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Screening Protocol for TMJ Involvement in those with Juvenile Idiopathic Arthritis

Megan L. Striedel Ms
University of New Mexico - Main Campus, mstriedel@unm.edu

SCREENING PROTOCOL FOR TMJ INVOLVEMENT IN THOSE WITH JUVENILE IDIOPATHIC ARTHRITIS

Megan Striedel, SPT
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University of New Mexico School of Medicine, Division of Physical Therapy,
Advisor: Jodi R Schilz, PhD

Background and Purpose

The patient came into clinic with their chief complaint, and reason for attending physical therapy, as bilateral hip pain that restricted their participation in school sports. In the MRI performed prior to therapy, there was abnormal edema within their pelvic bones and hip joints that were unexplainable, which later required further testing. Based on the MRI, the referring physician gave a non-impact activity restriction to the patient, which did not allow them to perform the tasks needed to be involved in their normal activities. Further into therapy, the patient complained of unilateral heel/Achilles pain that could not be reproduced with testing. This pain caused them to limp in some instances when going into a weight bearing position. Intermittently throughout therapy, the patient would complain of jaw pain that did not allow them to eat normally, no further testing was done to determine a potential cause. The patient's bilateral hip pain improved throughout therapy and they made excellent strength gains, until one of the last appointments when they came in with a "flare-up" of the hip pain again with unexplained cause. Once further testing was performed, the patient was sent to a rheumatologist where they were later diagnosed with Juvenile Idiopathic Arthritis (JIA).

Juvenile Idiopathic Arthritis (JIA) is the most common rheumatic disease in childhood and adolescence with a prevalence of .07 to 4.01 per 1,000 children (Keller, 2015). JIA is an auto inflammatory disease with six subtypes and those affected are usually diagnosed sometime between the ages of six months to 16 years. Within these subtypes can be different presentations, causing a different amount of affected joints as well as different causes of pain within the joints. Some of the most common early signs and symptoms of JIA are: warmth in and around joints, swelling and tenderness of joints, fever, rash, and a limp; those these symptoms vary throughout each case and can be different from day to day (Arthritis.org, 2017). In researching the disease further once my patient was diagnosed, I came across the idea that there is a higher incidence of temporomandibular joint (TMJ) involvement in this population than previously thought. This rang a bell as my patient complained of jaw pain, and also made me wish that I had performed the TMJ testing that we were trained on in school with this patient. Although, I was unaware as to whether or not the testing would be positive due to the cause of the pain which instigated my capstone project.

Unfortunately, detection of TMJ arthritis in children with JIA is difficult as early signs and symptoms are not often present (Kuseler, 2005). The incidence of TMJ involvement in those with JIA Is anywhere between 17%-87% as the testing and confirmation of joint involvement has not been standardized (Zwir, 2015). The gold standard for diagnosing acute arthritis and joint deformation is contrast enhanced magnetic resonance imaging (MRI) (Keller, 2015). Though, with early signs and symptoms not always present, the physician or rheumatologist may not get an MRI of the TMJ when the patient is initially diagnosed. In early onset patients, Weiss et al (2008) found that 75% of those already had acute TMJ arthritis, diagnosed by MRI. Failure to diagnose and treat TMJ arthritis may have severe consequences. When the TMJ is affected, children may have mastication difficulties such as pain on biting or yawning, as well, mandibular growth can be impaired and facial asymmetries can develop (Steenks, 2015). The consequences of not detecting TMJ involvement seem to far outweigh the costs of performing screening for this joint once a child is diagnosed. However, MRI's are expensive, time consuming, not available everywhere, and the imaging procedure, especially for young children,

is demanding (Keller, 2015). Furthermore, sedation using general anesthesia may be required to achieve accurate imaging with contrast MRI, especially in small children (Abramowicz, 2013). Therefore, some other method of screening needs to be created when the means of an MRI are not available or realistic.

A screening tool using physical presentation along with tests and measures to determine involvement of the TMJ in those with JIA would be optimal to use as an alternative, though questions of accuracy still remain. Rheumatologists have begun to attempt to create a screening protocol to be used to determine TMJ involvement in those with JIA. They look at various measures such as maximal mouth opening to correlate to TMJ involvement. Though at this point, there is only research and no protocol in place. Furthermore, the research indicates rheumatologists and orthodontist's performing these screenings and using tools that a PT has also been trained in. Overall, I wanted to see what the research indicates as the best tests and measures that can be used to accurately diagnose TMJ involvement in those with JIA other than a contrast enhanced MRI. Along with that, I want to develop a screening tool for physical therapist's that can be used in clinic and utilizes the skills that we are taught in school for this joint; instead of rheumatologists and orthodontists being the only providers capable of this testing.

Methods

I began my research by formulating my PICO question: Do clinical findings of TMJ dysfunction correlate with TMJ involvement in those with Juvenile Idiopathic Arthritis? I determined the population was going to be those with Juvenile Idiopathic Arthritis (JIA) though in my case there is no true intervention but rather a comparison of clinical findings to the gold standard of MRI. The outcome is determined in the accuracy of the clinical testing and whether or not the clinical exam can correlate to contrast MRI results in early detection of TMJ involvement of those with JIA.

I used the search words TMJ involvement AND JIA in PubMed and received about 60 results. Of those I used only 4 as they involved using a clinical examination as a standalone to determine TMJ involvement or in comparison to some other diagnosis method such as MRI or ultrasound. The other articles were excluded due to discussion about the results you see on MRI or radiographic testing that either diagnoses TMJ involvement or shows the arthritic changes that occur in that joint. I then used these same search words into CINAHL and received 22 results which included many of the same articles. No new articles were found from this search due to continued involvement of imaging results and discussion about treatment rather than detection through clinical testing. I then used the three search terms of clinical findings AND JIA AND TMJ into CINANHL and received 9 results of which I pulled one article out of for my research; others were repeated articles or discussion of symptomology.

I then used the search terms TMJ AND JIA into Cochrane and received seven results. Of these I used one article that related clinical exam findings most commonly found in those with JIA that can determine disease progression rather than diagnosis, but attempting to standardize a screening protocol for rheumatologists to use quickly in clinic. I used those same search terms into PEDro and received zero results. I changed the terms to clinical findings of TMJ and received 6 results, of which none involved those in the JIA population. Once I had determined

these 6 articles for use, I returned to PubMed and used the search terms clinical findings AND JIA AND TMJ compared to MRI of which I received 3 results. I pulled one article from these three results for use as one of the others was a repeat and the other was discussing the serum used for MRI studies.

For my last article to review, I chose to look into the current treatment for TMJ involvement. For this, I used the search terms treatment AND TMJ and received 13,290 results. I decided to narrow down my search terms to physical therapy treatment AND TMJ; receiving 1291 results. When I started to search through these, the third article listed was a recent article discussing conservative treatment and was a great article comparing other commonly used treatments and their efficacy. I decided to use this article as my last one because in looking through the titles of the other results, most were not applicable to my population of those with JIA.

Overall, my research seemed difficult to find options for comparing clinical findings to the gold standard of MRI and I believe this is a newer attempt in research. Most of the search engines used came up with the same articles with mostly journals involved in rheumatoid arthritis performing the research. I believe the articles chosen will help me determine a logical and practical screening protocol for physical therapists to use in clinic to determine TMJ involvement for those with JIA.

Results

The results of the studies reviewed fluctuated because they look at different variables within a single evaluation. Some looked at only objective variables while others looked at subjective and objective variables in tandem however, only some compared them back to MRI contrast results. The idea for the culmination of my capstone will be to formulate an objective testing protocol for physical therapists to use in clinic on patients with JIA to screen the TMJ for arthritic involvement. Therefore, I will mostly be divulging the results of the objective portions of the studies, though pain upon palpation or with a form of motion is considered an objective measure due to the provocation. I will also be reporting the patient's history and subjective findings because they are an important aspect that physical therapist's focus on during evaluation.

Self-reported limitations of TMJ function

Self-reported limitations was done for researchers to examine the patient's view of their symptoms or limitations. Project specific questionnaires were used in some of the studies evaluated and although it was not reported as a standardized questionnaire, the studies looked at similar aspects such as: reduced masticatory function, morning stiffness, pain at rest, and impaired chewing ability. Zwir et al., (2015) had 12% of patients with subjectively reported increased limitation in mouth opening at the first visit though only 3% at the second. Kuseler et al. (2005) and Pedersen et al. (2008) found 27% of subjects had symptoms at baseline based on their questionnaire responses.

