CRITICALLY APPRAISED TOPIC

FOCUSED CLINICAL QUESTION

In a 25-year-old female with cam femoroacetabular impingement (FAI), is arthroscopic surgery or conservative physical therapy treatment more effective in reducing pain?

AUTHOR

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CLINICAL SCENARIO

The patient is a 25-year-old female with complaints of pain and reduced function. She is physically active, but reports difficulty maintaining her prior level of function due to the severity of pain experienced with certain activities. She has had imaging and met with an orthopedic surgeon to determine the cause of pain, finding cam femoroacetabular impingement (FAI). The patient wondered if she could follow a more conservative plan of care in physical therapy to reduce her pain without requiring surgical intervention.

The prevalence of FAI is unknown, as it is possible to have the bony deformity at the hip (on the femoral or acetabular aspect of the joint) without presenting with symptoms.[1] Although there are conservative management options such as activity modification and strengthening of the muscles, since the bony abnormality is present in individuals with FAI, there is no true way to prevent it.[1] FAI is becoming increasingly recognized as a precursor to arthritis, yet research continues to be limited in determining best treatment.[10] While arthroscopic surgical techniques are continuing to improve, little research has been completed in assessing the effectiveness of conservative management of FAI.[6,10] In addition, though surgical treatment has been shown in the short-term to improve pain for individuals with FAI, there is limited research in finding baseline characteristics that may predict successful or failed treatment outcomes.[8] Since physical therapy is a direct access healthcare option, not only is it important to know how to administer various special tests to determine clinical diagnosis, but clinicians must also stay current with up-to-date evidence-based practice to educate patients and determine the most appropriate plan of care with the best possible outcome.

SUMMARY OF SEARCH

[Best evidence appraised and key findings]

- 10 studies were selected that met the inclusion/exclusion criteria. From there, three studies were found to be of higher evidence and/or more applicable to the clinical question in this appraisal and therefore were deemed "best evidence" for further discussion. Currently, limited research exists in directly comparing outcomes of conservative and surgical treatment interventions for FAI.
- While conservative management is found to be a viable first step in treating patients with FAI and should be considered prior to surgery, more active individuals are likely to require further surgical intervention.[10] Age and severity of cartilage damage are found to be the two main preoperative factors associated with failed surgical outcomes.[8] Cartilage degeneration will continue to occur over time, but those individuals with less severe chondral damage are more likely to have success postoperatively.[13]
- Future research is required to evaluate more long-term effects of both conservative management as well as surgical intervention.

CLINICAL BOTTOM LINE

In treating young adults with signs and symptoms of FAI who are unable to complete daily activities due to pain, evidence suggests that conservative management has the potential to be an effective intervention plan. However, if an individual is more active, of younger age, and with less severe damage to the cartilage, surgery may be the better treatment for successful reduction of pain. Future research is needed to understand long-term effects, but a clinician must educate patients on available conservative management techniques and understand which patients are more likely to benefit from conservative treatment versus surgical intervention.

This critically appraised topic has been individually prepared as part of a course requirement and has been peer-reviewed by one other independent course instructor

SEARCH STRATEGY

Terms used to guide the search strategy			
Patient/Client Group	**I**ntervention (or Assessment)	**C**omparison	**O**utcome(s)
young adult* female* hip femoroacetabular impingement FAI	arthroscopic surgery surgical operative	conservative physical therapy physiotherapy nonoperative non-operative nonsurgical non-surgical	pain

Final search strategy:

Show your final search strategy from one of the databases you searched. In the table below, show how many results you got from your search from each database you searched.

PubMed

1. young adult AND female
2. hip AND femoroacetabular impingement
3. femoroacetabular impingement AND pain
4. femoroacetabular impingement AND treatment
5. (surgery OR surgical) AND treatment
6. physical therapy OR physiotherapy
7. (conservative OR nonoperative OR non-operative) AND treatment
8. #1 AND #2 AND #3 AND #4
9. #2 AND (#5 OR #6 OR #7)
10. #3 AND #5
11. #3 AND (#6 OR #7)
12. #4 AND #5
13. #4 AND (#6 OR #7)
14. **#4 AND #5 AND #7**

Databases and Sites Searched	**Number of results**	**Limits applied, revised number of results (if applicable)**
PubMed (femoroacetabular impingement AND treatment) AND ((surgery OR surgical) AND treatment) AND ((conservative OR non-operative OR nonoperative) AND treatment)	**68**	
CINAHL femoroacetabular impingement AND treatment	**289**	**115** – applied limit of female sex and young adults (19-44) **83** – applied limit of title only
Cochrane femoroacetabular impingement treatment	**34**	**47** – applied limit of Trials **All searches: English**

INCLUSION and EXCLUSION CRITERIA

Inclusion Criteria
• Published in English • Femoroacetabular impingement diagnosis • Intervention by way of arthroscopic surgery and/or conservative management (non-surgical) • Sample included: young adults aged 20-50 • Outcome measures used to assess the effects of treatment on pain
Exclusion Criteria
• Population with neurologic conditions affecting pain and general hip function • Population with congenital anatomical defects such as hip dysplasia affecting hip function and pathomechanics of the hip

RESULTS OF SEARCH

A total of 10 relevant studies were located from the search and categorized in the table below using the Downs and Black checklist[2] for non-randomized trials and the AMSTAR checklist[3] for systematic reviews with the level of evidence determined using the Hierarchy of Evidence[4].

