

Supplementary data

Appendix 1a. Search Strings and its associated mesh terms for Pubmed

| | |
|------------------------|---|
| Hip replacement | “Arthroplasty, Re-placement, Hip”[mh] OR Hip Arthroplasty[tiab] OR Hip Replace-ment[tiab] OR THR[tiab] |
| Acetabular cup | Acetabular com-ponent[tiab] OR cup[tiab] OR cups[tiab] OR ace-tabular[tiab] OR liner[tiab] OR pol-yethylene[tiab] |
| Migration | Migrat*[tiab] OR movement[tiab] OR rotat*[tiab] OR inclina-tion[tiab] OR translat*[tiab] OR micromotion [tiab] |
| RSA | Radiostereometric analysis[mh] OR RSA[tiab] OR radiostere-ometr*[tiab] OR “Roentgen stereophotogrammetric”[tiab] |

Appendix 1b. Search Strings and its associated mesh terms for Embase

| | |
|------------------------|---|
| Hip replacement | hip arthroplasty/de OR hip replacement/de OR hip arthroplasty.ti,ab OR hip replacement.ti,ab OR THR.ti,ab |
| Acetabular cup | acetabular com-ponent.ti,ab OR cup.ti,ab OR cups.ti,ab OR ace-tabular.ti,ab OR liner.ti,ab OR pol-yethylene.ti,ab |
| Migration | Migrat*.ti,ab OR movement.ti,ab OR rotat*.ti,ab OR inclination.ti,ab OR translat*.ti,ab OR micromotion.ti,ab |
| RSA | Exp radiostereometric analysis OR RSA.ti,ab OR radiostereometry.ti,ab OR radiostereometric analysis.ti,ab OR radiostereometric analyses.ti,ab OR Roentgen stereophotogrammetric.ti,ab |

Appendix 1c. Search Strings and its associated mesh terms for Scopus

| | |
|------------------------|--|
| Hip replacement | hip arthroplasty OR hip replacement |
| Acetabular cup | acetabular component OR cup OR cups OR ace-tabular OR liner or poly-ethylene |
| Migration | Migrat* OR movement OR rotat* OR inclination OR translat* OR micromotion |
| RSA | rsa OR radiostereometry OR radiostereometric analysis OR radiostereometric anal-yses OR Roentgen stereophotogrammetric)) |

Appendix 2. List of studies that did not report migration at more than 1 follow-up time point

1. Baad-Hansen 2011
2. Galea 2019
3. Hjorth 2014
4. Kjærgaard 2020
5. Lindalen 2012
6. Nivbrant 2001
7. Onsten 1996
8. Röhrh 2004
9. Shareghi 2017

Appendix 3. Acetabular cup migration RSA studies included in meta-analysis with cohort details. Studies marked with a has reported the migration in unsigned (absolute) values