Pain

Pain near or due to limitations of the TMJ does not necessarily correlate to dysfunction. The researchers had to look at different aspects of pain and whether or not they correlate to TMJ dysfunction or abnormal testing results. Koos (2014) et al. found moderate to high frequencies of joint and muscle pain upon palpation; though a relatively low sensitivity (.62 and .4) it had a higher specificity (.71 and .86) when used for TMJ diagnosis. In the study by Zwir et al. (2015) they found that 37% of patients reported a symptom at their first visit and only 15% at the second examination which occurred one year later; this included pain at rest and with motion which I am including as provocation. Kuseler et al. (2005) also found that within their 4 examinations there were mild symptoms reported in 20.3% and severe symptoms in 10.2%. The study done by Pedersen et al. (2008) included neck pain upon palpation and found this in 53% of the patients with JIA and none of the healthy subjects, making this a potentially highly correlated variable to look at. Weiss et al. (2008) reported low frequencies of pain on chewing (16%), tenderness on palpation (13%), and tenderness with opening (13%).

Maximal incisal opening (MIO)

MIO is seen as the measurement between the front two teeth of the mandible and maxilla and is a commonly tested variable when evaluating the TMJ. Abramowicz et al.(2013) found a high sensitivity and specificity (.85 and .86) for prediction of TMJ inflammation with decreased MIO when combined with deviation upon opening with a positive predictive value of 1.00. With that, they found an odds ratio of 6.7 for decreased MIO in patients with MRI signs of TMJ arthritis. Keller et al. (2015) found that maximal mouth opening capacity had a p value of 0.005 when correlated with MRI enhancement findings determining those joints with arthritic signs. Steenks et al. (2015) used maximum mouth opening (MMO) as one of their screening protocol tests and compared it with the standard rheumatological exam, the JADAS-27, that does not include examination of the TMJ. They used cut-off values as “normal” values for determining if MMO was limited and correlated. A correlation coefficient of 0.61 was found for those with a difference greater than 7mm (the smallest detectable clinically relevant change) in those with JIA (Steenks, 2015). Koos et al. (2014) also used cutoff values for normal MIO to differentiate between reduced or not. They reported a relatively high prevalence in both groups, but no difference between the JIA patient group and the age-matched control group (19% and 18%) (Koos et al., 2014). Muller et al. (2009) reported a low specificity for MIO of 0.11 and high sensitivity of 0.91 for correlation of limited MIO with disease activity. Kuseler et al. (2005) and Pedersen et al. (2008) found reduced MIO in 20% of patients at baseline though these findings normalized at their 2 year follow up. Zwir et al. (2015) found reduced MIO in 25% of patients at first examination but only 13% of patients at their second examination; though reduced MIO was significantly associated with intense contrast-enhancement on MRI. Weiss et al. (2008) found that MIO was below the age-matched controls in 22% of their cases.

Condylar translation

Translation of the TMJ is when the mandible is moved side to side in the frontal plane without opening the mouth, palpated at the TMJ for amount of movement of the condylar head of the mandible. Pedersen et al.(2008) found decreased translation of the condyle in 43% of TMJs at baseline though this improved to 13% at the end of the two-year period. Weiss et al.

(2008) found a lower prevalence of reduced translation though when correlated with limited MIO it increased significantly (30%). Keller et al. (2015) found restriction in condylar translation with MRI enhancement to be statistically significant (p= 0.02) .

Deviation with mouth opening

Deviation with mouth opening is when the mouth does not stay in the sagittal plane but rather "deviates" to the left or right; it can return to the sagittal plane at maximal opening but does not need to in order to be classified as deviation. Stoll et al. (2012) found deviation upon opening in 49% of patients with findings of active arthritis on MRI and only 12% of those with no MRI signs of active TMJ arthritis. Koos et al. (2014) used lateral deviation of >/=2 mm as well as Stoll et al. (2012) and found it in 62% of patients with MRI findings and 16% in the control group, creating a sensitivity of 0.65 and specificity of 0.78. Weiss et al.(2008) found this in 19% of their patients. Steenks et al. (2015) correlated the finding of deviation upon opening with the rheumatologic exam and the JADAS-27 as 0.31 for arthritic involvement.

Mandibular protrusion

Protrusion occurs when the mandible is pushed forward in the sagittal plane and should remain consistent with no deviation to the left or right in a "normal" patient. Kuseler et al. (2005) used protrusion as </=7 mm to the left or right as a severe clinical indication of TMJ involvement though in early disease no significant results were found between the JIA patients and the control group.

Note that all of these findings are the result of rheumatologic or orthodontic examination in a variety of patient populations that were either referred with a suspicion of TMJ arthritis or newly diagnosed with JIA. This causes a high risk of bias in the results though should still be noted as clinically significant for the given patient population.

Discussion

Analysis of the clinical examination of TMJ involvement in those with JIA remains a difficult task as the results are not conclusive or clear cut. Throughout the studies chosen, they gave clear inclusion and exclusion criteria though with that, the populations of people examined were only similar in one major aspect, the diagnosis of JIA. Each study had a variation of people within this population including but not limited to; disease type, time since onset, age, and on or off of medication. These factors can influence the results of a clinical examination as well as contrast MRI. Overall, the level of evidence included in this literature review was low. Along with that, there are no clear outcome measures used and each parameter can be reported in a different way. There is also no means to distinguish between results coming from active inflammation in a joint or previous arthritis-related joint damage. This will affect the ability of a clinician to correctly asses the TMJ's status and determine the therapeutic consequences of our choices.

Though the recruitment of subjects employed in some of these studies is biased, cross-sectional studies and prospective cohort studies can be effective in the assessment of different outcomes. Within the studies that had selection bias, results were less likely to be used to

assess the frequency of clinical findings but when those same things are found in those with only suspected TMJ involvement, it has a higher likelihood of being reproducible. Even with the amount of bias that these studies exhibited, mostly in the recruitment of their subjects, I feel there is good evidence that has come from these. While this has been a topic of concern for some time now, this is only the beginning of the research to find other means than contrast MRI as a diagnostic tool.

Magnetic resonance imaging (MRI) with contrast is the standard imaging study for the diagnosis of TMJ synovitis, joint inflammation, in children with JIA (Abramowicz et al, 2013). However, "MRI is costly and time consuming and can require general anesthesia", especially in young children (Abramowicz et al, 2013 & Keller et al, 2015). Due to this issue, other examination methods would be desirable to detect early onset of TMJ involvement in children with JIA. The consequences of not receiving medical or other management for the TMJ include but are not limited to: condylar damage, alterations in normal facial growth, and decreased maximal incisal opening that can get worse over time (Weiss et al, 2008 & Zwir et al, 2015). With the risks being high, the desirable treatment option is a decrease of the inflammatory activity as soon as possible, which makes the use of a clinical diagnostic tool more important.

Reduced mandibular function, given as a decrease in MIO, was the most frequently used clinical parameter and was often used as a variable to express clinical treatment effectiveness. Some studies used dichotomous outcomes of reduced MIO while others accounted for overlap. For example, Abramowicz et al found that there was statistically significant correlation with a decrease in MIO and deviation on mouth opening with increased synovitis seen on MRI (2013). As stated before, the measurement of reduced MIO differed among studies with some using the amount of fingers the patients can fit between the incisors, and others using <40mm as a cutoff value. Though the sensitivity found with these results was low, the specificity was higher and indicates that TMJ involvement was likely present if the MIO was reduced below a certain cutoff value (Steenks et al, 2015). Kuseler et al and Pedersen et al reported an increased MIO over time in the JIA population despite a constantly high TMJ involvement reported on MRI. Therefore, it remains undetermined whether reduced MIO alone can indicate disease activity though when combining it with other measures, as in test clusters used elsewhere in physical therapy, it is more sensitive and specific.

For condylar translation there was significant differences seen between Pedersen et al at 43% and Weiss et al at 6%. For Pedersen et al, they found their results with correlated findings on MRI of resorptive changes in the condylar head and recommended that translation be included in the clinical exam of the TMJ (2008). Along with that, Keller et al found restriction in condylar translation as the only clinical finding with a significant correlation to enhancement of synovial fluid on MRI (2015).

Deviation with mouth opening showed large variations between studies. Though, definition of this parameter was only given in Koos et al's (2008) study as greater than or equal to two millimeters form midline. However, this clinical parameter was the best predictor of TMJ involvement in both Stoll et al. (2012) and Koos et al.'s (2008) study with 49% and 62% of JIA patients with confirmed TMJ arthritis compared to 12% and 16% of JIA patients without TMJ involvement.

For pain involving the TMJ within this population, the results were generally biased with no validated protocols used to make it an objective finding. However, the results of Pedersen et

al.'s (2008) study finding neck stiffness and tenderness in 53% of the patients with JIA and none in the healthy subjects stands out greatly to me. Throughout other examination processes in physical therapy you need to look at the joint above and below the one being examined just as Pedersen et al did. Therefore, I would leap to say that neck mobility and palpation should be included in the clinical examination of the TMJ in this population, just as it is in those without JIA, as a correlating factor of potential joint involvement.

