inflammatory drugs), or corticosteroid injections. Patients refractory to these treatments may need surgery: either complete shoulder arthroplasty using a stemmed humeral head prosthesis, or fusion of the joint.

What the procedure involves

The procedure is performed with the patient under general anaesthesia and in a semi-upright position.

An incision is made for either a deltopectoral or anterosuperior approach and the deltoid muscle is split to expose the surface of the humeral head. The centre is located and the humeral head is reamed to restore shape before drilling a hole for the central peg of an artificial resurfacing prosthesis.

The artificial prosthesis, which covers the whole or part of the humeral head is inserted into the drilled hole with morcellised bone or cement beneath to aid fixing. A glenoid prosthesis is inserted in a standard fashion where necessary. Tendons are sutured to the edge of the prosthesis and the shoulder reduced, and closed. A number of different devices are available for this procedure.

The potential advantages of shoulder resurfacing arthroplasty are replacement of only the damaged joint-bearing surfaces and restoration of normal anatomy with minimal bone resection. Subsequent revision with a stemmed prosthesis is more easily achieved than after primary total joint replacement and complications associated with a long humeral stem are avoided.

Literature review

Rapid review of literature

The medical literature was searched to identify studies and reviews relevant to shoulder resurfacing arthroplasty. Searches were conducted of the following databases, covering the period from their commencement to 23 October 2009: MEDLINE, PREMEDLINE, EMBASE, Cochrane Library and other databases. Trial registries and the Internet were also searched. No language restriction was applied to the searches (see appendix C for details of search strategy). Relevant published studies identified during consultation or resolution that are published after this date may also be considered for inclusion.

The following selection criteria (table 1) were applied to the abstracts identified by the literature search. Where selection criteria could not be determined from the abstracts the full paper was retrieved.

Table 1 Inclusion criteria for identification of relevant studies

Characteristic	Criteria
Publication type	Clinical studies were included. Emphasis was placed on identifying good quality studies. Abstracts were excluded where no clinical outcomes were reported, or where the paper was a review, editorial, or a laboratory or animal study. Conference abstracts were also excluded because of the difficulty of appraising study methodology, unless they reported specific adverse events that were not available in the published literature.
Patient	Patients requiring shoulder arthroplasty
Intervention/test	shoulder resurfacing arthroplasty
Outcome	Articles were retrieved if the abstract contained information relevant to the safety and/or efficacy.
Language	Non-English-language articles were excluded unless they were thought to add substantively to the English-language evidence base.

List of studies included in the overview

This overview is based on approximately 400 patients from 3 non-randomised controlled studies[1,2,3], and 4 case series[4,5,6,7].

Other studies that were considered to be relevant to the procedure but were not included in the main extraction table (table 2) have been listed in appendix A.

Table 2 Summary of key efficacy and safety findings on shoulder resurfacing arthroplasty

Abbreviations used: UCLA, the University of California, Los Angeles

Study details	Key efficacy findings	Key safety findings	Comments
Levy O (2004)[1] **Case series** UK Recruitment period: 1986 to 1997 Study population: patients with primary osteoarthritis of the shoulder. n = **69 (79 shoulders: 37 resurfacing, 42 resurfacing plus glenoid component)** Age: 72 years (mean) Sex: 84% female Patient selection criteria: > 40% of humeral head bone intact, no acute fractures, or fracture non-union. Technique: anterior deltopectoral or anterosuperior approach. Resurfacing arthroplasty: large osteophytes removed and subacromial space decompressed; Copeland cementless humeral resurfacing prosthesis inserted Vs humeral resurfacing prosthesis and glenoid component. Follow-up: **4.4 years (mean) resurfacing arthroplasty, 7.6 years (mean) resurfacing plus glenoid component.** Conflict of interest/source of funding: not reported	**Number of patients analysed: 30 resurfacing, 39 resurfacing plus glenoid component** **Shoulder function** Clinical and functional outcome measured by the Constant Shoulder Score: a 100-point scale (higher score better) corrected for expected score for age and gender (100% predicted). Constant Shoulder Score (%) Resurfacing / Resurfacing plus glenoid component Baseline: 40.0 / 33.8 Postoperative: 91.0 / 94.0 The angle of arm forward flexion achieved increased by 52° in the resurfacing group and 66° in the total arthroplasty group. Group mean pain score (0 to 15 points: higher scores better; not otherwise described) Resurfacing / Resurfacing plus glenoid component Baseline: 3.9 / 2.1 Follow-up: 12 / 14 **Radiographic assessment** No lucent lines (suggestive of misaligned or loose prosthesis) were visible in 93.9% (31/33) of humeruses in the resurfacing group, in 70.6% (24/34) of the total arthroplasty group, or in 47.1% (16/34) of glenoids in the total arthroplasty group.	**Complications:** No patient who underwent shoulder resurfacing arthroplasty needed revision surgery. Across both groups of patients 5.8% (4/69) of patients needed revision surgery, all for treatment of the glenoid component: 1 patient for failure of the prosthesis, 1 for continuing pain, 1 after loosening following a fall, and 1 for primary loosening.	**Follow-up issues:** Prospective follow-up. 4 patients died and 1 lost to follow-up. **Study design issues**: Surgical approach changed during the course of the study. Safety outcomes are not reported separately for shoulder resurfacing group and resurfacing plus glenoid comonent group. **Study population issues**: Comparison of clinical and demographic characteristics between groups not reported. **Other issues**: Method of case selection for resurfacing or total arthroscopy not reported. Possibly some of the same patients as reported in Levy (2001).