| Author | Year of publication | RCT | Primary study comparison(s) | Acetabular implant | Type of fixation | Number of hips at baseline | Diagnosis | Mean age | Mean proximal migration at 2-years | Years of FU | Numbers revised (reason) |
|-------------|---------------------|-----|--|--|------------------|----------------------------|-----------|----------|------------------------------------|-------------|--|
| Bergvinsson | 2022 | Y | VEPE liner UHMWPE | Exceed ABT | C | 24 | OA | 72 | 0.17 | 5 | 0 |
| | | | | Exceed ABT (Biomet, Warsaw, IN, USA) | C | 24 | OA | 71 | 0.24 | 5 | 0 |
| Bergvinsson | 2021 | Y | PE liner XLPE liner | CSF | U | 25 | OA | 64 | 0.32 | 10 | 0 |
| | | | | CSF Plus (JRI, London, UK) | U | 25 | OA | 62 | 0.04 | 10 | 1 (Hemato- genic Infec- tion at 10 yr) |
| Bergvinsson | 2020 | Y | Ceramic head Metal head | CSF Plus | U | 25 | OA | 59 | 0.05 | 5 | 0 |
| | | | | CSF Plus (JRI, Sheffield, UK) | U | 25 | OA | 60 | 0.10 | 5 | 0 |
| Carlsson | 2006 | Y | Screwless Screw | GOT: Gothenburg osseointegrated titanium (Astra Tech AB, Gothenburg, Sweden) | U | 24 | OA | 59 | 0.11 | 3 | 3 (Femoral component) |
| | | | | Harris Galante II (Zimmer, IN, USA) | U | 29 | OA | 59 | 0.16 | 3 | 1 (Disloca- tion of cup) |
| Digas | 2004 | Y | Palacos cement Cemex-F Uncemented | Reflection | C | 27 | OA | 73 | 0.12 | 2 | 0 |
| | | | | Reflection (Smith & Nephew, USA) | C | 32 | OA | 71 | 0.12 | 2 | 0 |
| | | | | Trilogy holes (Zimmer, Warsaw, IN, USA) | U | 37 | OA | 65 | 0.15 | 2 | 0 |
| Digas | 2003 | Y | XLPE Liner Conventional UHMWPE liner | Flanged all PE cup | C | 32 | OA, SOA | 55 | 0.07 | 10 | 0 |
| | | | | Flanged all PE cup (Weber, Centerpulse Orthopedics Ltd) | C | 29 | OA, SOA | 55 | 0.09 | 10 | 0 |
| Finnila | 2016 | N | Low BMD Normal BMD | ABG II (Stryker Europe) | U | 24 | OA | 66 | 0.29 | 2 | 2 (Fracture of ceramic head and liner) |
| | | | | ABG II (Stryker Europe) | U | 10 | OA | 58 | 0.08 | 2 | 0 |
| Flatoy | 2015 | N | – | Marathon (DePuy, Warsaw, USA) | C | 19 | OA | – | 0.03 | 3 | 0 |
| Flivik | 2006 and 2016 | Y | Retention of subchondral plate Removal of subchondral plate | Opticup (Biomet, UK) | C | 25 | OA | 69 | 0.12 | 10 | 1 (Suspected infection and loose stem at 6 years) |
| | | | | Opticup (Biomet, UK) | C | 25 | OA | 67 | 0.06 | 10 | 0 |
| Flivik | 2005 | Y | Finger-packed Pressurised | Opticup (Biomet, UK) | C | 24 | OA | 65 | 0.30 | 5 | 1 (suspected infection) |
| | | | | Opticup (Biomet, UK) | C | 23 | OA | 65 | 0.22 | 5 | 0 |
| Hjorth | 2017 | Y | Anterolateral approach Posterior approach | ReCap Hip Resurfacing | U | 24 | OA, SOA | 53 | 0.55 | 2 | 2 (revision of head and liner) |
| | | | | Recap Hip Resurfacing (Biomet, Warsaw, IN, USA) | U | 25 | OA, SOA | 47 | 0.40 | 2 | 1 (revision of head and liner) |
| Howie | 2020 | Y | Screws No screws | Trilogy (Zimmer) | U | 21 | OA, SOA | 57 | 0.19 | 2 | 1 (not stated) |
| | | | | TM (Zimmer) | U | 35 | OA, SOA | 58 | 0.17 | 2 | 1 (not stated) |
| Bourne | 2008 | N | – | R3 (Smith & Nephew, TN, USA) | U | 20 | OA | 75 | - | 1 | 0 |
| Itayem | 2007 | N | – | Birmingham Hip Resurfacing (Smith & Nephew, Warwick, UK) | U | 20 | - | - | 0.05 | 5 | 0 |
| Jacobsen | 2018 | N | – | Phoenix Cup (Peter Brehm GmbH, Weisendorf, Germany) | U | 39 | OA | 67 | 0.17 | 10 | 0 |
| Jorgensen | 2019 | Y | With coating No coating | Exceed ABT (Zimmer Biomet) | U | 28 | OA | 64 | 0.20 | 2 | 0 |
| | | | | Exceed ABT (Zimmer Biomet) | U | 25 | OA | 65 | 0.09 | 2 | 0 |
| Kadar | 2011 | Y | all poly, CoCr head all poly, Oxinium h | Charnley Flanged Ogee (DePuy, Leeds, UK) | C | 30 | OA, SOA | 70 | 0.19 | 2 | 1 (Dislocation) |
| | | | | Reflection (Smith & Nephew) | C | 30 | OA, SOA | 69 | 0.06 | 2 | 0 |
| | | | | Reflection (Smith & Nephew) | C | 30 | OA, SOA | 69 | 0.08 | 2 | 2 (Infection) |