With all studies involved in this literature review, it is determined that a cluster of tests is the best protocol to use for the TMJ clinical exam. Included in this exam, due to the results of discussed studies, will be MIO, deviation upon opening, condylar translation, and neck mobility. Due to the wide variety of normal values of MIO, using Keller et al.'s parameters of <40mm as a standard for this pediatric population will be used. With that, Koos et al's parameters of greater than or equal to two millimeters of deviation upon opening will be used. With condylar translation, it will be noted as an asymmetry for the patient, capable of being measured using a ruler and measuring the deviation from midline that is obtained upon attempted translation. Evaluation of neck mobility was not well defined in Pedersen et al's (2008) study, claiming "a general screen" was used. Based on my DPT education I am going to suggest that these standardized 4 tests be used to calculate neck mobility: OA flexion/extension, OA sidebending, long axis rotation, and AA rotation along with the generalized cervical screen of ROM and muscle recruitment patterns. Those four tests are the most frequently used by Dr. Beth Jones and have been given to the DPT class as the four to be done on any cervical patient.

Once all testing has been done, and it is determined whether or not your patient has TMJ involvement, then the question becomes how you help them as a physical therapist. The first step would be contacting their primary provider for further testing but also using the tools PT's have to help your patient in the moment. The study by Shaffer et al. (2014) discusses the use of multiple interventions to aid with TMJ dysfunction.

Shaffer et al (2014) gives a systematic review of the effectiveness of the known physical therapy interventions that are most commonly utilized in practice today. Though these interventions are not aimed directly at those with JIA, Nilbo et al (2016) gives some insight into the specifics of some interventions more likely used with the JIA population. In those with JIA, Nilbo et al (2016) explains that pharmacological management is one of the biggest differences, as JIA is an autoimmune disease that can be systematically helped with the use of DMARDs. The most common DMARD utilized with this population is Methotrexate (NIlbo et al, 2016). This drug has long term benefits in controlling disease activity and reduces the need of other medications such as corticosteroids. Although, the use of this drug also has potentially adverse effects and therefore requires careful monitoring (Nilbo et al., 2016). Nilbo et al. (2016) goes on to describe that other than the pharmacological treatment in those with JIA, the management of TMJ arthritis is similar to those with TMJ dysfunctions without the diagnosis of JIA, including: "counseling,…physiotherapy, occlusal appliances, orthodontics, and surgery".

Shaffer et al (2014) ultimately describes that "multimodal management of temporomandibular dysfunction (TMD) including soft tissue mobilization, muscle stretching, gentle isometric tension exercises against resistance, guided opening and closing, manual joint distraction, disc/condyle mobilization, postural corrections, and relaxation techniques are helpful in reducing symptoms" associated with TMJ dysfunction. Furthermore, in agreement with Pedersen et al. (2008), Shaffer et al. (2014) explains that "a thorough cervical spine

evaluation and relevant management are advised for patients with TMD". Shaffer et al (2014) expresses the need for management techniques to "at a minimum, address any cervical spine range deficits, accessory movement restrictions and altered muscle recruitment patterns". In combining the need for a generalized cervical screen, as Shaffer et al (2014) and Pedersen et al. (2008) have described, I feel it would not add significant time to the overall evaluation to include the 4 cervical screening tests that were proposed above: OA flexion/extension, OA sidebending, long axis rotation, and AA rotation.

Description of the various interventions for physical therapist to use for TMD management are provided by Shaffer et al (2014) including technique with associated pictures if further examination into treatment is desired.

Conclusion

Overall, though research is still limited on the accuracy of clinical exams to determine early involvement of the TMJ in those with JIA, I believe this proposed screening protocol can be a start for future patients. As a physical therapist, I believe our skills to provide accurate examination of all joints in the body, including the TMJ, is well known. This literature review supports physical therapists as an important provider on the healthcare team to give not only examination, but treatment as well, "Physical therapists are positioned well to step into the current treatment void and provide comprehensive conservative management" (Shaffer et al, 2014). Due to the addition of direct access, I believe screening tools such as this are going to become a more common practice and this protocol can begin the need for the population of those with JIA.

Reference #: Keller, H., Muller, L. M., Markic, G., Schraner, T., Kellenberger, C. J., & Saurenmann, R. K. (2015). Is early TMJ involvement in children with juvenile idiopathic arthritis clinically detectable? Clinical examination of the TMJ in comparison with contrast enhanced MRI in patients with juvenile idiopathic arthritis. *Pediatric Rheumatology*, *13*(1). https://doi.org/10.1186/s12969-015-0056-2

Is the purpose and background information sufficient?	
Appraisal Criterion	***Reader's Comments***
Study Purpose Stated clearly? Usually stated briefly in abstract and in greater detail in introduction. May be phrased as a question or hypothesis. A clear statement helps you determine if topic is important, relevant and of interest to you. Consider how the study can be applied to PT and/or your own situation. What is the purpose of this study?	The study's purpose was stated clearly and accurately in wanting to determine early diagnosis of TMJ involvement in those with JIA using clinical testing and symptoms against the gold standard of contrast MRI. I wanted to use this study to see if there is testing a PT could use in clinic with a client with JIA to have early detection and lead to further preventative care.
Literature Relevant background presented? A review of the literature should provide background for the study by synthesizing relevant information such as previous research and gaps in current knowledge, along with the clinical importance of the topic. Describe the justification of the need for this study	Juvenile Idiopathic Arthritis is the most common rheumatic disease affecting children and adolescence. Involvement of the TMJ varies highly but can have severe consequences if it goes unnoticed, which it often does. Some research has been done to quantify the involvement of this joint however using contrast MRI seems to be the only way to definitively determine it. This study wanted to fill the gap of finding clinical signs and symptoms that may be able to be used to determine TMJ involvement rather than subjecting a child to MRI if not needed.

Does the research design have internal validity?	
Appraisal Criterion	***Reader's Comments***
➢ **Discuss possible threats to internal validity in the research design. Include:** ➢ **Assignment** ➢ **Attrition**	The potential threats to internal validity in this study is that there was only one cohort of patients used to receive each of the evaluations: contrast MRI, rheumatologic, and orthodontic. There was no assignment to

➢ **History** ➢ **Instrumentation** ➢ **Maturation** ➢ **Testing** ➢ **Compensatory Equalization of treatments** ➢ **Compensatory rivalry** ➢ **Statistical Regression**	groups and no comparison to normative values other than in mouth opening capacity. Another potential threat was maturation as the evaluations were done within 3 months of each other, which in JIA can be the difference between having active flare-ups or not. Statistical regression would be the last of the threats to internal validity as many aspects throughout the study were attempted to be correlated using different evaluation methods.

Are the results of this therapeutic trial valid?	
Appraisal Criterion	***Reader's Comments***
1. Did the investigators randomly assign subjects to treatment groups? **a. If no, describe what was done** **b. What are the potential consequences of this assignment process for the study's results?**	No the investigators did not randomly assign subjects to treatment groups as there was no "treatment" in this study. It was a cohort of children diagnosed with JIA who were given three different evaluations to determine correlation of clinical findings and MRI findings. The consequences are that there is no comparison to a normative value of those in their same age ranges without JIA, this was don't for mouth opening capacity however.
2. Were the groups similar at the start of the trial? Did they report the demographics of the study groups? **a. If they were not similar – what differences existed?**	Yes, the group was similar throughout the cohort. They reported the subject characteristics and placed them in a table to compare. Giving p values where there was statistical significance.
3. Did the subjects know to which treatment group they were assign? **a. If yes, what are the potential consequences of the subjects' knowledge for this study's results**	There were no subject groups therefore each subject knew they were being evaluated for TMJ involvement. Each subject already knew they had the diagnosis of JIA prior to the study as well. The potential consequences could be a child "playing up" there TMJ involvement knowing they have a diagnosis that might allow for that.
4. Did the investigators know who was being assigned to which group prior to the allocation? **a. If they were not blind, what are the potential**	The investigators did not group the subjects therefore they knew that each subject would be receiving each evaluative technique. I don't believe there are consequences that come with this as the leads of the study were

consequences of this knowledge for the study's results?	not the ones performing the evaluations.
5. Were the groups managed equally, apart from the actual experimental treatment? **a. If not, what are the potential consequences of this knowledge for the study's results?**	All subjects were managed equally and in the case where they were not, due to timing of evaluations not falling within the given time range, those subjects statistics were not used statistically.
6. Was the subject follow-up time sufficiently long to answer the question(s) posed by the research? **a. If not, what are the potential consequences of this knowledge for the study's results?**	There was no subject follow up time in this study, there were evaluative techniques given within a three-month period to answer their research question. The potential consequences of this would be that a subject could be in or out of a flare up within a three-month period and that wasn't accounted for in this study.
7. Did all the subjects originally enrolled complete the study? **a. If not how many subjects were lost?** **b. What, if anything, did the authors do about this attrition?** **c. What are the implications of the attrition and the way it was handled with respect to the study's findings?**	No all subjects originally enrolled did not complete the study. There were 8 subjects lost for various reasons giving the study a 10% attrition rate. The authors did not use these subjects results in the statistical analysis. I don't believe this attrition had significant implications to the study as it was under 20% and the authors accounted for their loss.
8. Were all patients analyzed in the groups to which they were randomized (i.e. was there an intention to treat analysis)? **a. If not, what did the authors do with the data from these subjects?** **b. If the data were excluded, what are the potential consequences for this study's results?**	There were no randomized groups therefore the subjects were all analyzed using the same methods. They compared the data from each subject against their multitude of factors to determine correlating factors in each evaluative method used. The value that was excluded due to subject loss would not have any consequences on the study's final results.
Are the valid results of this RCT important?	
Appraisal Criterion	***Reader's Comments***
9. What were the statistical findings of	The statistical results of this study were that