Summary of articles retrieved that met inclusion and exclusion criteria

Author (Year)	Study quality score[2,3]	Level of Evidence[4]	Study design
Khaled Emara, Wail Samir, EL Hausain Motasem, Khaled Abd EL Ghafar (2011)[5]	**Downs and Black 10/29**	**Level IV**	**Case Series**
Laura E Diamond, Fiona L Dobson, Kim L Bennell, Tim V Wrigley, Paul W Hodges, Rana S Hinman (2014)[6]	**AMSTAR 10/11**	**Level IIa**	**Systematic Review**
Peter D. Fabricant, Benton E. Heyworth, Bryan T. Kelly (2011)[7]	**Downs and Black 16/29**	**Level IV**	**Case Series**
Ehsan Saadat, Scott D. Martin, Thomas S. Thornhill, Sarah Brownlee, Elena Losina, Jeffrey N. Katz (2014)[8]	**AMSTAR 8/11**	**Level IIIa**	**Systematic Review**
Peter DH Wall, Edward J Dickenson, David Robinson, Ivor Hughes, Alba Realpe, Rachel Hobson, Damian R Griffin, Nadine E Foster (2016)[9]	**PEDro 4/11**	**Level IIb**	**Randomized Control Trial**
Devyani Hunt, Heidi Prather, Marcie Harris Hayes, John C. Clohisy (2012)[10]	**Downs and Black 15/29**	**Level IV**	**Case Series**
Daniele Munegato, Marco Bigoni, Giulia Gridavilla, Stefano Olmi, Giovanni Cesana, Giovanni Zatti (2015) [11]	**AMSTAR 3/11**	**Level IIa**	**Systematic Review**
PDH Wall, JS Brown, N Parsons, R Buchbinder, ML Costa, D Griffin (2014)[12]	**AMSTAR 3/11**	**Level IIa**	**Systematic Review**

Florian Schmaranzer, Pascal C. Haefeli, Markus S. Hanke, Emanuel F. Liechti, Stefan F. Werlen, Klaus A. Siebenrock, Moritz Tannast (2016)[13]	**Downs and Black 15/29**	**Level IIb**	**Prospective Cohort**
Asheesh Bedi, Bryan T. Kelly (2013)[14]	**AMSTAR 5/11**	**Level IIIa**	**Systematic Review**

BEST EVIDENCE

The following 3 studies were identified as the 'best' evidence and selected for critical appraisal. Reasons for selecting these studies were:

- Saadat E, Martin SD, Thornhill TS, Brownlee S, Losina E, Katz JN. Factors associated with failure of surgical treatment for femoroacetabular impingement: Review of the literature. *Am J Sports Med*. 2014; 42(6): 1487-1495. **doi: 10.1177/0363546513500766**
  - This study was chosen as 'best' evidence as it scored quite high on its quality evaluation tool (8/11). In addition, it is considered to be in the middle of the hierarchy of evidence at Level IIIa. This systematic review is related to my original question, as well, in determining the factors associated with poor surgical outcomes for FAI treatment. With a better understanding of these implications, I can knowledgably discuss a patient's options for FAI treatment to allow for more informed decisions.
- Schmaranzer F, Haefeli PC, Hanke MS, et al. How does the dGEMRIC Index change after surgical treatment for FAI? A prospective controlled study: Preliminary results. *Clin Orthop Relat Res*. 2016. **doi: 10.1007/s11999-016-5098-3**
  - This study was chosen as 'best' evidence as it scored fairly average on its quality evaluation tool (15/29), better than five other studies listed above. In addition, it is one of the better studies in terms of its hierarchical level of evidence at Level IIb as a prospective cohort study. This study is relevant to my original research question in that it compares a variety of outcomes (dGEMRIC as well as studies such as the WOMAC, HOOS, and HHS) between subjects who underwent surgical intervention versus those who chose nonoperative treatment instead for FAI treatment in the young adult.
- Hunt D, Prather H, Harris Hayes M, Clohisy JC. Clinical outcomes analysis of conservative and surgical treatment of patients with clinical indications of prearthritic, intra-articular hip disorders. *PM R*. 2012; 4(7): 479-487. **doi: 10.1016/j.pmrj.2012.03.012**
  - This study was chosen as 'best' evidence as it also scored fairly average, tied with the Schmaranzer et al. (2016) study at 15/29 on its quality evaluation tool. Unfortunately, this study is classified as Level IV evidence on the hierarchy, meaning it is not considered to be the best evidence. However, this study is more relevant to my original question than some of the remaining studies listed above, thereby being included as one of the top three 'best' studies. This study also meets the original inclusion criteria in regards to age, considers a variety of outcome measurements, and considers both surgical and conservative interventions as treatment options for FAI in the young adult.

SUMMARY OF BEST EVIDENCE

(1) Description and appraisal of Factors associated with failure of surgical treatment for femoracetabular impingement: Review of the literature by Ehsan Saadat, Scott D. Martin, Thomas S. Thornhill, Sarah Brownlee, Elena Losina, & Jeffrey N. Katz, 2014

Aim/Objective of the Study/Systematic Review:

The objective of this systematic review was to determine the preoperative elements that may affect the outcome of femoroacetabular impingement (FAI) open surgery or arthroscopic surgery by reviewing current literature.

Study Design

[e.g., systematic review, cohort, randomised controlled trial, qualitative study, grounded theory. Includes information about study characteristics such as blinding and allocation concealment. When were outcomes measured, if relevant]

Note: For systematic review, use headings 'search strategy', 'selection criteria', 'methods' etc. For qualitative studies, identify data collection/analyses methods.

This study could be classified as a systematic review, cohort composition, and pre-post design.

Search Strategy

- The authors searched the PubMed database with the words "femoroacetabular", "impingement", and "treatment". Two different authors screened the studies before convening to agree on accepted articles.

Selection Criteria

- Inclusion:
  - English language
  - Articles published between 1966 (Medline origin) and August 2012
  - The study must have been predominantly reporting about the treatment of FAI
  - Arthroscopic, open, or combination surgical intervention for FAI
  - Minimum follow-up no greater than 6 months with details surrounding patient improvement/failure
  - Outcome measures for pain and function
  - Articles must include hips with failed surgical intervention (per the authors' two definitions of "failure") and identification of the influencing preoperative factors with completed statistical analysis
- Exclusion:
  - Articles predominantly reporting on specific surgical technique(s) for FAI
  - Articles reporting on non-operative treatment for FAI
  - Research on surgical intervention that did not report any quantitative data or statistical analysis in the assessment of preoperative influences and their relationship with surgical outcomes
  - Studies without report of surgical failure

Methods

- Two separate authors reviewed 319 articles before convening to agree on 13, which were accepted from those that met the eligible inclusion criteria. None of the reviewed articles were randomized controlled trials (RCTs). A p value of <0.05 was considered a statistically significant association between the preoperative factor and a failed surgical outcome in the accepted articles. The authors utilized a semiquantitative assessment of preoperative factors that may influence prognosis, but did not complete a meta-analysis with the data from the included articles.