Appendix 3 continued

| Author | Year of publication | RCT | Primary study comparison(s) | Acetabular implant | Type of fixation | Number of hips at baseline | Diagnosis | Mean age | Mean proximal migration at 2-years | Years of FU | Numbers revised (reason) |
|--|---------------------|-----|-----------------------------|-------------------------------|------------------|----------------------------|-----------|----------|------------------------------------|-------------|-----------------------------|
| Klaassen | 2022 | Y | XLPE, CoCr head | Reflection (Smith & Nephew) | C | 30 | OA, SOA | 70 | 0.06 | 2 | 1 (Infection) |
| | | | XLPE, Oxinium h. | Reflection (Smith & Nephew) | C | 30 | OA, SOA | 70 | 0.04 | 2 | 1 (Infection) |
| | | | Ceramic liner | Delta TT | U | 27 | - | 58 | 0.56 | 2 | 0 |
| | | | XLPE liner | Delta TT | U | 25 | - | 60 | 0.54 | 2 | 0 |
| (Lima-Corporate, Villa-nova San Daniele del Friuli, Italy) | | | | | | | | | | | |
| Laende | 2020 | N | - | ADM (Stryker, NJ, USA) | U | 30 | OA | 63 | 0.18 | 3 | 0 |
| Lazarinis | 2014 | N | - | TOP (Link, Hamburg, Germany) | U | 30 | OA | 56 | 0.32 | 2 | 0 |
| Munzinger | 2013 | Y | HA coating | EP-FIT PLUS | U | 22 | OA | 68 | 0.11 | 2 | 0 |
| | | | no HA coating | EP-FIT PLUS | U | 22 | OA | 70 | 0.10 | 2 | 0 |
| (Smith & Nephew, Baar, Switzerland) | | | | | | | | | | | |
| Naudie | 2013 | Y | Stiktite | Reflection | U | 33 | - | 75 | 0.04 | 2 | 0 |
| | | | Roughcoat | Reflection | U | 29 | - | 77 | 0.15 | 2 | 0 |
| (Smith & Nephew, Memphis, TN, USA) | | | | | | | | | | | |
| Nilsson ^a | 2017 | N | - | R3 | U | 20 | OA | 70 | 0.39 | 5 | 0 |
| (Smith & Nephew, Memphis, TN, USA) | | | | | | | | | | | |
| Onsten ^a | 1994 | Y | Cemented | Charnley flanged ogee | C | 30 | OA | 63 | 0.32 | 2 | 0 |
| | | | Uncemented | HG1 (Zimmer) | U | 30 | OA | 62 | 0.18 | 2 | 0 |
| Onsten | 1993 | N | OA | Charnley flanged ogee | C | 23 | OA | 0.1 | 2 | - | |
| | | | RA | Charnley flanged ogee | C | 23 | RA | 0.6 | 2 | - | |
| (Depuy Synthes) | | | | | | | | | | | |
| Pakvis | 2012 | Y | No screws | RM | U | 19 | OA | 64 | 0.27 | 2 | 0 |
| | | | With screws | RM | U | 18 | OA | 62 | 0.06 | 2 | 0 |
| (Mathys AG, Bettlach, Switzerland) | | | | | | | | | | | |
| Palm | 2007 | Y | Flanged anti-luxation cup | Lubinus Flanged | C | 28 | OA | 70 | - | 3 | - |
| | | | Standard eccentric cup | Lubinus eccentric | C | 25 | OA | 69 | - | 3 | - |
| (Link, Hamburg, Germany) | | | | | | | | | | | |
| Rohrl | 2005, 2006 and 2012 | N | - | Osteonics (Stryker) | C | 10 | OA | 58 | 0.16 | 10 | 0 |
| Rohrl | 2006 | N | - | TOP (Link, Hamburg, Germany) | U | 26 | OA, SOA | 54 | 0.11 | 2 | 0 |
| Salemyr | 2015 | Y | Porous titanium | Regenerex (Biomet, USA) | U | 25 | OA | 62 | 0.38 | 2 | 0 |
| | | | Porous coated | Pinnacle | U | 26 | OA | 62 | 0.24 | 2 | 0 |
| (Depuy Johnson & Johnson, USA) | | | | | | | | | | | |
| Sillesen | 2015 | N | Medical centre 1 | Regenerex (Biomet) | U | 52 | OA | 59 | 0.15 | 3 | 1 (Infection) |
| | | | Medical centre 2 | Regenerex (Biomet) | U | 32 | OA | 66 | ??? | 3 | 1 (Dislocation) |
| Skoldenberg | 2019 | Y | PE | Exceed ABT | C | 21 | OA | 67 | 0.11 | 2 | 1 (Dislocation) |
| | | | VEPE | Exceed ABT | C | 21 | OA | 67 | 0.32 | 2 | 1 (Dislocation) |
| (Zimmer Biomet, Warsaw, IN, USA) | | | | | | | | | | | |
| Snorrason | 1990 | N | - | Link V | U | 20 | OA | 51 | 1.4 | 2 | 1 (Pain) |
| (Waldemar Link, Norderstedt, Germany) | | | | | | | | | | | |
| Tabori Jensen | 2020 | Y | Cement | Avantage Reload Dual Mobility | C | 28 | OA | 75 | 0.11 | 2 | 1 (Liner and head exchange) |
| | | | Cementless | Avantage Reload Dual Mobility | U | 28 | OA | 75 | 0.09 | 2 | |
| (Zimmer-Biomet, Warsaw, IN, USA) | | | | | | | | | | | |
| Thanner | 2000 | Y | Screwless | Trilogy no holes | U | 34 | - | - | 0.10 | 2 | 0 |
| | | | Screw | Trilogy holes | U | 30 | - | - | 0.12 | 2 | 0 |
| (Zimmer, Warsaw, IN, USA) | | | | | | | | | | | |
| Thanner | 1995 | Y | Palacos | Reflection (Smith & Nephew) | C | 14 | - | 71 | - | 1 | - |
| | | | Bonoloc | Reflection (Smith & Nephew) | C | 16 | - | 71 | - | 1 | - |
| Thien | 2012 | Y | Composite stem | Trilogy holes (Zimmer) | U | 22 | OA, SOA | 57 | 0.10 | 7 | 0 |
| | | | Solid stem | Trilogy holes (Zimmer) | U | 18 | OA, SOA | 61 | 0.00 | 7 | 1 (Infection) |
| Thien | 2007 | Y | Partial weight bear. | ABG I (Stryker-Howmedica) | U | 21 | - | 53 | - | 1 | 0 |
| | | | Full weight bearing | ABG I (Stryker-Howmedica) | U | 19 | - | 54 | - | 1 | 0 |
| Thoen | 2020 | Y | Modified XLPE | Marathon cup | C | 31 | OA, SOA | 61 | 0.23 | 5 | - |
| | | | VEPE | E1 Biomet | C | 37 | OA, SOA | 58 | 0.53 | 5 | - |
| (DePuy, Warsaw, IN, USA) | | | | | | | | | | | |