this study? **a. When appropriate use the calculation forms below to determine these values** **b. Include: tests of differences? With p-values and CI** **c. Include effect size with p-values and CI** **d. Include ARR/ABI and RRR/RBI with p-values and CI** **e. Include NNT and CI** **10. What is the meaning of these statistical findings for your patient/client's case? What does this mean to your practice?**	the MRI findings detected 71% involvement of the TMJ joint and 68% of active TMJ arthritis. There was increased joint fluid found in 10 patients, showing inflammation. Also the MRI results showed that 33 patients had condylar deformity however those patients did not necessarily have increased fluid. The correlation between degree of enhancement, fluid build up, and degree of condylar deformity was statistically significant. The rheumatologic exam results were that only 29% of patients reported pain. The mean mouth opening capacity (MOC) was 44.8 mm with 37% of patients falling below the 30th percentile. With those that had decreased MOC, most had positive findings on MRI of TMJ involvement. Condylar growth disturbance, mandibular retrognathism and mandibular asymmetry were also measured though know correlation between those factors and MRi findings were found. In the orthodontic examination 37% of patients reported pain. They examined the TMJ and the mastication muscles for pain and found positive findings in 47% of patients. TMJ crepitation or clicking was found in 21% of patients. The mean MOC in the orthodontic exam was 44.6 mm with 425% of patients falling below the 30th percentile. The MOC findings correlated with the MRI findings for fluid build up or deformity as well. There was no significant record of pain with active TMJ arthritis, rheumatologic or orthodontic evaluation. MRI deformation and fluid build up were statistically significant when correlating with restriction in condylar translation and antegonial notching. *** ask about points b,c,d, and e*** 10. The meanings of these statistical findings is that there are things we can evaluate as PT's to determine if our patient with JIA has TMJ involvement. It also means that since the TMJ is commonly missed in evaluation,

	we can spend a few more minutes in our exam with someone who is in the midst of a flare up to determine if their TMJ is involved and refer them to further treatment if necessary. Also throughout the 75 patients, almost 75% had some form of involvement of the TMJ, making it a more common occurrence than previously thought of. In terms of my patient, I would have wanted to check for this involvement when she was having pain in other joints. Lastly, I want to portray the huge difference that this may make in a child's life because TMJ dysfunctions can lead to multiple other symptoms and can become a life long issue.
11. Do these findings exceed a minimally important difference? **a. If not, will you still use this evidence?**	There is no MCID for mouth opening and TMJ dysfunction as everyone differs so much in their involvement. There are also no MDC or MDIC's for condylar translation or antegonial notching and TMJ dysfunction therefore no numerical values can be placed on a patient to determine involvement. I will still use this evidence because the population is so specific and the percentage of patients with TMJ involvement is higher than previously thought. Therefore, if I can assess these things quickly in clinic and make a difference for my patient, I believe that is worth the extra time.
Can you apply this valid, important evidence about an intervention in caring for your patient/client? What is the external validity?	
Appraisal Criterion	***Reader's Comments***
12. Does this intervention sound appropriate for use (available, affordable) in your clinical setting?	Yes this evaluative technique costs no money and PT's are already trained in how to do it through there general schooling, not requiring a specialization.
13. Are the study subjects similar to your patient/ client? **a. If not, how different? Can you use this intervention in spite of the differences?**	Yes, the study subjects were very similar to my patient in having JIA and being within the same age range.
14. Do the potential benefits outweigh	I believe the potential benefits of early

the potential risks using this intervention with your patient/client?	detection of TMJ involvement in those with JIA outweigh the risks of not performing these simple clinical tests. This is because someone with TMJ dysfunction can have other problems long term if not detected early on.
15. Does the intervention fit within your patient/client's stated values or expectations? **a. If not, what will you do now?**	Yes, my patient came in complaining of various joint pains and ROM restrictions and wanting to help her flare-ups not be so painful when they did occur. Therefore, making sure all joints are cleared for involvement to maintain a healthy lifestyle is critical, especially for children or adolescents.
16. Are there any threats to external validity in this study?	I don't see any threats to external validity in this study at this time.
What is the bottom line? What pedro score would you give this trial?	
Appraisal Criterion	***Reader's Comments***
17. Summarize your findings and relate this back to clinical significance	My clinical bottom line is that the clinical tests that can be done in on a patient are relatively quick, costless, and important if they end up detecting a disturbance in the TMJ's. Although this study did not find many statistically significant correlations between the clinical findings and the MRI findings, their numbers still show an impact on the JIA community. I believe using these clinical tests can lead to further interventions for a child that might save them from future discomfort due to their diagnosis.

PEDro Internal Validity Scale	**No**	**Yes**
1. Eligibility criteria were specified		1
2. subjects were randomly allocated to groups (in a crossover study, subjects were randomly allocated an order in which treatments were received)		1
3. allocation was concealed		1
4. the groups were similar at baseline regarding the most important prognostic indicators		1
5. there was blinding of all subjects	1	
6. there was blinding of all therapists who administered the therapy	1	
7. there was blinding of all assessors who measured at least one key outcome	1	
8. measures of at least one key outcome were obtained from more than 85% of the subjects initially allocated to groups		1

9. all subjects for whom outcome measures were available received the treatment or control condition as allocated or, where this was not the case, data for at least one key outcome was analysed by "intention to treat"	1	
10. the results of between-group statistical comparisons are reported for at least one key outcome		1
11. the study provides both point measures and measures of variability for at least one key outcome		1
PEDro Score:	7/11	

Reference #? Keller, H., Müller, L., Markic, G., Schraner, T., Kellenberger, C., & Saurenmann, R. (2015). Is early TMJ involvement in children with juvenile idiopathic arthritis clinically detectable? Clinical examination of the TMJ in comparison with contrast enhanced MRI in patients with juvenile idiopathic arthritis. *Pediatric Rheumatology*, *13*(1), 56. http://dx.doi.org/10.1186/s12969-015-0056-2

(Bibliography #?): In text: (Keller et al., 2015)

Level of evidence: cross sectional research PEDro Scale: 7/10

Purpose: The purpose of this cross sectional study was to compare clinical findings of the temporomandibular joints of children with diagnosed juvenile idiopathic arthritis using rheumatologic and orthodontic evaluations as compared to the gold standard of contrast MRI.

Methods: The methods of this study involved having a cohort of 83 children with diagnosed juvenile idiopathic arthritis, using only 75 for analysis, and giving each a rheumetalogic and orthodontic evaluation and a contrast MRI to determine if there was involvement or arthritis of the temporomandibular joints. They assessed mouth opening capacity, condylar asymmetry, and restriction in condylar translation in the physical examinations and compared these results to the standard MRI contrast findings that determine joint involvement such as enhancement or deformity of the TMJ or condyle. For each finding in the physical exam or the MRI they conducted a chi-square test to determine if the factors were independent or not, also determining their correlation if so.

Results: The results of this cross sectional study found that the clinical findings of mouth opening capacity, condylar asymmetry, and restriction in condylar translation show significant correlation with temporomandibular joint enhancement and deformity on contrast MRI; indicating temporomandibular joint involvement in children with juvenile idiopathic arthritis. This study also found that at least 50% of these patients had TMJ involvement even without clinical symptoms, though clinical findings were often still present. In determining correlation of these factors, all reviewers and examiners were blinded to the subjects' diagnosis and clinical symptoms or findings. Lastly, the study did conclude that

contrast MRI should still be used to definitively determine TMJ involvement in children with diagnosed JIA.

Critique/Bottom Line: The bottom line of this study is that contrast MRI should still be used to determine TMJ involvement in patients with JIA. Although, I believe these clinical findings showed enough significance to be used in a clinical setting as an early indicator of TMJ involvement in children with JIA. I believe that a patient coming in with JIA may often not disclose all of their symptoms, even more so being a child, therefore the use of quick physical screening tools would be useful to have in our exam to check involvement of the TMJ's without patient report. This study reported that most children did not have clinical symptoms though MRI or physical exam still determined TMJ involvement, further backing that we should screen the joint to begin preventative measures of further joint deterioration if needed.