Data Extraction

- The factors examined in all accepted studies were the design of the study, composition of the study's cohort(s), duration of study, follow-up time, surgical failure (per the authors' two definitions of "failure"), and individual patient factors that affected surgical outcome.

Setting

[e.g., locations such as hospital, community; rural; metropolitan; country]

12 of the 13 studies were competed in "single centers". Though the exact setting is not specified for each individual study included in this systematic review, it can be inferred the surgeries were completed in a hospital setting. Countries the studies took place in were the United States, Switzerland, France, Spain, and Canada. The systematic review was completed at Brigham and Women's Hospital in Boston, Massachusetts.

Participants

[N, diagnosis, eligibility criteria, how recruited, type of sample (e.g., purposive, random), key demographics such as mean age, gender, duration of illness/disease, and if groups in an RCT were comparable at baseline on key demographic variables; number of dropouts if relevant, number available for follow-up]

Note: This is not a list of the inclusion and exclusion criteria. This is a description of the actual sample that participated in the study. You can find this descriptive information in the text and tables in the article.

The authors of this systematic review included 13 studies; retrospective and prospective studies were included, but no RCTs. The number of hips (rather than individual participants due to some bilateral involvement) in the included studies totaled 1,447 (ranging 20-233 hips). The mean age of the participants was 37.3 years of age (ranging 29-57 years in all 13 studies). One study only assessed individuals over the age of 50, while another focused on purely athletic participants. Gender was reported in 12 of the 13 studies, ranging from 20% female to 52% female (mean of 38.8% female in the 12 studies). The studies followed up with the participants at a length of time that ranged 22-61 months postoperatively, with no discussion as to the number of participants lost at follow-up.

Intervention Investigated

[Provide details of methods, who provided treatment, when and where, how many hours of treatment provided]

Control

The articles included in this review were not required to have a control group. The focus was on within-group change for FAI surgical treatment.

Experimental

The number of individual hips (opposed to the number of participants, due to some with bilateral treatment) undergoing arthroscopic, open, or combination surgery for FAI treatment totaled 1,447. It is noted in the systematic review that hip surgeons and arthroscopists with a lot of experience completed the surgeries. As mentioned above in the "Setting" subsection, it can be inferred the surgeries were completed in a hospital in the countries in the articles (United States, Switzerland, France, Spain, and Canada). No additional treatment outside of the surgery was described in the articles, so the single surgery itself can account for the frequency and duration of treatment.

Outcome Measures (Primary and Secondary)

[Give details of each measure, maximum possible score and range for each measure, administered by whom, where]

The primary outcome examined was failure of FAI surgical intervention and the secondary outcomes were measures for patient satisfaction, functional scores, and pain. Cartilage degeneration and radiographic measurements were examined in some studies as potential predictors, but were not utilized as outcome measures. Failure was classified by the authors of this systematic review as either having no postoperative statistical improvement (in pain, function, or patient satisfaction) or as having continued symptoms requiring subsequent surgery (revision or an adjustment to hip arthroplasty, or THA). 7 of the 13 studies utilized outcome measures to assess pain and function. For the purpose of this appraisal, only outcomes related to pain are summarized. These measures included the Harris Hip Score (HHS), the Western Ontario and McMaster Universities (WOMAC) arthritis index, and a combination of the Merle d'Aubigné-Postel and Dexus scores. The HHS is measured with a score of 0-100, with scores closer to 0 indicating poor function.[15] The WOMAC is created into a percentage out of 96 total points, with a higher percentage indicating a higher level of impairment.[16] The Merle d'Aubigné-Postel scores 0-6 on pain, walking ability, and mobility for a total of 0-18 points, with a score closer to 0 indicating poor function.[17] In the data provided in the Appendix of this systematic review, the modified Harris Hip Score (mHHS) and Non-Arthritic Hip Score (NAHS) were included as outcome measures. The mHHS uses eight questions and is scored 0-91 points, with a score closer to 0 indicating a higher level of impairment.[18] The NAHS is scored from 0-80, with scores closer to 0 indicating a higher level of impairment.[19]

Main Findings

[Provide summary of mean scores/mean differences/treatment effect, 95% confidence intervals and p-values etc., where provided; you may calculate your own values if necessary/applicable]

13 studies were included in the final assessment. Only those studies finding statistical significance using a 95% confidence interval ($p < 0.05$) were included in this systematic review. The preoperative factors considered as potential influencers to postoperative outcomes were demographic factors (age, gender, BMI), clinical history and exam findings (history of hip surgery, symptom type and duration, preoperative range of motion), pain and functional measures (HHS, WOMAC, mHHS, NAHS, HOS, SF-12), cartilage degeneration, and radiographic findings (impingement type, joint angles, crossover sign). The type of surgical treatment (labral debridement, reinsertion, microfracture) was also considered as an influencing factor on postoperative outcome.

This systematic review concluded from the 13 included studies that various factors could play a role in postoperative outcomes. Of the seven studies that considered age a factor, four found that higher age is a predictive sign of hip arthroplasty. Of the three studies that looked at gender, one found that females are more likely to have a poor surgical outcome. BMI was only considered in two articles, each with different findings; one stated BMI had no effect on subsequent surgery while the other found a BMI of 21.3kg/m^2 to be indicative of requiring hip arthroplasty after FAI surgical intervention. In terms of cartilage degeneration, preoperative joint space was examined by three articles finding that cartilage less than 2mm in thickness was indicative of requiring subsequent surgery; osteoarthritis (OA) was evaluated by two articles in an unspecified manner finding an association (albeit an association not further elaborated upon) between OA and subsequent surgery; osteoarthritis by Tonnis grades was evaluated by four articles, with one finding that higher preoperative Tonnis grades were more likely to result in poor outcomes; cartilage according to the Beck grading system was evaluated in one study stating a Beck grade of 5 to be significant in regards to surgical failure; nonspecific cartilage lesions were evaluated in four articles with two of them finding these lesions to be indicative of a failed surgical outcome. In the two studies that utilized the mHHS, both found that a worse mHHS is statistically significant in its association with a failed outcome requiring subsequent surgery. Longer symptom duration was found in one of the thirteen articles as indicative of requiring subsequent surgery. Surgical intervention in the form of microfracturing to the femoral head and acetabulum was found in one of the articles to be associated with subsequent surgery. Of the 1,447 hips that received surgical intervention for FAI, 302 were found to have failed (per the authors' two definitions of "failure" stated above). The authors did not discuss effect size or power surrounding the clinical significance of this systematic review.