Abbreviations used: UCLA, the University of California, Los Angeles

Study details	Key efficacy findings	Key safety findings	Comments
Buchner M (2008)[2] **Non-randomised controlled trial** Germany Recruitment period: 2004 Study population: patients with primary osteoarthritis of the shoulder. n = **44 (22 resurfacing, 22 total arthroplasty)** Age: 61 years (mean) Sex: 50% female Patient selection criteria: no secondary arthrosis. No glenoids with eccentric position of the humeral head, glenoidal biconcavity, or severe destruction. No dysplastic retroversion of the glenoid > 25%. Technique: deltopectoral approach. Copeland cementless humeral resurfacing prosthesis inserted. Standard rehabilitation programme vs total arthroplasty. Follow-up: **1 year (median)** Conflict of interest/source of funding: not reported	**Number of patients analysed: 22 resurfacing, 22 total arthroplasty at 6 months.** **Shoulder function** Mean and standard deviation Constant shoulder score at 6 and 12 months 6 months Overall function: 56.6 ± 17.1 vs 63.3 ± 16.2, p 0.190 Change in overall function: +23.5 ± 11.4 vs +37.4 ± 4.5, p 0.036 Change in pain: +6.8 ± 1.7 vs +7.9 ± 1.3, p 0.127 12 months Overall function: 59.3 ± 14.5 vs 67.2 ± 11.7, p 0.056 Change in overall function: +26.1 ± 8.8 vs +41.3 ± 0.0, p 0.033 Change in pain: +8.1 ± 0.0 vs +8.5 ± 0.7, p 0.356 **Range of motion (°)**Mean and standard deviation at 6 and 12 months 6 months Change in flexion: +28.6 ± 12.3 vs +62.7 ± 10.5, p < 0.001 Change in abduction: +28.6 ± 15.8 vs +66.4 ± 17.3, p < 0.001 Change in rotation: +2.7 ± 1.4 vs +4.0 ± 0.4, p 0.103 12 months Change in flexion: +44.9 ± 14.0 vs +69.5 ± 4.5, p 0.007 Change in abduction: +29.1 ± 20.2 vs +70.0 ± 13.7, p < 0.001 Change in rotation: +4.0 ± 0.7 vs +4.4 ± 0.7, p 0.672	**Complications:** There were no intraoperative infections in either group, or postoperative infection or repeat surgery in either group at 6-month follow-up. 9.1% (2/22) of patients in the resurfacing group required conversion to total arthroplasty due to glenoidal erosion and persistent pain at 7 and 9 months respectively.	**Follow-up issues**: Prospective follow-up. 9.1% (2/22) of patients in the resurfacing group had revision surgery between 6 and 12-month follow-up and were excluded from analysis. **Study design issues**: All surface replacement procedures undertaken by the same surgeon. **Study population issues**: Matched pair analysis from concurrent treatment period with same inclusion criteria based on age, gender, diagnosis, and glenoid status. Patients in the resurfacing group had significantly better overall Constant Shoulder Score and better range of abduction at baseline. **Other issues**: Patient selection method for either treatment group not reported.

Abbreviations used: UCLA, the University of California, Los Angeles

Study details	Key efficacy findings	Key safety findings	Comments

Operative characteristics

6 months

	Resurfacing	Total arthroplasty	p
Surgical time (min)	72.7 ± 15.9	138.4 ± 104.7	0.006
Inpatient (days)	13.5 ± 2.9	20.7 ± 3.1	< 0.0001
Blood loss (mm)	237.7 ± 114.1	391.8 ± 127.6	< 0.0001