Reference: Abramowicz, S., Susarla, H. K., Kim, S., & Kaban, L. B. (2013). Physical Findings Associated With Active Temporomandibular Joint Inflammation in Children With Juvenile Idiopathic Arthritis. *Journal of Oral and Maxillofacial Surgery*, *71*(10), 1683–1687. https://doi.org/10.1016/j.joms.2013.04.009

Is the purpose and background information sufficient?	
Appraisal Criterion	***Reader's Comments***
Study Purpose Stated clearly? Usually stated briefly in abstract and in greater detail in introduction. May be phrased as a question or hypothesis. A clear statement helps you determine if topic is important, relevant and of interest to you. Consider how the study can be applied to PT and/or your own situation. What is the purpose of this study?	The purpose of this study was to identify and associate physical findings of active temporomandibular joint inflammation in children with juvenile idiopathic arthritis (JIA). This study can be applied to PT because it will give the PT the physical findings to look for in clinic with a patient diagnosed with JIA to determine if they have active TMJ inflammation and proceed with other interventions if needed.
Literature Relevant background presented? A review of the literature should provide background for the study by synthesizing relevant information such as previous research and gaps in current knowledge, along with the clinical importance of the topic. Describe the justification of the need for this study	The background given indicated that TMJ inflammation or synovitis is often overlooked in children with JIA due to lack of consistency in physical symptoms or findings and decreased use of MRI to confirm a diagnosis. The results of untreated disease can be life changing however so determining consistent physical findings to look for can help with early intervention and decrease long term

	affects due to lack of treatment. The prevalence of TMJ involvement in this population is known to occur but often underestimated and should be screened for more in children with JIA.

Does the research design have internal validity?	
Appraisal Criterion	***Reader's Comments***
➢ **Discuss possible threats to internal validity in the research design. Include:** ➢ **Assignment** ➢ **Attrition** ➢ **History** ➢ **Instrumentation** ➢ **Maturation** ➢ **Testing** ➢ **Compensatory Equalization of treatments** ➢ **Compensatory rivalry** ➢ **Statistical Regression**	A threat to internal validity in this study is statistical regression in that the subjects selected for this study were all diagnosed with JIA and observed by multiple medical teams. Therefore, these patients were more likely to have joint synovitis already due to their diagnosis and not because of a true singular joint problem. Maturation is also an internal threat to this study as the subjects were selected retrospectively from September of 2009 to September of 2012 and children could have matured from that time to develop other TMJ impairments. Due to the fact that this is not a randomized controlled trial study, rather a retrospective observational study, the other threats to internal validity mostly do not apply.

Are the results of this therapeutic trial valid?	
Appraisal Criterion	***Reader's Comments***
18. Did the investigators randomly assign subjects to treatment groups? **a. If no, describe what was done** **b. What are the potential consequences of this assignment process for the study's results?**	There were no treatment groups involved in this study. There was a cohort of children selected due to their diagnosis who were all treated the same in testing. The consequences of this being that there is no control group to compare these findings to, therefore external validity outside of this population of children is poor.
19. Were the groups similar at the start	There were no groups given, though all

of the trial? Did they report the demographics of the study groups? **a. If they were not similar – what differences existed?**	subjects selected had a confirmed diagnosis of JIA, had undergone MRI with contrast, and had been evaluated by an Oral and Maxillofacial Surgeon. All subjects were also selected from Boston's Children's Hospital who were evaluated from September of 2009 to September of 2012.
20. Did the subjects know to which treatment group they were assign? **a. If yes, what are the potential consequences of the subjects' knowledge for this study's results**	The subjects were not grouped therefore every participant received the same treatment by the examiner. I believe the subjects knew they were being evaluated for their TMJ's and due to their diagnosis of JIA. I don't believe there are consequences as the participants nor examiners were looking for a specific characteristic.
21. Did the investigators know who was being assigned to which group prior to the allocation? **a. If they were not blind, what are the potential consequences of this knowledge for the study's results?**	The investigators who reviewed the subjects MRI findings were not blinded as they knew these patients had a diagnosis of JIA because it was needed for study approval. Also, the examiner who reviewed the subjects physical characteristics was aware of the children's diagnosis. The consequences of this could be that the MRI examiners were more sensitive to finding synovitis in the TMJ since they are aware that this diagnosis often comes with increased synovial fluid or involvement of joint spaces. The examiner might also have been more sensitive to measuring on the lower side of certain characteristics in hopes to find decreases in motion with these patients.
22. Were the groups managed equally, apart from the actual experimental treatment? **a. If not, what are the potential consequences of this knowledge for the study's results?**	The group was managed the same way in receiving the same medical consultations and examiner physical testing. Since there was only one group in this retrospective observational study, the participants may have been aware the researchers were looking for characteristics of TMJ involvement.
23. Was the subject follow-up time sufficiently long to answer the question(s) posed by the research? **a. If not, what are the potential consequences of this**	There was no subject follow up time in this study, the subjects were examined between 2009-2012 and then given this physical exam during the study period. Therefore, only one testing time was needed with no follow up. A

knowledge for the study's results?	consequence of this is that there is no comparison to a control group, decreasing external validity.
24. Did all the subjects originally enrolled complete the study? **a. If not how many subjects were lost?** **b. What, if anything, did the authors do about this attrition?** **c. What are the implications of the attrition and the way it was handled with respect to the study's findings?**	A total of 51 patients were evaluated for the study however only 43 of them met the inclusion criteria. This study has an attrition rate of 0 however because it is not an experimental design there are implications from one group involved in the study.
25. Were all patients analyzed in the groups to which they were randomized (i.e. was there an intention to treat analysis)? **a. If not, what did the authors do with the data from these subjects?** **b. If the data were excluded, what are the potential consequences for this study's results?**	The subjects were not placed into separate groups therefore each one was evaluated in the same group. There were no lost subjects so no data had to be excluded.
Are the valid results of this RCT important?	
Appraisal Criterion	***Reader's Comments***
26. What were the statistical findings of this study? **a. When appropriate use the calculation forms below to determine these values** **b. Include: tests of differences? With p-values and CI** **c. Include effect size with p-values and CI** **d. Include ARR/ABI and RRR/RBI with p-values and CI** **e. Include NNT and CI** **27. What is the meaning of these statistical findings for your patient/client's case? What does this mean to your practice?**	The patients with limited MIO were 6.7 times more likely to have synovitis (95% confidence interval, 1.44 to 31.20; *P* = .015) than those with normal MIO (nominal level of evidence with binary yes/no for limitation). Among the patients with limited MIO, deviation on opening verified the presence of synovitis (positive predictive value = 1.00, negative predictive value = 0.46). The p value used for this study was <.05 to show significance. Of 43 subjects, 27 showed TMJ synovitis on MRI. The meaning of these statistical findings for my case is that these two physical characteristics should be quickly checked in clinic even in the absence of pain because pain is not a

	positive predictor of TMJ synovitis. In patients with JIA, the consequences of TMJ synovitis outweigh the consequences of the time it would take a PT to check these tests in clinic and possibly prevent more damage if detected.
28. Do these findings exceed a minimally important difference? **a. If not, will you still use this evidence?**	There is no MCID for mouth incisal opening or deviation of the mouth so it cannot be said whether it falls inside or outside the clinically important measure. Also, normative values on children MOI or deviation are not well studied. However normative values for adults are: 48mm for women and 52mm for men. In the children studies that do exist for normative values its shown to be about 45mm as average. The study states that the mean MIO for the non-synovitis group was 41.1mm with the range being from 25-57. This result shows high variability in children MIO with or without synovitis and therefore makes it harder to generalize the data.
Can you apply this valid, important evidence about an intervention in caring for your patient/client? What is the external validity?	
Appraisal Criterion	***Reader's Comments***
29. Does this intervention sound appropriate for use (available, affordable) in your clinical setting?	Yes these clinical tests of measuring mouth opening and deviation are available and completely affordable to perform in any clinic.
30. Are the study subjects similar to your patient/ client? **a. If not, how different? Can you use this intervention in spite of the differences?**	If the therapist is working with patients who are diagnosed with JIA then yes these subjects would be similar.
31. Do the potential benefits outweigh the potential risks using this intervention with your patient/client?	Yes the benefits of early detection of TMJ degradation highly outweigh the minutes it would take a therapist to perform these measurement.
32. Does the intervention fit within your patient/client's stated values or expectations? **a. If not, what will you do now?**	I believe this would fit with a clients values because they would know they have a disease that makes them more susceptible to joint break down; any form of

	preventative measures to increase quality of life would be accepted.
33. Are there any threats to external validity in this study?	The threat to external validity is that this study focused on a specific population of those children diagnosed with JIA and their results would have to stay in that population.
What is the bottom line? What pedro score would you give this trial?	
Appraisal Criterion	***Reader's Comments***
34. Summarize your findings and relate this back to clinical significance	The findings indicate that children with active TMJ synovitis will most likely display the physical characteristics of decreased mouth opening and deviation in mouth opening. The clinical significance is early detection of TMJ involvement in children who have been diagnosed with JIA and further evaluation or preventative measures can be taken if deemed necessary.