Original Authors' Conclusions

[Paraphrase as required. If providing a direct quote, add page number]

The authors concluded that the two preoperative factors with the most association to failed postoperative outcomes for FAI treatment were age and cartilage damage. Symptom duration is considered to be an influencing factor, although as the authors of this systematic review noted, age, cartilage degeneration, and symptom duration may all be interconnected and requires additional research to further specify which factor is more influential in postoperative outcomes. Moreover, the score on the mHHS may be considered a supplementary indicator of postoperative failure, but again it can be expected that patients of older age with increased cartilage damage and who have had symptoms for longer periods of time will score lower on the mHHS preoperatively, therefore it also requires further research.

Critical Appraisal

Validity

[Identify the strengths and limitations of the study, including potential sources of bias. Comment on the overall methodological quality (including the score) as you determined from your assessment of the article. Comment on anything you believe was missing in the paper.]

This systematic review scored an 8/11 on the AMSTAR rating scale. The study included its purpose and reasoning for this research. The authors provided the reader with their specific search strategy, inclusion/exclusion criteria, and data extraction. The studies chosen for this systematic review were done so by two separate authors independently reviewing articles before convening to agree on those accepted. The authors included a table of the articles with their respective characteristics and findings. The methods in choosing the studies and assessing the quality of the individual studies were explained.

The authors were forthcoming about the limitations in this systematic review, specifically the lack of high-level evidence such as RCTs. Due to continued need for additional research on FAI, many of the studies lacked quality research and quantitative analysis. The authors also only utilized one database (PubMed) to search for articles. The issue of confounding is a possibility as the applicability of these results to the general public is questioned due to the high skill level of the surgeons involved in comparison to general surgical proficiency. In addition, the studies included in this systematic review did not place emphasis on a variety of other factors potentially causing failed surgical outcomes, such as compression and traction on hip pathology (versus just viewing repetitive loading and anatomical alignment as factors), the influence of the iliopsoas tendon, effects of hypermobility or hyperlaxity, and the assessment of femoral version. The articles in this systematic review only considered intra-articular influences on FAI whereas research is now acknowledging extra-articular influences as well. The authors of this study were specific in their inclusion criteria for quantitative analysis and statistical significance yet did not complete any further calculations or statistical analyses with the data from all articles before making conclusions. The individual studies do lack blinding, but since this systematic review is looking at surgical outcomes, it is not possible for the participants or researchers to be blinded to the intervention/results. Publication bias also plays a role, as the authors were strictly assessing failed surgical outcomes and did not incorporate studies detailing successful FAI treatment intervention.

Interpretation of Results

[This is YOUR interpretation of the results taking into consideration the strengths and limitations as you discussed above. Please comment on clinical significance of effect size / study findings. Describe in your own words what the results mean.]

The results from this systematic review provide clinicians with a better understanding of the preoperative factors for FAI intervention that have the potential to negatively influence postoperative outcomes. The authors concluded that older age and a larger degree of cartilaginous damage are the two most significant aspects of patients to know prior to surgery for FAI treatment. By acknowledging the factors with a negative influence on surgical outcomes, it's possible to better screen patients and further specify the appropriate candidates for surgical intervention for FAI. However, it's important to note that this systematic review is not all-inclusive in regards to all possible preoperative factors to consider. While the review does not use quantitative statistical analysis to support significance, I think the results of this study are clinically significant in determining appropriate course of action for patients with FAI.

(2) Description and appraisal of How does the dGEMRIC Index change after surgical treatment for FAI? A prospective controlled study: Preliminary results by Florian Schmaranzer, Pascal C. Haefeli, Markus S. Hanke, Emanuel F. Liechti, Stefan F. Werlen, Klaus A. Siebenrock, & Moritz Tannast, 2016

Aim/Objective of the Study/Systematic Review:

The objective of this study was to determine the degree/severity of cartilage degeneration (measured by the dGEMRIC Index) in individuals with femoroacetabular impingement (FAI), comparing those who undergo

surgical intervention to those who are treated conservatively, and how that finding compares to patient-reported outcome measures.

Study Design

[e.g., systematic review, cohort, randomised controlled trial, qualitative study, grounded theory. Includes information about study characteristics such as blinding and allocation concealment. When were outcomes measured, if relevant]

Note: For systematic review, use headings 'search strategy', 'selection criteria', 'methods' etc. For qualitative studies, identify data collection/analyses methods.

This study could be classified as a prospective cohort with a pre-post design.

Methods

- Participants were chosen between September 2012 and August 2016. Participants were excluded for having prior surgery, a childhood disease (Legg-Calvé-Perthes, slipped capital femoral epiphysis), unconfirmed FAI diagnosis, end-stage osteoarthritis, and/or were unavailable for 1-year follow-up. Accepted participants underwent delayed gadolinium-enhanced MRI of cartilage (dGEMRIC) and then chose to undergo surgery (hip arthroscopy or surgical hip dislocation) or conservative, non-operative treatment for FAI. Two separate authors measured the dGEMRIC indices independently from each other. Patient-reported outcome measures were administered at baseline and one-year follow-up.