Abbreviations used: UCLA, the University of California, Los Angeles

Study details	Key efficacy findings	Key safety findings	Comments
Jonsson E (1998)[3] **Non-randomised controlled trial** Sweden Recruitment period: not reported Study population: patients with rheumatoid osteoarthritis of the shoulder with severe pain or poor function. n = **8 (10 shoulders: 5 resurfacing, 5 fusion)** Age: 37.4 years (mean) Sex: 100% female Patient selection criteria: not reported. Technique: cup resurfacing arthroplasty (not otherwise described) vs fusion. Follow-up: **24 months (mean) resurfacing, 120 months (mean) fusion** Conflict of interest/source of funding: supported by foundations	**Number of patients analysed: 8 (5 shoulders resurfacing, 5 fusion)** **Shoulder function** Group mean UCLA shoulder score (0 to 30: higher better) Resurfacing / Fusion Baseline 3.0 / 3.0 Follow-up 18.2 / 19.0 (Significance not stated.) All shoulders in both groups were pain free at final follow-up. Hand grip strength (kPa) mean (range) Resurfacing / Fusion Follow-up 15 (10 to 20) / 47 (15 to 90) **Range of motion (°)** Mean (range) Resurfacing / Fusion Flexion 73 (40 to 130 / 87 (75 to 90) Extension 51 (45 to 60) / 25 (15 to 30) Abduction 52 (30 to 90) / 75 (50 to 90) (Significance not stated.)	**Complications:** There were no wound or general complications in either group. 4 out of 5 patients in the fusion group had postoperative stiff and painful elbows, requiring surgery in 1 patient.	**Follow-up issues**: Follow-up schedule not reported. Period of follow-up considerably longer in fusion group. **Study design issues**: Few efficacy outcomes compared both at baseline and follow-up. **Study population issues**: Two patients received bilateral treatment resurfacing 1 side and fusion on the contralateral side. **Other issues**. Patient selection method not reported. Dominant shoulders were treated with fusion. UCLA shoulder score not described.

Abbreviations used: UCLA, the University of California, Los Angeles

Study details	Key efficacy findings	Key safety findings	Comments
Levy (2001)[4] **Case series** UK Recruitment period: 1990 to 1994 Study population: patients with a range of indications including osteoarthritis, avascular necrosis, rheumatoid arthritis, cuff tear arthropathy, instability arthropathy, septic arthritis, or other. Patients with pain and limitation of function (not otherwise described). n = **94 (103 shoulders)** Age: 64 years (mean) Sex: 78% female. Patient selection criteria: not reported Technique: deltopectoral or anterior-superior approach. Osteophytes removed, and Copeland II prosthesis implanted without cement, with glenoid component inserted where necessary. Follow-up: **6.8 years (mean)** Conflict of interest/source of funding: supported by manufacturer	**Number of patients analysed: 90 (98 shoulders glenoid and humeral components in 68 and humeral only in 35) maximum, fewer for some outcomes.** **Shoulder function** Group mean (Constant Shoulder Score) | | Pain | Overall | Overall % predicted | |---|---|---|---| | Baseline | 1.8 points | 15.4 points | 24% | | 6.8 years | 12.1 points | 52.4 points | 75% | ($p < 0.001$) **Range of motion** Group mean (°) | | Flexion | Abduction | Rotation | |---|---|---|---| | Baseline | 56 | 33 | 8 | | 6.8 years | 110 | 90 | 48 | ($p < 0.001$) **Quality of life** 69.4% (68/98) of shoulders were classified as 'much better' at final follow-up, 24.5% (24/98) were 'better', and 6.1% (6/98) were assessed as 'unchanged' (usually improvement in pain but limited movement). **Radiographic assessment** No lucent lines were visible in 69.3% (61/88) the humeral components of the shoulder.	**Complications:** **Additional surgery requirements** | Revision | Rate per shoulder | |---|---| | Removal of prosthesis and fusion (1 deep infection 1 instability) | 2.0% (2/98) | | Revision for stemmed humeral prosthesis | 6.1% (6/98) | **Operative and postoperative events** | Outcome | Rate per shoulder | |---|---| | Myositis ossificans with almost complete ankylosis (baseline diagnosis was septic arthritis with extensive previous surgery) | 1.0% (1/98) | | Spontaneous pneumothorax (treatment not reported) | 1.0% (1/98) | | Inadequate exposure of the glenoid – hemiarthroplasty only | 1.0% (1/98) | | Minor fracture of the glenoid rim on insertion of glenoid prosthesis | 6.1% (6/98) | | Superficial wound infection (treated by antibiotics) | 2.0% (2/98) | | Arthroscopy for unexplained pain | 3.1% (3/98) | | Rotor cuff tear after fall | 2.0% (2/98) | | Subacromial fibrosis with no loosening after trauma | 1.0% (1/98) | Mild subsidence of the humeral prosthesis was reported in 5.1% (5/98) of shoulders; this had no effect on clinical outcomes.	**Follow-up issues**: Follow-up assessment undertaken independently by clinician. 6% (6/94) of patients died during follow-up and last observation used for analysis. 4% (4/94) of patients lost to follow-up. 7% (7/94) of patients not able to attend follow-up clinic but had data available for Constant Shoulder Score and radiographic assessment. **Study design issues**: All procedures undertaken by the same surgeon. Early in the series total shoulder replacement was attempted in all patients. Later a glenoid component was added – only the rotor cuff was intact and the bony glenoid non-concentric. **Study population issues**: Consecutive case accrual. **Other issues**. Authors state that removal of the resurfacing prosthesis in cases of revision is easy as no cement or stem had to be exposed and removed.