PEDro Internal Validity Scale	**No**	**Yes**
12. Eligibility criteria were specified		1
13. subjects were randomly allocated to groups (in a crossover study, subjects were randomly allocated an order in which treatments were received)	1	
14. allocation was concealed	1	
15. the groups were similar at baseline regarding the most important prognostic indicators		1
16. there was blinding of all subjects	1	
17. there was blinding of all therapists who administered the therapy	1	
18. there was blinding of all assessors who measured at least one key outcome	1	
19. measures of at least one key outcome were obtained from more than 85% of the subjects initially allocated to groups		1
20. all subjects for whom outcome measures were available received the treatment or control condition as allocated or, where this was not the case, data for at least one key outcome was analysed by "intention to treat"		1
21. the results of between-group statistical comparisons are reported for at least one key outcome	1	
22. the study provides both point measures and measures of variability for at least one key outcome		
PEDro Score:	4/10	

Reference #? Abramowicz, S., Susarla, H. K., Kim, S., & Kaban, L. B. (2013). Physical Findings Associated With Active Temporomandibular Joint Inflammation in Children With Juvenile

Idiopathic Arthritis. *Journal of Oral and Maxillofacial Surgery*, *71*(10), 1683–1687. https://doi.org/10.1016/j.joms.2013.04.009

(Bibliography #?): In text: (Abramowicz et al., 2013)

Level of evidence: 2b PEDro Scale: 4/10

Purpose: The purpose of this retrospective cohort study was to associate the findings of synovitis on a contrast MRI in children with diagnosed juvenile idiopathic arthritis to physical findings found on exam. The researchers wanted to find which physical findings most associated with active TMJ arthritis in order to increase clinical options in determining TMJ involvement because the gold standard of contrast MRI is not always feasible.

Methods: The methods of this study involved a cohort of 43 patients chosen from Boston Children's Hospital database who had been diagnosed with JIA between September of 2009 and September of 2012. These patients also had to have had a contrast MRI on their TMJ's and met with an Oral and Maxillofacial surgeon to be included in the study. A single examiner then gave a physical exam to the subjects that evaluated facial asymmetry, joint noises, MIO, deviation on MIO, and occlusal cant. These were measured using a rigid equilateral triangular device with specific landmarks used on the subjects face for each test. Radiologists then examined each subject's MRI for presence of synovitis and associated those findings with that of the physical exam to determine coinciding characteristics of the subjects.

Results: The results of this retrospective cohort study were that limited mouth incisal opening (MIO) was highly associated with active TMJ synovitis. Furthermore, the presence of limited MIO with deviation on MIO was 100% associated with active TMJ synovitis. These were the only two physical characteristics that showed statistically significant associated with active TMJ synovitis, which was defined as "linear or circular enhancement, surrounding the disk in the upper and/or lower joint compartments" on contrast T1 weighted MRI images.

Critique/Bottom Line: The bottom line of this study is that is that physical findings on exam such as limited MIO and deviation on MIO can be used in clinic to give early indication of possible TMJ active synovitis in those children diagnosed with JIA. The prevalence of TMJ involvement in children with JIA has been shown in higher numbers than previously thought and therefore needs to be on the minds of medical providers when this diagnosis is made. Contrast MRI's can be expensive, time comsuming, and difficult to do with children as it requires them to remain very still; this can cause sedative measures to be used which can be harmful on a child's system. These physical findings can be a screening tool for healthcare providers to use to determine if a contrast MRI is needed in the suspected presence of TMJ involvement for those children with JIA.

Reference #? Koos, B., Twilt, M., Kyank, U., Fischer-Brandies, H., Gassling, V., & Tzaribachev, N. (2014). Reliability of Clinical Symptoms in Diagnosing Temporomandibular Joint Arthritis in

Juvenile Idiopathic Arthritis. *The Journal of Rheumatology*, *41*(9), 1871–1877. https://doi.org/10.3899/jrheum.131337

Is the purpose and background information sufficient?	
Appraisal Criterion	***Reader's Comments***
Study Purpose Stated clearly? Usually stated briefly in abstract and in greater detail in introduction. May be phrased as a question or hypothesis. A clear statement helps you determine if topic is important, relevant and of interest to you. Consider how the study can be applied to PT and/or your own situation. What is the purpose of this study?	This study wanted to test the reliability of clinical findings, as a concise screening protocol, in diagnosing TMJ arthritis in those with Juvenile Idiopathic Arthritis (JIA) as compared with the reference method of contrast MRI. This can be applied to PT as a quick screening to use in their patients with JIA through their clinical examination instead of needing a contrast MRI which can be expensive, time consuming, and have the potential to need sedative medicine to perform on children.
Literature Relevant background presented? A review of the literature should provide background for the study by synthesizing relevant information such as previous research and gaps in current knowledge, along with the clinical importance of the topic. Describe the justification of the need for this study	There was plenty of relevant background stating that contrast MRI is without question the gold standard of diagnosing TMJ arthritis. However, due to MRI's down falls, a clinical examination should be created to save money and time, but will it be accurate? It is commonly known that TMJ arthritis is prevalent in children with JIA, if a screening tool can be created to save children and their families the pain of the consequences that could come from a lack of diagnosis, while saving them money as well, it should be done.

Does the research design have internal validity?	
Appraisal Criterion	***Reader's Comments***
➢ **Discuss possible threats to internal validity in the research design. Include:** ➢ **Assignment** ➢ **Attrition** ➢ **History** ➢ **Instrumentation** ➢ **Maturation** ➢ **Testing** ➢ **Compensatory Equalization of treatments**	One threat to internal validity that may be present lays in the nature of this not be an experimental design but rather a comparison cross sectional study. The selection of the groups were made with intent on having healthy controls, while children with JIA were in the opposing group. Though the study did attempt to control this by having age and gender matched controls to the JIA group, the intent of the groups selected were not random.

➢ **Compensatory rivalry** ➢ **Statistical Regression**	

Are the results of this therapeutic trial valid?	
Appraisal Criterion	***Reader's Comments***
35. Did the investigators randomly assign subjects to treatment groups? **a. If no, describe what was done** **b. What are the potential consequences of this assignment process for the study's results?**	No, the investigators did not randomly assign children to either group. There was a group selected for their medical diagnosis of JIA and the other group was healthy controls who were matched by age and gender. There are not consequences for this in an observational comparison study as the purpose of the study is to measure differences in one population versus another.
36. Were the groups similar at the start of the trial? Did they report the demographics of the study groups? **a. If they were not similar – what differences existed?**	The groups were similar in that they were matched for age and gender however dissimilar in their health status.
37. Did the subjects know to which treatment group they were assign? **a. If yes, what are the potential consequences of the subjects' knowledge for this study's results**	Yes, the subjects were aware that they were being tested either because they were "healthy" or were diagnosed with JIA however it was unclear as to whether the groups knew about each other. I don't believe there are consequences for these actions in this study's design.
38. Did the investigators know who was being assigned to which group prior to the allocation? **a. If they were not blind, what are the potential consequences of this knowledge for the study's results?**	No, the subjects' clinical exam and MRI readings were done by clinicians who were unaware of the child's status. The MRI readers did not know the results of the child's clinical exam as well as the examiner did not know the results of their MRI readings.
39. Were the groups managed equally, apart from the actual experimental treatment? **a. If not, what are the potential**	The groups were not managed equally because the researchers did not have the healthy controls receive a contrast MRI due to ethical reasons. However both groups

consequences of this knowledge for the study's results?	underwent the same treatment otherwise.
40. Was the subject follow-up time sufficiently long to answer the question(s) posed by the research? **a. If not, what are the potential consequences of this knowledge for the study's results?**	There was no subject follow up time for this study as each clinical exam and written survey occurred in the same day. The JIA group underwent the clinical exam and MRI within a one-week period. Due to the aim of the study, no follow up was needed with the participants.
41. Did all the subjects originally enrolled complete the study? **a. If not how many subjects were lost?** **b. What, if anything, did the authors do about this attrition?** **c. What are the implications of the attrition and the way it was handled with respect to the study's findings?**	Yes, all subjects originally enrolled in the study were examined and their data used in the results. Due to the lack of follow up needed in this study's design, attrition was not a factor.
42. Were all patients analyzed in the groups to which they were randomized (i.e. was there an intention to treat analysis)? **a. If not, what did the authors do with the data from these subjects?** **b. If the data were excluded, what are the potential consequences for this study's results?**	Yes, all subjects were analyzed in the group to which they were originally assigned because the design of this study was to compare one population's results to another. Therefore, no switching of subjects results would be necessary benefit the researchers.
Are the valid results of this RCT important?	
Appraisal Criterion	***Reader's Comments***
43. What were the statistical findings of this study? **a. When appropriate use the calculation forms below to determine these values** **b. Include: tests of differences? With p-values and CI** **c. Include effect size with p-**	The significant statistical findings of this study are as follows: Power= .965 Asymmetric Mouth Opening: Sens= .65, Spec= .78 Combination of all 5 items= sens= .85, spec= .70 The meaning of these results is that the