Statistical Analysis

- Power analysis was completed using G*Power finding a level of β to be 0.20 (power of 0.80). Intraclass correlation coefficient was utilized in comparing the two authors' dGEMRIC measurements to assess intra-observer reliability using a 95% confidence interval. Normal distribution data was analyzed with unpaired t-tests while non-normal distribution data was analyzed with the Mann-Whitney U-test. 'Categorical variables' were analyzed with the chi square test. Linear regression analysis was utilized in assessing the correlation between the change in outcome measures from baseline to follow-up and the baseline dGEMRIC indices.

Setting

[e.g., locations such as hospital, community; rural; metropolitan; country]

This study was conducted at the Department of Orthopaedic Surgery, Inselspital, at the University of Bern in Bern, Switzerland. It is inferred the surgeries were completed in this hospital setting. There is no explicit description of the conservative treatment used, but it is inferred as no change from daily routine thereby not requiring a specific setting.

Participants

[N, diagnosis, eligibility criteria, how recruited, type of sample (e.g., purposive, random), key demographics such as mean age, gender, duration of illness/disease, and if groups in an RCT were comparable at baseline on key demographic variables; number of dropouts if relevant, number available for follow-up]

Note: This is not a list of the inclusion and exclusion criteria. This is a description of the actual sample that participated in the study. You can find this descriptive information in the text and tables in the article.

After narrowing down the participants and adjusting for those lost to follow-up, 39 participants (40 hips) were considered eligible for the study between September 2012 and April 2016. 20 hips underwent surgical intervention and 20 hips underwent conservative, non-operative treatment. At baseline, the two groups were comparable in terms of their Tönnis osteoarthritis scores, outcome measure scores, and dGEMRIC indices. The demographics of the non-operative group, made up of 20 participants and 20 hips, included an average age of 36 and consisted of 60% female participants. The operative group was comprised of 19 participants and 20 hips, was only 30% female, and had a lower average age of 30 years. Though the recruitment method is not explicitly stated, it can be inferred to be a sample of convenience. The drop out rate was already taken into account prior to final data reporting by the authors.

Intervention Investigated

[Provide details of methods, who provided treatment, when and where, how many hours of treatment provided]

Control

The non-operative group is deemed the control group in this study. 20 participants (20 hips) chose conservative treatment of FAI symptoms, allowing for a natural progression of FAI. In this case, there was no treatment provider, nor setting, and participants continued with their daily routine between baseline measurements and one-year follow-up. Clinical evaluation of the participants took place at baseline and at one-year follow-up, and was completed by one of three authors not involved in the care of participants so as to avoid bias.

Experimental

19 participants (20 hips) chose surgical intervention for treatment of FAI symptoms. Based on severity of the deformities, 12 hips underwent hip dislocation and 8 hips underwent hip arthroscopy, though the two surgical groups were similar in regards to demographic information and characteristics on radiographs. As mentioned above in the "Setting" subsection, the surgeries were completed at the Department of Orthopaedic Surgery, Inselspital, at the University of Bern in Bern, Switzerland. No additional treatment outside of the surgery was described, so the single surgery itself can account for the frequency and duration of treatment.

Outcome Measures (Primary and Secondary)

[Give details of each measure, maximum possible score and range for each measure, administered by whom, where]

The dGEMRIC Index was utilized as a primary outcome in this study, where a higher index is associated with a healthier joint. The dGEMRIC Index was used to evaluate the amount of cartilage degeneration between the initiation of treatment (or lack of treatment for the control group) and the one-year follow-up. The patient-reported outcome measures (PROMs) the authors examined were the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), the Hip Disability and Osteoarthritis Outcome Score (HOOS), and the modified Harris Hip Score (mHHS). In addition, the participants in the experimental group were assessed using the Beck grading scale for intraoperative damage. For the purpose of this appraisal, only the PROMs, or outcomes related to pain, are summarized. The WOMAC is created into a percentage out of 96 total points, with a higher percentage indicating a higher level of impairment.[16] The HOOS is a 40-item questionnaire totaling a score between 0-100, with a score closer to 0 indicating more severe symptoms.[20] The mHHS uses eight questions and is scored 0-91 points, with a score closer to 0 indicating a higher level of impairment.[18] These three PROMs were administered at the beginning of the study and again at the one-year follow-up.

Main Findings

[Provide summary of mean scores/mean differences/treatment effect, 95% confidence intervals and p-values etc., where provided; you may calculate your own values if necessary/applicable]

The authors of this study found that the control and experimental groups experienced a decreased dGEMRIC Index, with the experimental (surgical) group to a greater degree. At the one-year follow-up, the dGEMRIC Index for the surgical group was reduced in 43 of 44 regions whereas only four of the 44 regions were reduced in the conservative control group. In the conservative group, the mean acetabular dGEMRIC Index score decreased by 16 points while the mean femoral dGEMRIC Index score decreased by 21 points with a p value of <0.001. In the surgical group, the mean acetabular and femoral dGEMRIC Index scores both decreased by 96 points at the one-year follow-up with a p value of <0.001. The intraclass correlation coefficient was used in comparing the two authors' dGEMRIC index measurements with 95% confidence intervals and moderate to high intraobserver reliability (0.792 to 0.978).

The PROM scores for all participants improved from baseline to the one-year follow-up. The mean WOMAC score increased by 5 points for no difference in the conservative control group with a p value of 0.906 and improved by 28 for the surgical group with a p value of 0.001. The minimally clinical important difference (MCID) for the WOMAC outcome measure is 9.1 points[16], meaning the improvement noted in the scores of the surgical group, not the conservative group, is significant. The mean HOOS score increased by one point for the conservative control group with a p value of 0.828 and improved by 12 points for the surgical group with a p value of 0.004. The MCID for the HOOS in the ADL section is 9 points while the MCID for the sports and recreation section is 6 points, for a total of 15 points.[20] This means neither the improvement noted in the control group nor the surgical groups is clinically significant in this study. The mean mHHS score improved by 11 points for the conservative control group with a p value of 0.013 and improved by 14 points with a p value of 0.001. At one-year follow-up, the MCID for the mHHS is 20 points[21], meaning the improvements made were not clinically significant. No correlation was found between the dGEMRIC Index scores and the change in PROM scores for the conservative control group. However, in assessing the correlation between dGEMRIC Index scores and PROM scores for the surgical group, the change in WOMAC score demonstrated the highest correlation of 0.788 with a p value <0.001.