Abbreviations used: UCLA, the University of California, Los Angeles

Study details	Key efficacy findings	Key safety findings	Comments
Scalise J J (2008)[5] **Case series** USA Recruitment period: not reported Study population: patients with a range of indications including osteoarthritis, avascular necrosis, rheumatoid arthritis, post-traumatic arthritis, focal chondral defects, cuff tear arthropathy. n = **78 (16 type A, 62 type B)** Age: 57 years (mean) Sex: not reported Patient selection criteria: not reported. Technique: deltopectoral approach, resurfacing arthroplasty after reaming of humeral head, and intraoperative sizing of prosthesis (and reaming of the glenoid where required, with a DePuy or Copeland II cap [group A], or partial surface prosthesis HemiCAP [group B]). In 26 patients in group B concomitant rotor cuff repair or subacromial decompression was performed. Follow-up: **8 and 19 months (mean) for 2 prosthesis types** Conflict of interest/source of funding: 1 author associated with manufacturer	**Number of patients analysed: 78 (split into 2 groups)** **Shoulder function** In group A mean University of Pennsylvania Shoulder Outcome Score (0 to 100 points; higher scores better) improved from roughly 36 points at baseline to 71 points at 1-year follow-up (confidence intervals do not overlap between pre and post operative figures). In group B the American Shoulder and Elbow Surgeons score (not otherwise described) improved significantly from 38 points at baseline to 70 points at 8-month follow-up (significance not stated). Also in this group the Constant Shoulder Score improved significantly from 55 points at baseline to 78 points at 8-month follow-up (significance not stated).	**Complications:** In group B there was no implant/prosthesis interface problems, osteolysis, or loss of fixation were reported at 8-month follow-up. Safety outcomes for group A were not reported.	**Follow-up issues**: Loss to follow-up not reported. **Study design issues**: Efficacy outcome score used is not described but is reported to be validated. For group A efficacy outcomes were derived from the figure rather than from the text of the article. Some efficacy outcomes were described as significant, however statistical measurement of significance was not reported. **Study population issues**: Efficacy outcomes for patients in group A are compared with a group of patients receiving stemmed (standard) prosthesis but the clinical characteristics of the 2 groups are not compared. Method/criteria for patient selection for resurfacing arthroplasty (or prosthesis type) not reported. **Other issues**: none

Abbreviations used: UCLA, the University of California, Los Angeles

Study details	Key efficacy findings	Key safety findings	Comments
Levy (2004)[6] **Case series** UK Recruitment period: 1986 to 1998 Study population: patients with rheumatoid arthritis, pain and limitation of function (not otherwise described). n = **62 (75 shoulders)** Age: 61 years (mean) Sex: 77% female. Patient selection criteria: not reported Technique: deltopectoral or anterior-superior approach. Osteophytes removed, and Copeland II prosthesis implanted without cement, with glenoid component inserted if necessary. Follow-up: **6.5 years (mean).** Conflict of interest/source of funding: 1 author associated with manufacturer	**Number of patients analysed: 62 (75 shoulders)** **Shoulder function** Group mean score (and standard deviation) at 6.5-year follow-up Constant Shoulder Score: Resurfacing: Total arthroplasty (with glenoid component) Baseline: 11.8 ± 6.8 points: 6 ± 2.5 points 6.5 years: 47.9 ± 17.8 points: 52.4 ± 13.6 points % predicted Baseline: 19.6 ± 11.2%: 9 ± 6.3% 6.5 years: 71 ± 19.8 %: 76 ± 13.4% Pain Baseline: 1.6 ± 2.2 points: 1.1 ± 0.4 points 6.5 years: 11 ± 3.8 points: 12 ± 3.1 points (Significance not stated.) Resurfacing only group mean (°) Flexion / Abduction / Rotation Baseline: 50 / 35 / 5 6.5 years: 101 / 83 / 44 Total arthroplasty group mean (°) Flexion / Abduction / Rotation Baseline: 47 / 37 / 6 6.5 years: 104 / 87 / 47 **Quality of life** 96.0% (72/75) of shoulders were reported to be 'much better' or 'better' at final follow-up. **Radiographic assessment (68 shoulders)** No lucent lines were visible in 82.4% (56/68) of the humeral components.	**Complications:** **Revision surgery** Revision due to loosening of both components (massive rotor cuff tear at baseline): 2/75 shoulders Revision to total arthroplasty with glenoid component in patient with resurfacing (pain): 1/75 shoulders	**Follow-up issues**: Retrospective study. Loss to follow-up not reported. Radiographic assessment undertaken by 2 independent clinicians. **Study design issues**: All procedures undertaken by 2 surgeons. Perioperative safety outcomes not reported. **Study population issues**: Consecutive case accrual. **Other issues**. Potentially 41 patients the same as reported in Levy (2001).

