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## Appendix:

Using the defined inclusion and exclusion criteria, a detailed search strategy was followed for each joint and location.

*Search 1*: (osteochondral [All Fields] or osteoarticular [All Fields]) AND ("allografts"[MeSH Terms] OR 'allografts'[All Fields] OR 'allograft'[All Fields])) AND ("knee"[MeSH Terms] OR "knee"[All Fields] OR "knee joint"[MeSH Terms] OR ("knee"[All Fields] AND "joint"[All Fields]) OR "knee joint"[All Fields]

*Search 2:* (osteochondral [All Fields] or osteoarticular [All Fields]) AND ("allografts"[MeSH Terms] OR 'allografts'[All Fields] OR 'allograft'[All Fields]) AND "patella"[All Fields]

*Search 3:* (osteochondral [All Fields] or osteoarticular [All Fields]) AND ("allografts"[MeSH Terms] OR 'allografts'[All Fields] OR 'allograft'[All Fields]) AND ("ankle"[All Fields] OR "talus"[All fields] OR "talar"[All Fields])

*Search 4:* (osteochondral [All Fields] or osteoarticular [All Fields]) AND ("allografts"[MeSH Terms] OR 'allografts'[All Fields] OR 'allograft'[All Fields]) AND ('humeral'[All Terms] OR 'glenoid'[All Terms] OR 'shoulder'[All Terms'] 'glenohumeral'[All Terms] AND "Joint"[All Terms])

*Search 5*: ('osteochondral' [All Fields] or 'osteoarticular' [All Fields]) AND ("allografts"[MeSH Terms] OR 'allografts'[All Fields] OR 'allograft'[All Fields]) AND ('femoral head'[All Terms] OR 'acetabulum'[All Terms] OR 'hip'[All Terms'] AND "Joint"[All Terms])

*Inclusion/exclusion criteria*

The results were filtered to English and full-text articles. References were reviewed to identify additional articles and confirm completeness. Inclusion criteria for clinical studies of each joint

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location included original research studies that investigated the use of fresh osteochondral allograft transplantation in humans to treat chondral or osteochondral defects. The inclusion criteria for clinical studies required at least one patient, reported patient outcomes, and minimum follow-up of 12 months. Systematic reviews of clinical studies investigation outcomes of OCA, consensus statements, and health economic studies were included as relevant to this study. Exclusion criteria for all joint locations were as follows: articles not written in English; review or expert opinion articles; instructional courses; surgical technique articles; conference proceedings and presentations; OCAs for tumor; basic science or animal studies, articles that used OCAs that were cryopreserved, frozen, or decellularized; One author performed the literature search (S.M.T) and 2 authors (D.C., S.M.T) independently reviewed the search results. Titles and abstracts were reviewed for all search results. Full-text articles were obtained to determine if the study met the established inclusion and exclusion criteria. In total, 103 articles were identified that reported clinical outcomes of OCA in the knee joint, 32 articles reported outcomes of OCA in the ankle joint, 10 articles report outcomes of OCA in the shoulder joint, and 11 articles report outcomes of OCA in the hip joint.

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**Appendix Table 1**: Statements generated from private payer insurance policies

| | **Statements based on private payer medical criteria** |
|---|---|
| | **Defect characteristics** |
| 1 | There should be a maximum and minimum defect size for OCA transplantation |
| 2 | Defect should be focal, isolated, unipolar |
| 3 | Defect should be full thickness and grade III or IV |
| 4 | Defect should be located on weight bearing surface of medial or lateral femoral condyles or trochlear region (trochlear groove of femur) |
| 5 | Defect can be located on patella |
| 6 | The patella region is non-load bearing |
| 7 | Weight bearing and non-weight bearing should not be criteria |
| 8 | OCA is only for femoral articulation |
| 9 | Specific location of the knee should not be criteria |
| 10 | The lesion should only involve one side of joint and opposing articular cartilage surface should be generally free of disease or injury including no arthritis on corresponding tibial surface |
| 11 | Lesion must/should be "contained" |
| 12 | Lesions must/should be adjacent to near normal surrounding articular cartilage with minimal to absent degenerative changes (e.g. Kellgren-Lawrence Grade 2 or less) |
| 13 | Lesions must/should be opposed by near normal articulating cartilage (e.g. grade 0, 1, 2) |
| 14 | Joint should have absence of a corresponding 'kissing lesion' with a Modified Outerbridge Scale of Grade III or IV of the distal femur (trochlea, condyles), patella, or tibia |
| | **Joint and health stability** |
| 15 | Patient should have normal knee alignment or surgically corrected at time of allograft or prior to grafting |
| 16 | The knee should have meniscus that is intact or has stable partial tears |
| 17 | Individuals who have had a previous total meniscectomy is a contraindication to OCA transplantation |
| 18 | The knee should be stable with intact or reconstructed ligaments |
| 19 | Knee should have normal tibial-femoral and/or patella/femoral alignment |
| 20 | The joint space should be normal without evidence of inflammation or degenerative changes |
| 21 | Presence inflammation or osteoarthritis of the joint is a contraindication to OCA transplantation |
| 22 | Joint space should be normal or near-normal with no > 15% joint space narrowing |
| 23 | Individuals with a cartilaginous defect associated with osteoarthritis should be a contraindication |
| 24 | Individuals with inflammatory joint disease should be a contraindication to OCA |