values and CI **d. Include ARR/ABI and RRR/RBI with p-values and CI** **e. Include NNT and CI** **44. What is the meaning of these statistical findings for your patient/client's case? What does this mean to your practice?**	combination of using all 5 clinical exam techniques will give the the best outcome in terms of accurately diagnosing TMJ arthritis without the use of contrast MRI. This means that by using all items instead of one such as, mouth opening, that a concise screening protocol can be used and still be accurate for my patients.
45. Do these findings exceed a minimally important difference? **a. If not, will you still use this evidence?**	There is no MCID for the clinical findings used: asymmetric mouth opening, pain on palpation of masticatory muscles, pain on palpation on TMJ, TMJ clicking, and reduced mouth opening capacity. I will still use this evidence because it shows that a cluster of tests, such as similar ones used in other orthopedic settings, can give us high enough values of accuracy to prevent further medical costs yet give early detection and possibly prevent joint degradation.
Can you apply this valid, important evidence about an intervention in caring for your patient/client? What is the external validity?	
Appraisal Criterion	***Reader's Comments***
46. Does this intervention sound appropriate for use (available, affordable) in your clinical setting?	Yes, this intervention sounds very appropriate for use in my clinic. It can give me a screening tool to use with a patient diagnosed with JIA that can prevent costs and give accurate early detection of TMJ arthritis.
47. Are the study subjects similar to your patient/ client? **a. If not, how different? Can you use this intervention in spite of the differences?**	The study subjects are very similar to mine in their diagnosis and age range. It can be applied directly to most clients with this diagnosis other than those who have aged into their 20's.
48. Do the potential benefits outweigh the potential risks using this intervention with your patient/client?	The potential benefits far outweigh the risks of this screening. The patient either gets early detection of TMJ involvement or prevents unneeded medical costs of a MRI.
49. Does the intervention fit within your patient/client's stated values or expectations? **a. If not, what will you do now?**	This screening fits with my clients values because they have a diagnosis that subjects them to joint breakdown and would therefore want early detection of any involved joint. They also already have higher

	medical costs than the average child so saving potentially costly measures will lay within theirs and their parents values.
50. Are there any threats to external validity in this study?	Threats to external validity come with trying to use this screening protocol on populations that have not been diagnosed with JIA.
What is the bottom line? What pedro score would you give this trial?	
Appraisal Criterion	***Reader's Comments***
51. Summarize your findings and relate this back to clinical significance	The clinical significance is that PT's have the training to perform all clinical tests that may be used in any setting for this TMJ screening. They also have the potential to see these children with JIA for reasons outside of TMJ and should have the knowledge of this screening to provide the best care possible.

PEDro Internal Validity Scale	**No**	**Yes**
23. Eligibility criteria were specified		1
24. subjects were randomly allocated to groups (in a crossover study, subjects were randomly allocated an order in which treatments were received)	1	
25. allocation was concealed		1
26. the groups were similar at baseline regarding the most important prognostic indicators		1
27. there was blinding of all subjects	1	
28. there was blinding of all therapists who administered the therapy		1
29. there was blinding of all assessors who measured at least one key outcome		1
30. measures of at least one key outcome were obtained from more than 85% of the subjects initially allocated to groups		1
31. all subjects for whom outcome measures were available received the treatment or control condition as allocated or, where this was not the case, data for at least one key outcome was analysed by "intention to treat"		1
32. the results of between-group statistical comparisons are reported for at least one key outcome		
33. the study provides both point measures and measures of variability for at least one key outcome		1
PEDro Score:	7/10	

Reference #? Koos, B., Twilt, M., Kyank, U., Fischer-Brandies, H., Gassling, V., & Tzaribachev, N. (2014). Reliability of Clinical Symptoms in Diagnosing Temporomandibular Joint Arthritis in Juvenile Idiopathic Arthritis. *The Journal of Rheumatology*, *41*(9), 1871–1877. https://doi.org/10.3899/jrheum.131337

(Bibliography #?): In text: (Koos et al., 2014)

Level of evidence: 2b PEDro Scale: 7/10

Purpose: The purpose of this cross sectional study was to test the reliability of clinical findings, as a concise screening protocol, in diagnosing TMJ arthritis in those with Juvenile Idiopathic Arthritis (JIA) as compared with the reference method of contrast MRI. The researchers wanted to create a cluster of tests that can be used to accurately diagnose TMJ arthritis and prevent future medical costs if possible.

Methods: The methods of this study involved finding 134 patients with diagnosed JIA over a 3-month period and having them undergo a clinical examination as well as contrast MRI to determine the presence of TMJ arthritis. The researchers then found 134 matched healthy controls who underwent the same clinical examination however did not undergo a contrast MRI due to ethical reasons. The clinical exam included a blinded, experienced practitioner who looked at asymmetric mouth opening, pain on palpation of masticatory muscles, pain on palpation on TMJ, TMJ clicking, and reduced mouth opening capacity. Two experienced MRI readers looked at each contrast MRI to determine the presence of TMJ arthritis in the joints imaged, these readers were also blinded to the subject's clinical exam or diagnosis.

Results: The results of this study found high correlation with asymmetric mouth opening and TMJ arthritis found on contrast MRI in those patients with JIA. However, the best findings in terms of highest sensitivity and specificity came when all 5 clinical exam results were compared to contrast MRI findings. The sensitivity of the combination of all the tests was .85 while the specificity was .70, showing a very accurate cluster of tests in determining TMJ arthritis in those children with JIA.

Critique/Bottom Line: The bottom line of this study is that a cluster of tests that can be used in any clinical setting by a physical therapist can save future medical costs as well as provide early detection of TMJ involvement in children with JIA. Contrast MRI's can be expensive, time consuming, and require possible sedative medicine to be used with children therefore if it can be avoided due to ruling out TMJ arthritis in clinic, I feel it should be done. The tests that this screening require is well within the scope of practice for PT's and would require minimal time in an appointment although show huge benefits to the patient. If TMJ arthritis goes undiagnosed it can result in mandibular growth disturbances and subsequent facial asymmetry, causing for increased need in early diagnosis. Though not all children with JIA will have TMJ involvement, it is known that the presence of this happens more than previously thought, even without TMJ symptoms present. Overall, as the patient might not know potential damage is occurring to this joint, given their diagnosis a screening tool to prevent further health problems should be done to provide optimal patient care.

Reference #? Zwir, L. M. L. F., Terreri, M. T. R. A., Sousa, S. A., Fernandes, A. R. C., Guimar?es, A. S., & Hil?rio, M. O. E. (2015). Are temporomandibular joint signs and symptoms associated with

magnetic resonance imaging findings in juvenile idiopathic arthritis patients? A longitudinal study. *Clinical Rheumatology*, *34*(12), 2057–2063. https://doi.org/10.1007/s10067-015-2925-y

Is the purpose and background information sufficient?	
Appraisal Criterion	***Reader's Comments***
Study Purpose Stated clearly? Usually stated briefly in abstract and in greater detail in introduction. May be phrased as a question or hypothesis. A clear statement helps you determine if topic is important, relevant and of interest to you. Consider how the study can be applied to PT and/or your own situation. What is the purpose of this study?	The study's purpose was to perform a comprehensive evaluation of the TMJ and to investigate the association between the clinical and MRI findings in the TMJ's of patients with JIA. This topic is relevant to my patient and study because I am looking for a screening tool to put together to have early diagnosis of TMJ involvement even without the presence of reported symptoms.
Literature Relevant background presented? A review of the literature should provide background for the study by synthesizing relevant information such as previous research and gaps in current knowledge, along with the clinical importance of the topic. Describe the justification of the need for this study	There was relevant literature presented stating that TMJ is often one of the early joints involved in patients with JIA and also goes unnoticed more often than not. It was also stated that the literature presents contrast MRI as the gold standard, though without patient complaints the bone deformation can be occurring unknowingly. Therefore, earlier detection is needed in patients with JIA to prevent further joint damage or bone deformation while the child is growing.

Does the research design have internal validity?	
Appraisal Criterion	***Reader's Comments***
➢ **Discuss possible threats to internal validity in the research design. Include:** ➢ **Assignment** ➢ **Attrition** ➢ **History** ➢ **Instrumentation** ➢ **Maturation**	There was an internal threat of assignment or selection in this study due to the instance of non-randomization in group selection. Participants were assigned to groups using their disease status of active, remission on medication, or remission off medication.