Abbreviations used: UCLA, the University of California, Los Angeles

Study details	Key efficacy findings	Key safety findings	Comments
Rydholm U (1993)[7] **Case series** Sweden Recruitment period: 1981 to 1989 Study population: patients with rheumatoid arthritis, unresponsive to conservative therapy, or with poor function. n = **70 (84 shoulders)** Age: 53 years (mean) Sex: 85% female. Patient selection criteria: not reported Technique: deltopectoral approach. Humeral head reaming of cartilage and osteophytes and attachment of 1 of 5 different-sized prostheses (scan shoulder MITAB) using bone cement. Follow-up: **4.2 years (mean)** Conflict of interest/source of funding: supported by grant.	**Number of patients analysed: 62 (75 shoulders)** **Shoulder function** Pain at rest (proportion of shoulders at 4.2-year follow-up) Severe: Baseline 65%, Follow-up 1% Moderate: Baseline 28%, Follow-up 22% Slight: Baseline 7%, Follow-up 23% Pain free: Baseline 0%, Follow-up 44% (Significance not stated). Pain on motion (proportion of shoulders at 4.2-year follow-up) Severe: Baseline 93%, Follow-up 6% Moderate: Baseline 6%, Follow-up 31% Slight: Baseline 1%, Follow-up 29% Pain free: Baseline 0%, Follow-up 34% Patients able to reach (up to 4.2-year follow-up) The neck: Baseline 14.0% (8/57), 1 year 60.9% (39/64), Follow-up 56.3% (40/71) The axilla: Baseline 35.1% (20/57), 1 year 86.4% (57/66), Follow-up 90.1% (64/71) Behind trunk: Baseline 35.6% (21/59), 1 year 76.9% (50/65), Follow-up 77.5% (55/71) **Quality of life** 94% of 68 patients who completed a questionnaire were pleased with the outcome of the operation. 82% of patients reported their shoulder mobility to be 'improved' or 'much improved'. **Radiographic assessment (68 shoulders)** There was no significant difference in pain relief, motion, or function between shoulders with well-fixed or loose prostheses.	**Complications:** Superficial wound infection in 1/84 shoulders. There were no other perioperative or postoperative complications. No prostheses were revised during a mean follow-up of 4.2 years.	**Follow-up issues**: 15.7% (11/70) of patients died during follow-up and were not included in analysis. Not all patients were available for analysis for all efficacy outcomes. **Study design issues**: No statistical test comparing baseline with follow-up is reported. **Study population issues**: Patients with severe bone loss or cystic undermining were selected for a stemmed prosthesis and excluded from this study. **Other issues**: none.

Efficacy

A case series of 69 patients (79 shoulders) reported that mean shoulder function (as measured by the Constant Shoulder Scale [100-point scale; higher scores better]) improved from 40% of predicted (for age and gender) at baseline to 91% at 4.4-year follow-up in shoulders treated by shoulder resurfacing arthroplasty, and from 34% at baseline to 94% at 7.6-year follow-up in patients treated with resurfacing plus glenoid component (significance not stated)[1]. A non-randomised controlled trial of 44 patients reported that there was no significant difference in the mean change in shoulder function (Constant Shoulder Scale) from baseline to 12-month follow-up in patients treated with shoulder resurfacing arthroplasty (8.1 ± 0.0 points), and patients treated by total shoulder arthroplasty (8.5 ± 0.7 points) ($p = 0.356$)[2]. A case series of 94 patients (103 shoulders) reported that mean shoulder function (Constant Shoulder Scale adjusted for age and gender) improved from 24% of predicted at baseline to 75% of predicted at 6.8-year follow-up ($p < 0.001$)[4].

The case series of 69 patients (79 shoulders) reported that mean shoulder pain improved from 3.9 points at baseline to 12 points at 4.4-year follow-up in patients treated with shoulder resurfacing arthroplasty, and from 2.1 points to 14 points at 7.6-year follow-up in patients undergoing resurfacing plus glenoid component (significance not stated)[1]. A case series of 70 patients (84 shoulders) reported that 6% had ‘severe pain’ on motion, 31% had ‘moderate’ pain, 29% had ‘slight’ pain, and 34% were pain free at 4.2-year follow-up[7].

A non-randomised controlled trial of 8 patients (10 shoulders) reported that mean hand grip strength was 15 kPa at 24-month follow-up following shoulder resurfacing arthroplasty, and 47 kPa at 120-month follow-up after shoulder fusion (significance not stated)[3].

A case series of 62 patients (75 shoulders) reported that 96% of shoulders were rated as ‘much better’ or ‘better’ (not otherwise described) at 6.5-year follow-up[6].