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| | |
|---|---|
| 25 | Individuals where osteoarthritic or inflammatory process significantly affects the quality of perilesional cartilage should be a contraindication |
| 26 | Presence of active infection is a contraindication |
| 27 | Presence of synovial disease is a contraindication |
| 28 | Patient history of malignancy is a contraindication |
| 29 | Presence of a current unresected tumor is a contraindication |
| | **Patient selection** |
| 30 | The defect should be identified during an MRI or CT arthrogram, or during arthroscopy |
| 31 | OCA can treat avascular necrosis lesions of the femoral condyle |
| 32 | The chondral defect of the knee should be caused by acute or repetitive trauma |
| 33 | OCA transplantation can be used in skeletally immature patients |
| 34 | Patients should show skeletal maturity |
| 35 | There should be criteria for maximum and minimum age limit. |
| 36 | Adult patients should be too young to be considered an appropriate candidate for total or partial knee arthroplasty or other reconstructive knee surgery (e.g. less than or equal to 55 years) |
| 37 | There should be criteria for maximum BMI |
| 38 | BMI greater than 35kg/$m^2$ is considered severe obesity and a contraindication to OCA |
| 39 | Patient selection should include no history of cancer in the bones, cartilage, fat, or muscle of affected limb |
| 40 | Patient selection should include absence of localized or systemic infection |
| 41 | Patient must be willing and capable to participate in an extensive period of non-weight bearing and supervised post-operative physical rehabilitation program |
| | **Patient history** |
| 42 | The defect should cause disabling localized knee pain that is unresponsive to conservative treatment |
| 43 | Patient should have function-limiting pain (e.g. loss of knee function which interferes with ability to carry out age appropriate activities of daily living and/or demands of employment) |
| 44 | Patient should have presence of disabling, localized knee pain of greater than or equal to 6 months duration that is refractory to conservative treatment, as well as, arthroplasty and/or microfracture techniques |
| 45 | Patient should have debilitating symptoms that significantly limit ambulation |
| 46 | Patient should have at least 6 months of keen pain and failed conservative treatment measures |
| 47 | Patient should have failed a provider-directed non-surgical management for at least three (3) months in duration |
| 48 | Patient should have disabling symptoms such as locking, swelling, or knee pain that are unresponsive to conservative treatment for a minimum of 2 months |
| 49 | Patients should have failed arthroscopic procedure or are not candidates for such procedure because of size, shape, or location of the lesion |

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| | |
|---|---|
| 50 | Patient should have unsatisfactory outcome with previous arthroscopic or other traditional surgical procedure (i.e. microfracture drilling, abrasion, osteochondral graft) |
| 51 | If debridement is only prior surgical treatment consideration should be given to marrow-stimulation techniques before osteochondral grafting |
| 52 | OCA transplantation should be indicated when other cartilage repair techniques (e.g. microfracture, osteochondral autografting or autologous chondrocyte implantation) would be inadequate due to lesion size, location, or depth |
| | **Other locations/joints for OCAs** |
| 53 | OCA of all other joints besides the knee is investigational due and does not have scientific evidence of effectiveness improving health outcomes |
| 54 | OCA transplantation of the patella unproven/investigational |
| 55 | OCA transplantation of the talus unproven/investigational |
| 56 | OCA transplantation of the shoulder unproven/investigational |
| 57 | OCA transplantation of the elbow unproven/investigational |