Original Authors' Conclusions

[Paraphrase as required. If providing a direct quote, add page number]

The authors concluded that the dGEMRIC Index decreases with time regardless of intervention, signifying an increase that occurs in cartilage degeneration over time. This finding is contradictory to the improvement of PROMs in the study for the surgical group from baseline to follow-up one year later, albeit not unusual in comparison to studies for participants undergoing periacetabular osteotomies for hip dysplasia. From these findings, the authors determined that individuals with a lower dGEMRIC Index who present with symptoms that are less severe will experience more benefit from surgery to preserve the hip joint and improve pain via the WOMAC outcome measure. Due to the nature of FAI treatment, the reduced dGEMRIC Index scores in this

study do not provide a clear conclusion on the long-term effects of surgery on joint cartilage. Further research is necessary to determine if these effects on the cartilage are permanent or have potential for reversal.

Critical Appraisal

Validity

[Identify the strengths and limitations of the study, including potential sources of bias. Comment on the overall methodological quality (including the score) as you determined from your assessment of the article. Comment on anything you believe was missing in the paper.]

This prospective cohort study scored a 15/29 on the Downs and Black rating scale. The authors included a clear objective, detailed the participant demographics (including those who were not accepted for the study and those lost to follow-up), and provided the outcome measures that were used in the study. The findings for each intervention group are described in the literature, as well as in table-form for ease of understanding. A power analysis was reported and the authors conducted statistical analysis to evaluate the results and make conclusions. Though the authors detailed the various surgical interventions and the purpose behind each, no potential adverse effects the participants may have experienced during the course of the one-year follow-up were described. Since the participants were a sample of convenience experiencing FAI symptoms, the demographics of the participants, as well as those of the treating clinicians, are not necessarily representative of the entire population and the treatment most participants receive. Also, due to the nature of the study, blinding of the participants was not possible. That being said, the researchers who extracted the data and administered the outcome measures were not involved in any aspect of the surgical care for the participants. In addition, two separate observers at two separate points measured the dGEMRIC Index scores to assess for intraobserver reliability.

The authors were forthcoming about the limitations of this study, including the small sample size and the difference in demographics between the control and experimental groups in terms of age, sex, and alpha angle imaging measurements. Furthermore, use of the dGEMRIC Index is complex as a result of the various influences such as body mass index, physical activity engagement, and injection time that can affect the results. This particular study also allowed participants to undergo either open or arthroscopic hip surgery as FAI treatment, making the comparison between surgical and conservative intervention more vague. Finally, the conservative treatment option was not detailed, but is inferred that these participants did not differ from a typical routine. In this case, likely any intervention in comparison to the control group will demonstrate improvement in outcomes.

Interpretation of Results

[This is YOUR interpretation of the results taking into consideration the strengths and limitations as you discussed above. Please comment on clinical significance of effect size / study findings. Describe in your own words what the results mean.]

The results of this study provide clinicians with a better understanding of which patients might be better suited for surgical intervention for FAI treatment. By using symptom severity and degree of cartilage degeneration as preoperative factors, it is possible to better screen patients and further specify the appropriate candidates for surgical intervention for FAI. Although the degeneration of cartilage worsened with time in both groups, albeit more so in the experimental group, those who chose surgical intervention reported more clinically significant improvements in patient-reported outcome measures which demonstrates clinical importance. As a result, I believe the results of this study are clinically significant in determining plan of care for patients suffering from FAI symptoms, provided imaging is available to understand the severity of cartilaginous involvement.

(3) Description and appraisal of Clinical outcomes analysis of conservative and surgical treatment of patients with clinical indications of prearthritic, intra-articular hip disorders by Devyani Hunt, Heidi Prather, Marcie Harris Hayes, & John C. Clohisy, 2012

Aim/Objective of the Study/Systematic Review:

The objective of this study was to determine the effect conservative physical therapy treatment has on individuals with prearthritic and intra-articular hip disorders such as femoroacetabular impingement (FAI).

Study Design

[e.g., systematic review, cohort, randomised controlled trial, qualitative study, grounded theory. Includes information about study characteristics such as blinding and allocation concealment. When were outcomes measured, if relevant]

identify data collection/analyses methods.

This study could be classified as a prospective observational case series.

Methods

- Participants were recruited between April 2006 and August 2007. All participants were treated with conservative physical therapy treatment for three months as phase one of the intervention. If FAI symptoms continued at that point, phase two was initiated which consisted of an intra-articular hip injection (still deemed conservative management as it is non-surgical). At that point, participants who continued to suffer from pain and reduced function, and had a lesion at the hip that could be treated surgically (as determined by a magnetic resonance arthrogram), phase three was offered for surgical intervention as a final treatment option. Outcome measures in the form of questionnaires were administered to the participants at baseline and at 3-month, 6-month, and 1-year follow-up periods. Participants who continued with conservative management were re-evaluated one year after the initiation of treatment, while the participants who decided upon surgical intervention were re-evaluated one year after the surgery.

Statistical Analysis

- SAS software was utilized for data analysis in this study. Unpaired t-tests were used for continuous measures and X^2 tests were used for categorical measures in cross-sectional comparison of the groups of participants. Wilcoxon or Fisher exact test was used for statistical analysis as a nonparametric alternative when conditions were not met for a t-test or X^2 test. In determining predictive baseline characteristics of the participants that went through all three phases, ultimately choosing surgical intervention, Logistic regression was utilized in comparing characteristics to the participants who successfully continued with conservative management. Analysis of covariance was used to compare the participants' outcome measures at the one-year follow up.

Setting

[e.g., locations such as hospital, community; rural; metropolitan; country]

The study was completed by members of the Department of Orthopaedic Surgery at Washington University School of Medicine in St. Louis, Missouri. Though not explicitly stated, it can be inferred the conservative treatment intervention of physical therapy was completed in a clinical setting local to St. Louis, Missouri. Phase three of surgical intervention was completed at a tertiary hospital associated with Washington University School of Medicine.