Appendix 3 continued

| Author | Year of publication | RCT | Primary study comparison(s) | Acetabular implant | Type of fixation | Number of hips at baseline | Diagnosis | Mean age | Mean proximal migration at 2-years | Years of FU | Numbers revised (reason) |
|---------------|---------------------|-----|-------------------------------|---|------------------|----------------------------|-----------|----------|------------------------------------|-------------|--|
| Tsikandylakis | 2020 | Y | Porous titanium coating | G7 (Zimmer Biomet) | U | 48 | OA | 63 | 0.15 | 2 | 3 (2 dislocation, 1 prosthetic femoral fracture) |
| | | | Porous plasma spray | G7 (Zimmer Biomet) | U | 48 | OA | 63 | 0.21 | 2 | |
| von Schewelov | 2005 | Y | Hylamer, stainless steel head | Charnley flanged ogee (Depuy Synthes) | C | 30 | – | – | 0.48 | 5 | 5 (wear and loosening) |
| | | | Hylamer, zirconium oxide head | Charnley flanged ogee (Depuy Synthes) | C | 28 | – | – | 0.42 | 5 | 6 (wear and loosening) |
| | | | Stainless steel head | Charnley flanged ogee (Depuy Synthes) | C | 28 | – | – | 0.28 | 5 | 0 |
| | | | Zirconium oxide head | Charnley flanged ogee (Depuy Synthes) | C | 28 | - | - | 0.19 | 5 | 1 |
| von Schewelov | 2004 | N | – | OmniFit (Stryker Howmedica Osteonics) | U | 154 | OA, SOA | 50 | 0.08 | 7 | 66 by 7 years (43 loosening of cup) |
| Zhou | 2006 | Y | Ceramic XLPE | Reflection cup | U | 31 | OA | 66 | 0.40 | 2 | – |
| | | | | Reflection cup (Smith & Nephew, Memphis, TN, USA) | U | 30 | OA | 68 | 0.31 | 2 | – |

BMD = bone mineral density, FU = follow up, OA = osteoarthritis, PE = polyethylene liner, PLLA = poly-L-lactic acid, RA = rheumatoid arthritis, RCT = randomized controlled trial, SOA = secondary osteoarthritis, Ti = titanium, UHMWPE = ultra high molecular weight polyethylene, VEPE = vitamin E infused polyethylene, XLPE = crosslinked polyethylene.