The non-randomised controlled trial of 44 patients reported that mean inpatient stay was significantly shorter following shoulder resurfacing arthroplasty (13.5 ± 2.9 days) than following total shoulder arthroplasty (20.7 ± 3.1 days) ($p < 0.0001$)[2].

Safety

The case series of 69 patients (79 shoulders) reported that no patient treated by shoulder resurfacing arthroplasty needed a revision procedure at 4.4-year follow-up[1]. A case series of 70 patients (84 shoulders) reported that no patient treated by shoulder resurfacing arthroplasty needed a revision procedure during 4.2-year follow-up[7].

The case series of 94 patients (103 shoulders) reported removal of the prosthesis and fusion in 2% (2/98) of shoulders and revision surgery (for stemmed humeral prosthesis) in 6% (6/98) of shoulders at mean follow-up of 6.8 years[4]. The case series of 62 patients (75 shoulders) reported revision to total shoulder arthroplasty due to persistent pain in 1 of 75 shoulders at a mean follow-up of 6.5 years[6]. The non-randomised controlled trial of 44 patients reported that, of the 22 patients 9 treated by shoulder resurfacing arthroplasty, 1 required conversion to total shoulder arthroplasty due to glenoidal erosion and 1 because of persistent pain at 7 and 9 months respectively[2]. In the same study there were no intraoperative or postoperative infections in either the shoulder resurfacing arthroplasty or total arthroplasty groups at 6-month follow-up.

Myositis ossificans causing almost complete ankylosis was reported in 1 patient in the case series of 94 patients (mean follow-up 6.8 years). The patient had had an initial diagnosis of septic arthritis and extensive previous surgery[4].

Validity and generalisability of the studies

- A wide range of different scores and scales have been used within and across the studies, many are not well described and with little detail provided about their validation. This makes comparison between studies difficult.
- There is a wide variety of prostheses available for this procedure, some include a pin-anchoring component, and some are designed to resurface only a proportion of the humeral head.
- There is considerable variation in the clinical indication for this procedure e.g. rrheumatoid arthritis, osteoarthritis, trauma, avascular necrosis.
- The degree of intervention required on the glenoid during surgery varies between and within studies. Some required a prosthesis in this component too.

Existing assessments of this procedure

There were no published assessments from other organisations identified at the time of the literature search.

Related NICE guidance

Below is a list of NICE guidance related to this procedure. Appendix B gives details of the recommendations made in each piece of guidance listed.

Clinical guidelines

- Osteoarthritis: the care and management of osteoarthritis in adults. NICE clinical guideline 59 (2008). Available from www.nice.org.uk/CG59

Specialist Advisers' opinions

Specialist advice was sought from consultants who have been nominated or ratified by their Specialist Society or Royal College. The advice received is their individual opinion and does not represent the view of the society.

Prof. A Carr (British Elbow and Shoulder Society), Mr R Kulkarni (British Elbow and Shoulder Society), Mr D Stanley (British Elbow and Shoulder Society).

- All 3 Specialist Advisers considered this procedure to be established and no longer new.
- Two Specialist Advisers estimated 50% or more of their colleagues to be undertaking the procedure, and 1 estimated 10–50%.
- The main comparator to this procedure was total shoulder arthroplasty with a stemmed humeral prosthesis.
- The key efficacy outcomes for this procedure were pain, range of motion, patient quality of life, and rate of revision procedures.
- Adverse events seen or reported following the procedure included loosening of the prosthesis, impingement and overstuffing during implant if it had been incorrectly sized.
- Additional theoretical adverse events included infection, nerve injury, deep vein thrombosis, fracture, failure requiring revision, and stiffness.
- Two of the Specialist Advisers stated that they were not aware of any extra safety concerns than those seen with insertion of a stemmed prosthesis, and 1 suggested that there might be fewer.
- Revision is considerably easier and less extensive than when using a stemmed prosthesis for primary arthroplasty.
- Training for this procedure is covered as part of the certificate of completion of specialist training.

- All 3 Specialist Advisers thought that if found to be safe and efficacious the procedure would be available at most or all district general hospitals.

Patient Commentators' opinions

NICE's Patient and Public Involvement Programme was unable to gather patient commentary for this procedure.

Issues for consideration by IPAC

- Non-English language studies not included in this overview.
- Studies on patients receiving revision surgery are not included in this overview.