Participants

[N, diagnosis, eligibility criteria, how recruited, type of sample (e.g., purposive, random), key demographics such as mean age, gender, duration of illness/disease, and if groups in an RCT were comparable at baseline on key demographic variables; number of dropouts if relevant, number available for follow-up]

Note: This is not a list of the inclusion and exclusion criteria. This is a description of the actual sample that participated in the study. You can find this descriptive information in the text and tables in the article.

The participants in this study were recruited using a sample of convenience from adults between ages 18-50 who were seeking treatment from a physical medicine and rehabilitation physician or an orthopedic surgeon. 58 participants initially enrolled in the study, but six were lost to follow-up leaving 52 participants eligible for completion. Eligible participants must have demonstrated clinical indicators such as anterior or lateral hip pain, a history of pain increased with bearing weight or activity, mechanical symptoms in addition to pain, pain at rest, and the ability to reproduce pain through clinical evaluation. Baseline data is reported for all 58 participants that began the study with radiographic evaluation discovering 32 participants with no deformity, 8 participants with mild dysplasia, and 18 participants with mild FAI. Although this baseline data from imaging is reported using these three classifications, and FAI is the focus of this appraisal, the remainder of data is summed from all 58 participants to ensure baseline data is all-inclusive. The average age of the participants was 35.3 years and 49 of the 58 participants were female. The participants reported suffering from symptoms for an average duration of 18.96 months with 46 participants testing positive for hip impingement and 36 participants exhibiting mechanical symptoms. BMI was comparable across all participants. Participants were re-evaluated at 3-month, 6-month, and 1-year follow-up periods; more specifically, participants who underwent conservative management were re-evaluated one year after the initiation of treatment, while the participants who chose to continue with surgical intervention were re-evaluated one year after the surgery.

Intervention Investigated

[Provide details of methods, who provided treatment, when and where, how many hours of treatment provided]

Control

The control comparison in this study consisted of the participants who were satisfied and/or decided to continue with non-surgical management. In this study, 49 of the 52 participants initially underwent conservative

management (three chose not to due to prior failed physical therapy experiences). Data from the participants who reported relief from this intervention alone was then used as a control in comparison to those who continued on to surgical intervention. The physical therapy protocol followed a set of precautions such as avoiding straight leg raises, avoiding weight bearing rotation of the acetabulum on the femur, and following a general pain-free range of motion program for all activities to reduce further aggravation. The goals of physical therapy included modifying activities, improving hip motion, and training to improve function of the correct muscles (quadriceps, hamstrings, iliopsoas, gluteus maximus and minimus, muscles responsible for hip external rotation, and abdominals) surrounding the hip joint. The participants went to an average of 6.4 physical therapy sessions (ranging from 1-19 sessions) for three months and were then provided a home exercise program to continue independently throughout the course of the year. 38 participants continued on to phase two of receiving a hip injection, also deemed to be a control as it is a non-surgical intervention. 23 participants (44%) are included in the data for non-surgical intervention.

Experimental

29 participants (56%) progressed to phase three of the study for surgical intervention. Depending upon severity and individual situations, surgical options included repair or debridement for a tear of the labrum, repair or debridement for a chondral abnormality, and rectifying a bony deformity via periacetabular osteotomy or femoral osteochondroplasty. The single surgery itself accounts for the frequency and duration of treatment.

Outcome Measures (Primary and Secondary)

[Give details of each measure, maximum possible score and range for each measure, administered by whom, where]

The study evaluated participants with six outcome measure questionnaires along with the additional outcome as to whether or not the participant chose to continue to phase three for surgical intervention. The outcome measures utilized were the Numeric Pain Score (0-10), Short Form-12, Modified Harris Hip Score (mHHS), Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), Nonarthritic Hip Score (NAHS), and Baecke Questionnaire of Habitual Activity. For the purpose of this appraisal, only outcomes associated with pain will be addressed. The authors outlined the aim of each outcome measure used in this study as well as the proper scoring for each: the Numeric Pain Scale used in this study scored from 0-10, with a score close to 10 indicating more severe pain; the mHHS is scored from 0-100 with a score closer to 0 representing more impairment; the WOMAC is scored from 0-96 with a number closer to 96 denoting higher levels of pain and reduced function; the NAHS is scored from 0-100 with a score closer to 0 indicating more pain and reduced function. The authors of this study administered the outcome measure questionnaires at baseline and again at follow-up one year later.

Main Findings

[Provide summary of mean scores/mean differences/treatment effect, 95% confidence intervals and p-values etc., where provided; you may calculate your own values if necessary/applicable]

Of the 49 participants who completed conservative physical therapy management, 14 reported successful outcomes and satisfaction, therefore not moving on to phases two or three of the study for additional treatment. 38 of the original 52 participants (78%) continued on to phase two, with 21 of the participants receiving the hip injection and 35 of the participants having a magnetic resonance arthrogram (MRA). From the 21 participants who received hip injections, positive pain provocation tests prior to injection and negative tests after injection indicated an intra-articular source of pain for 18 participants. From the 35 participants who had an MRA, 25 were found to have an acetabular tear of the labrum, 6 had a combination of a chondral abnormality along with a tear of the labrum, 4 only had the chondral abnormalities, and 2 were found to have mild FAI without a chondral abnormality or tear of the labrum noticeable on MRA. 9 participants from phase two reported satisfaction with conservative care and did not progress to further intervention. In total, 23 participants (44%) reported satisfaction with conservative management of symptoms. After phase two, 29 participants (56%) continued on to phase three of surgical intervention, with a mean duration of 177 days between the start of conservative management to date of surgery.

There were no statistical significant differences at baseline between the participants who continued with conservative management and the participants who progressed to surgical intervention. However, with a p value of 0.02 and 95% confidence interval, it is statistically significant that those who continued to surgical intervention were more active at baseline. Statistically significant improvements in all outcome measures were reported for the conservative management group (reported one year after the start of conservative care) and for the surgical intervention group (one year after surgery) with both reporting reduced activity levels that were statistically significant ($p = 0.0003 – 0.0006$). Notably, neither a deformity nor the severity of the deformity was a statistically significant factor in the participants who chose to undergo surgical treatment.