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**Appendix Table 2:** Level of evidence for statements that reach consensus

| MOCA Likert survey results | | | | |
|---|---|---|---|---|
| **Statements** | **Level of Evidence** | **% Agree** | **% Neither agree or disagree** | **% Disagree** |
| Defect should be full thickness and grade III or IV[1,7–100] | II, III, IV | 96.7 | 0.0 | 3.3 |
| Defect can be located on patella[5,19,25,34,38,42,45,60,63,67,83,95,101] | IV | 96.7 | 3.3 | 0.0 |
| Weight bearing and non-weight bearing should not be criteria[8] | IV | 83.3 | 10.0 | 6.7 |
| Specific location of the knee should not be criteria[1,3-100,] | II, III, IV | 80.0 | 3.3 | 16.7 |
| The defect should be identified during an MRI or CT arthrogram, or during arthroscopy | NA | 93.3 | 3.3 | 3.3 |
| Lesions must/should be adjacent to near normal surrounding articular cartilage with minimal to absent degenerative changes (e.g. Kellgren-Lawrence Grade 2 or less)[18,30,58,59,95,96] | IV | 80.0 | 13.3 | 6.7 |
| Patient should have normal knee alignment or surgically corrected at time of allograft or prior to grafting[17,25,38,40,41,44,50,52,57-59,80-82,100] | IV | 96.7 | 3.3 | 0.0 |
| The knee should be stable with intact or reconstructed ligaments[13,80,82,87,94] | III, IV | 96.7 | 3.3 | 0.0 |
| Individuals where osteoarthritic or inflammatory process significantly affects the quality of perilesion cartilage should be a contraindication[20,30,58,59,95,96] | IV | 80.0 | 20.0 | 0.0 |
| Presence of active infection is a contraindication | NA | 96.7 | 0.0 | 3.3 |
| OCA transplantation can be used in skeletally immature patients[64,92] | IV | 93.3 | 3.3 | 3.3 |
| Patient selection should include absence of localized or systemic infection | NA | 100.0 | 0.0 | 0.0 |
| Patient must be willing and capable to participate in an extensive period of non-weight bearing and supervised post-operative physical rehabilitation program[73] | III | 80.0 | 3.3 | 16.7 |
| Patient should have function-limiting pain (e.g. loss of knee function which interferes with ability to carry out age appropriate activities of daily living and/or demands of employment) | NA | 80.0 | 10.0 | 10.0 |

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| | | | | |
|---|---|---|---|---|
| OCA can treat avascular necrosis lesions of the femoral condyle[8,21,59,32,41,86] | II, IV | 96.7 | 0.0 | 3.3 |
| OCA transplantation should be indicated when other cartilage repair techniques (e.g. microfracture, osteochondral autografting or autologous chondrocyte implantation) would be inadequate due to lesion size, location, or depth[1-100,] | II, III, IV | 80.0 | 6.7 | 13.3 |
| The patella region is non-load bearing | NA | 3.3 | 0.0 | 96.7 |
| Osteochondral allograft (OCA) is only for femoral articulation[5,19,25,34,38,42,45,60,63,67,83,95,101] | IV | 6.7 | 10.0 | 83.3 |
| Patient history of malignancy is a contraindication | NA | 10.0 | 10.0 | 80.0 |
| Patients should show skeletal maturity[64,92] | IV | 16.7 | 3.3 | 80.0 |
| There should be criteria for maximum and minimum age limit[1,3,14,23,27,51,64,68,92,95] | III, IV | 6.7 | 16.7 | 76.7 |
| Patient should have presence of disabling, localized knee pain of greater than or equal to 6 months duration that is refractory to conservative treatment, as well as, arthroplasty and/or microfracture techniques[33,35,48,58,72,98] | III, IV | 10.0 | 6.7 | 83.3 |
| Patient should have unsatisfactory outcome with previous arthroscopic or other traditional surgical procedure (i.e. microfracture drilling, abrasion, osteochondral graft) [33,35,48,58,72,98] | III, IV | 13.3 | 6.7 | 80.0 |
| If debridement is only prior surgical treatment consideration should be given to marrow-stimulation techniques before osteochondral grafting[33,35,48,58,72,98] | III, IV | 3.3 | 10.0 | 86.7 |
| OCA of all other joints besides the knee is investigational and does not have scientific evidence of effectiveness improving health outcomes [5,19,25,34,38,42,45,60,95,101-152] | II, III, IV | 10.0 | 3.3 | 86.7 |
| OCA transplantation of patella is unproven/investigational[5,25,34,38,42,45,60,63,67,83,95,101] | IV | 3.3 | 0.0 | 96.7 |
| OCA transplantation of the talus is unproven/investigational[102,103,105-107,109-116,118-120,123,125,126,128,134,136,137,141-145,147, 149, 153] | II, III, IV | 10.0 | 0.0 | 90.0 |

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