References

1 Levy O and Copeland SA. (2004) Cementless surface replacement arthroplasty (Copeland CSRA) for osteoarthritis of the shoulder. Journal of Shoulder & Elbow Surgery 13: 266–71

2 Buchner M, Eschbach N, Loew M. (2008) Comparison of the short-term functional results after surface replacement and total shoulder arthroplasty for osteoarthritis of the shoulder: a matched-pair analysis. Archives of Orthopaedic & Trauma Surgery 128: 347–54

3 Jonsson E, Brattstrom M, Lidgren L. (1988) Evaluation of the rheumatoid shoulder function after hemiarthroplasty and arthrodesis. Scandinavian Journal of Rheumatology 17: 17–26

4 Levy O and Copeland SA. (2001) Cementless surface replacement arthroplasty of the shoulder. 5- to 10-year results with the Copeland mark-2 prosthesis. Journal of Bone & Joint Surgery – British Volume 83: 213–21

5 Scalise JJ, Miniaci A, Iannotti JP. (2008) Resurfacing arthroplasty of the humerus: Indications, surgical technique, and clinical results. Current Orthopaedic Practice 19: 443–50

6 Levy O, Funk L, Sforza G et al. (2004) Copeland surface replacement arthroplasty of the shoulder in rheumatoid arthritis. Journal of Bone & Joint Surgery – American Volume 86-A: 512–8

7 Rydholm U and Sjoden J. (1993) Surface replacement of the humeral head in the rheumatoid shoulder. Journal of Shoulder & Elbow Surgery 2: 286–95

Appendix A: Additional papers on shoulder resurfacing arthroplasty

The following table outlines the studies that are considered potentially relevant to the overview but were not included in the main data extraction table (table 2). It is by no means an exhaustive list of potentially relevant studies.

Article	Number of patients/follow-up	Direction of conclusions	Reasons for non-inclusion in table 2
Alund M, Hoe-Hansen C, Tillander B et al. (2000) Outcome after cup hemiarthroplasty in the rheumatoid shoulder: a retrospective evaluation of 39 patients followed for 2-6 years. Acta Orthopaedica Scandinavica 71 (2) 180-184.	n = 33 Follow-up = 4.4 years	At follow-up, 26 patients were satisfied with the procedure, despite poor shoulder function and radiographic deterioration	Larger studies are included in table 2
Bailie DS, Llian PJ, Ellenbecker TS (2008) Cementless Humeral Resurfacing arthroplasty in active patients less than fifty-five years of age. Journal of bone joint surgery of America. 90: 110-117.	n = 36 Follow-up = 38 months	Cementless humeral resurfacing arthroplasty is a viable treatment option for younger active patients.	Larger studies are included in table 2
Fink B, Singer J, Lamla U et al. (2004) Surface replacement of the humeral head in rheumatoid arthritis. Archives of Orthopaedic & Trauma Surgery 124 (6) 366-373	n = 39 Follow-up = 45 months	The results of the Durom Cup are encouraging. In shoulders with additional massive cuff tear, the limited goal criteria were always achieved	Larger studies are included in table 2
Fuerst M, Fink B, and Ruther W (2007) The DUROM cup humeral surface replacement in patients with rheumatoid arthritis. Journal of Bone & Joint Surgery - American Volume 89 (8) 1756-1762	n = 35 Follow-up = 73 months	The midterm results of the cemented DUROM cup surface replacement for patients with advanced rheumatoid arthritis of the shoulder are very encouraging, even for patients with a massive tear of the rotator cuff.	Larger studies are included in table 2
Jonsson E, Egund N, and Kelly. (1986) Cup arthroplasty of the rheumatoid shoulder. Acta Orthopaedica Scandinavica 57 (6) 542-546	n = 25 Follow-up = 28 months	all the shoulders were painless and had satisfactory function. Partial radiolucent zones exceeding 1 mm were seen in three shoulders	Larger studies are included in table 2 Possibly the same patients as reported in Jonsson (1998)

Mullett H, Levy O, Raj D et al. (2007) Copeland surface replacement of the shoulder: Results of an hydroxyapatite-coated cementless implant in patients over 80 years of age. Journal of Bone and Joint Surgery - Series B 89 (11) 1466-1469	n = 29 Follow-up = 54 months	Copeland surface replacement shoulder arthroplasty may be performed with minimal morbidity and rapid rehabilitation in the elderly	Larger studies are included in table 2
Radnay CS, Setter KJ, Chambers L, Levine WN et al. (2007) Total shoulder replacement compared with humeral head replacement for the treatment of primary glenohumeral osteoarthritis: a systematic review. Journal of Shoulder & Elbow Surgery 16 (4) 396-402	n = 1952 Follow-up = 43.4 months	On the basis of this review and analysis, in comparison with humeral head replacement, total shoulder replacement for the treatment of primary glenohumeral osteoarthritis significantly improves pain relief, range of motion, and satisfaction and has a significantly lower rate of revision surgery. Inconsistent outcome reporting and poor study design may warrant standardization of outcome instruments and improved study design in the future	Systematic review compares outcomes between resurfacing and total arthroplasty by pooling results of independent case series where patient selection and clinical characteristics of patients at baseline might be significantly different.
Raiss P, Kasten P, Baumann F et al. (2009) Treatment of osteonecrosis of the humeral head with cementless surface replacement arthroplasty. Journal of Bone & Joint Surgery - American Volume 91 (2) 340-349	n = 14 Follow-up = not reported	Cementless humeral surface replacement arthroplasty is a potentially bone-preserving option for patients with posttraumatic and nontraumatic osteonecrosis of the humeral head.	Larger studies are included in table 2
Steffee AD, Moore RW (1984) Hemi-resurfacing arthroplasty of the shoulder. Contemporary orthopaedics. 9: 51-59	n = 64 Follow-up = 22 months	The surgical procedure is usually a simple one with minimal morbidity to the patient	Studies with longer follow-up included in table 2
Thomas SR, Wilson AJ, Chambler A et al, (2005) Outcome of Copeland surface replacement shoulder arthroplasty. Journal of Shoulder & Elbow Surgery 14 (5) 485-491	n = 52 Follow-up = 34 months	These results are comparable to those obtained with a modern stemmed hemiarthroplasty and are similar to Copeland's own series	Larger studies are included in table 2