Original Authors' Conclusions

[Paraphrase as required. If providing a direct quote, add page number]

The authors of this study concluded that conservative management should be the first step in treating participants with signs and symptoms of hip disorders found to be prearthritic and of intra-articular origin. Conservative, non-operative management demonstrates effectiveness in reducing pain and improving function for individuals with FAI. The authors found that baseline activity level, rather than pain or general function, is the only statistically significant factor correlated with the need for surgical intervention.

Critical Appraisal

Validity

[Identify the strengths and limitations of the study, including potential sources of bias. Comment on the overall methodological quality (including the score) as you determined from your assessment of the article. Comment on anything you believe was missing in the paper.]

This case series scored 15/29 on the Downs and Black rating scale. This study clearly stated the objective along with the main outcomes to be measured. Key demographics were included in written and table form at baseline for comparison between groups, with non-surgical and surgical interventions detailed appropriately. The authors provided results in terms of outcome measures at one-year follow-up from the intervention, with explanation for any participants who did not partake in a phase or who were lost to follow-up. The results were analyzed in a statistical manner, with reported p values for all measures. The participants were selected out of convenience from the office of three of the four authors, so it is difficult to say whether the participants in this study are representative of the general population and of the care most patients would receive. Due to the nature of the study, with active involvement (consisting of physical therapy, injection, or surgery), blinding was not used in providing the intervention(s) or the outcome measures. While the participants were all recruited from the same place in the same time period, the specific set up of this study did not allow for randomization of intervention groups.

The authors were forthcoming of the limitations of this study, such as the limited sample size and the finding that more active individuals are more apt to progress to surgery. With a small sample of participants and the understanding that activity plays a role in the effect of an intervention, the results are less representative to then extrapolate for the entire population. In addition, all 52 participants did not have an MRA; rather only 35 of those who progressed to phase two received this imaging. This means that all 52 participants did not obtain a true structural diagnosis. However, this is representative of management of hip pain in clinical practice with the authors reporting that an MRA is not necessarily required for all patients presenting with prearthritic, intra-articular hip disorders if conservative intervention measures are satisfactory. Another limitation the authors reported was that not all participants received the same exact physical therapy treatment based upon differing numbers in visits and the fact that multiple physical therapists and clinics were involved in providing conservative care. The participants who were not satisfied with conservative management discussed surgical options with a physician who is also one of the authors of the study. As a result, the influence of the physician leads to potential bias.

Interpretation of Results

[This is YOUR interpretation of the results taking into consideration the strengths and limitations as you discussed above. Please comment on clinical significance of effect size / study findings. Describe in your own words what the results mean.]

The results from this study sought to find predicting factors that might indicate which patients are more likely to require further intervention in the form of surgical management. Notably, the authors determined that conservative management is the best first step for individuals suffering from prearthritic, intra-articular hip pain as it can provide some patients with satisfactory improvements in pain and function without progressing to further surgical intervention. I think the results of this study are clinically significant as it demonstrates that physical therapy has a place in the conservative management of patients with FAI.

EVIDENCE SYNTHESIS AND IMPLICATIONS

Synthesis of Appraisal

Due to the nature of the clinical question leading this appraisal, high-level research studies such as randomized controlled trials are not available. Therefore, the evidence included above is at a minimal level, which is important to note in using it to guide clinical practice. In regards to determining the best plan of care for a young adult suffering from pain due to FAI, the three studies detailed above concluded which factors may play a role in choosing the most effective plan of care. It was determined that conservative management through education, activity modification, and physical therapy is an appropriate initial treatment option for individuals with FAI.[10] That being said, it should be noted that individuals who are more physically active at baseline will have more successful outcomes with surgical intervention rather than conservative management[10] provided

they are of younger age with less severe cartilage damage at the joint[8,13].

Implications for Clinical Practice

Despite the evidence not being of the highest level, the evidence reviewed in this appraisal supports the implementation of a conservative treatment plan to address the signs and symptoms of FAI.[10] Physical therapy should be focused on avoiding further aggravation of the joint, improving pain-free hip range of motion, and training the surrounding musculature of the hip. Due to such limited evidence in non-operative FAI treatment, a protocol titled Personal Hip Therapy (PHT) provides more structure for a conservative plan of care administered by a physical therapist.[9] In addition to education and physical therapy, conservative management could also include intra-articular injection at the hip to provide pain relief.[10] It is important to acknowledge that neither conservative management nor surgical intervention is an all-inclusive treatment option for all individuals with FAI. More specifically, individuals who are more active at baseline are more likely to require surgical intervention after attempting conservative treatment.[10] That being said, individuals who are older in age and/or have more severe cartilage damage (as determined via radiographic imaging or an MRA) are more likely to suffer failed surgical efforts.[8,13] This supports the idea that early intervention is essential to successful surgical outcomes before cartilage damage becomes irreparable.[14] As a treating physical therapist, it is important to understand all clinical implications of the various treatment options for FAI to educate patients properly and discuss the most appropriate plan of care for the most optimal outcomes. In addition to physical therapists, primary care physicians and orthopedic surgeons should remain up-to-date on this research to educate and provide evidence-based care to their respective patients.

Implications for Future Research

As the authors in each article concluded, future research is certainly required for further understanding of FAI and the most effective treatment options. In particular, these studies need to look at more long-term effects to better appreciate how conservative management or surgical intervention impacts an individual throughout life and return to activity. Research should be comprised of larger sample sizes to allow for more subgroup analysis based on age, activity level, type of activity, duration of symptoms, or previous impairments, for example. Furthermore, while effective physical therapy care is tailored to the specific patient, future research should look at developing a more specific physical therapy protocol to follow for individuals suffering from FAI symptoms. At that point, it would be interesting to again compare and contrast the new evidence-based physical therapy treatment with surgical intervention and the effects each have on individuals with FAI. This would further assist clinicians in using baseline demographic information to determine the best plan of care.

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