Uribe JW and Botto-van Bemden A (2009) Partial humeral head resurfacing for osteonecrosis. Journal of Shoulder and Elbow Surgery 18 (5) 711-716	n = 11 Follow-up = 30 months	This prospective series on partial resurfacing of the humeral head for patients with advanced-stage osteonecrosis has shown it to be effective in relieving pain and restoring function.	Larger studies are included in table 2

Appendix B: Related NICE guidance for shoulder resurfacing arthroplasty

Guidance	Recommendations
Clinical guidelines	**The care and management of osteoarthritis in adults. NICE clinical guideline 59 (2008)** 1.5.1.1 Clinicians with responsibility for referring a person with osteoarthritis for consideration of joint surgery should ensure that the person has been offered at least the core (non-surgical) treatment options. 1.5.1.2 Referral for joint replacement surgery should be considered for people with osteoarthritis who experience joint symptoms (pain, stiffness and reduced function) that have a substantial impact on their quality of life and are refractory to non-surgical treatment. Referral should be made before there is prolonged and established functional limitation and severe pain.

Appendix C: Literature search for shoulder resurfacing arthroplasty

Database	Date searched	Version/files
Cochrane Database of Systematic Reviews – CDSR (Cochrane Library)	23/10/09	Issue 4, 2009
Database of Abstracts of Reviews of Effects – DARE (CRD website)	23/10/09	N/A
HTA database (CRD website)	23/10/09	N/A
Cochrane Central Database of Controlled Trials – CENTRAL (Cochrane Library)	23/10/09	Issue 4, 2009
MEDLINE (Ovid)	23/10/09	1950 to October Week 3 2009
MEDLINE In-Process (Ovid)	23/10/09	October 22, 2009
EMBASE (Ovid)	23/10/09	1980 to 2009 Week 42
CINAHL (NLH Search 2.0/EBSCOhost)	23/10/09	1981 to Present
BLIC (Dialog DataStar)	23/10/09	1995 to date

The following search strategy was used to identify papers in MEDLINE. A similar strategy was used to identify papers in other databases.

1	Shoulder/
2	Arthroplasty, Replacement/
3	1 and 2
4	((Shoulder* or Glenohumeral*) adj5 Arthroplast* adj5 (Replace* or Resurface* or Repair* or Reconstruct*)).tw.
5	((Shoulder* or Glenohumeral*) adj5 (Surface* or Joint*) adj5 (Replace* or Resurface* or Repair* or Reconstruct*)).tw.
6	(Humeral* adj5 Head* adj5 (Replace* or Resurface* or Repair* or Reconstruct*)).tw.
7	((Shoulder* or Glenohumeral*) adj5 Hemiarthroplast*).tw.
8	Durom.tw.
9	Hemi-cap.tw.
10	Copeland.tw.
11	Buechel-pappas.tw.

12	or/3-11
13	Osteoarthritis/
14	((Shoulder* or Glenohumeral*) adj5 (Osteoarthritis* or Osteo-arthritis*)).tw.
15	Arthritis, Rheumatoid/
16	((Shoulder* or Glenohumeral*) adj5 Rheumat* adj5 Arthritis*).tw.
17	Shoulder Dislocation/
18	((Shoulder* or Glenohumeral*) adj5 (Subluxat* or Dislocat* or Luxat*)).tw.
19	Osteonecrosis/
20	Osteoradionecrosis/
21	((Shoulder* or Glenohumeral*) adj5 (Osteonecrosis* or Osteoradionecrosis*)).tw.
22	((Shoulder* or Glenohumeral*) adj5 (Avascular* or Aseptic* or Ischemic* or Bone*) adj5 necrosis*).tw.
23	AVN.tw.
24	(Cuff* adj3 Arthropath*).tw.
25	or/13-24
26	12 and 25
27	Animals/ not Humans/
28	26 not 27