➢ **Testing** ➢ **Compensatory Equalization of treatments** ➢ **Compensatory rivalry** ➢ **Statistical Regression**	

Are the results of this therapeutic trial valid?	
Appraisal Criterion	***Reader's Comments***
52. Did the investigators randomly assign subjects to treatment groups? **a. If no, describe what was done** **b. What are the potential consequences of this assignment process for the study's results?**	No, the researchers did not randomly assign the subjects to their group. They were assigned based on disease status of active, remission on medication or remission off medication. The consequences for this are that the results may be skewed due to not all groups being similar.
53. Were the groups similar at the start of the trial? Did they report the demographics of the study groups? **a. If they were not similar – what differences existed?**	The groups were similar in having a diagnosis of JIA however they ranged widely in age, disease progression, disease onset age and disease type. They did not report the specific demographics of each group.
54. Did the subjects know to which treatment group they were assign? **a. If yes, what are the potential consequences of the subjects' knowledge for this study's results**	It was not stated whether or not the subjects were aware of their group assignment however in this instance of an observational study, I don't see consequences for this.
55. Did the investigators know who was being assigned to which group prior to the allocation? **a. If they were not blind, what are the potential consequences of this knowledge for the study's results?**	Yes, the researchers knew who was going to be placed in each group prior to starting the study. The consequences for this may be differential treatment however in an observational study I don't believe that bias was present.
56. Were the groups managed equally, apart from the actual experimental treatment? **a. If not, what are the potential consequences of this knowledge for the study's results?**	The groups were managed equally in their treatment of the physical examination and contrast MRI given.

57. Was the subject follow-up time sufficiently long to answer the question(s) posed by the research? **a. If not, what are the potential consequences of this knowledge for the study's results?**	The subject follow-up time was one year, which is sufficient to see a change in disease status as well as changes in the TMJ itself if present. Also, it allows enough time for beginning or relief of TMJ symptoms due to their diagnosis.
58. Did all the subjects originally enrolled complete the study? **a. If not how many subjects were lost?** **b. What, if anything, did the authors do about this attrition?** **c. What are the implications of the attrition and the way it was handled with respect to the study's findings?**	Yes, all subjects originally enrolled in the study completed the initial day of exams as well as the one year follow up exams. There were no subjects lost in this study. They stated that if a child was unable to participate in the MRI that they would be excluded however no children were reported as not participating.
59. Were all patients analyzed in the groups to which they were randomized (i.e. was there an intention to treat analysis)? **a. If not, what did the authors do with the data from these subjects?** **b. If the data were excluded, what are the potential consequences for this study's results?**	Yes, all patients were analyzed in the groups they were originally placed in. However, due to the nature of the study, it was not stated what was done if the child's disease status changed at the follow up examination, if they were taken from their original group or not. The researchers did not state any data was excluded therefore I assume all participants were evaluated in the originally given groups.
Are the valid results of this RCT important?	
Appraisal Criterion	***Reader's Comments***
60. What were the statistical findings of this study? **a. When appropriate use the calculation forms below to determine these values** **b. Include: tests of differences? With p-values and CI** **c. Include effect size with p-values and CI** **d. Include ARR/ABI and RRR/RBI**	The statistical findings of the study were that there was significant, p=.023, signs found in the groups at the first and second evaluation. These signs included pain on TMJ palpation, restricted mouth opening capacity and TMJ crepitus. There were also significant differences found in maximal mouth opening in those with active disease as compared to the other groups. Synovial enhancement was significantly associated with altered condylar

with p-values and CI **e. Include NNT and CI** **61. What is the meaning of these statistical findings for your patient/client's case? What does this mean to your practice?**	shape at both evaluations, p=.007. Intense enhancement was also significantly associated with disease activity and the presence of erosions at both evaluations. There was 94 % agreement, and a kappa coefficient of 0.81 between the two radiologists and the intra observer agreement was 90 % in relation to the presence of erosions and the presence of enhancement and its quantification. The meaning of these statistical findings for my patient is that with active disease, more signs may be present than when in remission. It is hard to know without other tests performed whether the patient is in an active disease state or not but if the presence of these signs such as decreased maximal mouth opening is present, it can be a screening tool used to send them back their doctor for further evaluation.
62. Do these findings exceed a minimally important difference? **a. If not, will you still use this evidence?**	There is no minimally important difference for maximal mouth opening in children therefore no comparison can be made. However according to the averages that have been presented, the average mouth opening capacity of these subjects did not differ, even with disease status. I will still use this evidence as a screening tool in clinic when further diagnostic testing is not available.
Can you apply this valid, important evidence about an intervention in caring for your patient/client? What is the external validity?	
Appraisal Criterion	***Reader's Comments***
63. Does this intervention sound appropriate for use (available, affordable) in your clinical setting?	Yes, this intervention sounds appropriate for use as it can be used as a screening tool to prevent further medical costs or have early detection of disease presence to prevent further damage.
64. Are the study subjects similar to your patient/ client? **a. If not, how different? Can you**	Yes, the study subjects were very similar to my patient as they have the diagnosis of JIA and fall within the same age range. However,

use this intervention in spite of the differences?	this study had a vast age range and disease type therefore in that instance I am not sure how applicable their results can be.
65. Do the potential benefits outweigh the potential risks using this intervention with your patient/client?	Yes, the potential benefits far outweigh the risks. The threat of facial deformity and restricted use of their mouth should call for a screening tool to be made that can send the patient back to the doctor if disease activity is suspected or save medical costs if the screening is negative.
66. Does the intervention fit within your patient/client's stated values or expectations? **a. If not, what will you do now?**	I believe the intervention fits within my patients values because given their diagnosis, they will want to be aware of further joint break down especially in the phases of growth. Therefore, performing this screening can aid in better awareness of possible joint involvement.
67. Are there any threats to external validity in this study?	Threats to external validity fall in the specificity of the population and specificity of the joint evaluated, if applied to those same populations however there are no threats to external validity.
What is the bottom line? What pedro score would you give this trial?	
Appraisal Criterion	***Reader's Comments***
68. Summarize your findings and relate this back to clinical significance	The findings state that contrast MRI will still be the most definitive test to determine active TMJ arthritis in those patients with JIA. However the clinical significance is that physical therapists can be a line of early detection of TMJ involvement by using clinical signs and symptoms as a screening tool to be used for further testing if needed.

PEDro Internal Validity Scale	**No**	**Yes**
34. Eligibility criteria were specified		1
35. subjects were randomly allocated to groups (in a crossover study, subjects were randomly allocated an order in which treatments were received)	1	
36. allocation was concealed	1	
37. the groups were similar at baseline regarding the most important prognostic indicators		1
38. there was blinding of all subjects		1
39. there was blinding of all therapists who administered the therapy		1

40. there was blinding of all assessors who measured at least one key outcome		1
41. measures of at least one key outcome were obtained from more than 85% of the subjects initially allocated to groups		1
42. all subjects for whom outcome measures were available received the treatment or control condition as allocated or, where this was not the case, data for at least one key outcome was analysed by "intention to treat"		1
43. the results of between-group statistical comparisons are reported for at least one key outcome		1
44. the study provides both point measures and measures of variability for at least one key outcome		
PEDro Score:	8/10	

Reference #? Zwir, L. M. L. F., Terreri, M. T. R. A., Sousa, S. A., Fernandes, A. R. C., Guimar?es, A. S., & Hil?rio, M. O. E. (2015). Are temporomandibular joint signs and symptoms associated with magnetic resonance imaging findings in juvenile idiopathic arthritis patients? A longitudinal study. *Clinical Rheumatology*, *34*(12), 2057–2063. https://doi.org/10.1007/s10067-015-2925-y

(Bibliography #?): **In text: (Zwir, L. et al., 2015)**

Level of evidence: 2b **PEDro Scale: 8/10**

Purpose: The study's purpose was to perform a comprehensive evaluation of the TMJ and to investigate the association between the clinical and MRI findings in the TMJ's of patients with JIA.

Methods: Seventy-five patients with JIA were divided into groups of active, remission on medication and remission off medication and then given a contrast MRI as well as a clinical exam by a dentist. All exams were given on the same date for each patient and then performed once again one year later. The subjects were also all given a questionnaire regarding their subjective symptoms of TMJ involvement regarding many variables. The clinical exam evaluated maximal mouth opening between incisal edges of the front teeth, presence of tenderness on palpation of the TMJ bilaterally, and presence of TMJ crepitus detected objectively during opening and closing movements of the mouth. The contrast MRI detected synovial enhancement, condylar deformation, and bone erosions examined by two blinded radiologists who were tested for intra and interobserver reliability.

Results: The statistical findings of the study were that there was significant, p=.023, signs of TMJ involvement found in the groups at the first and second evaluation. There were also significant differences found in maximal mouth opening in those with active disease as compared to the other groups. Synovial enhancement was significantly associated with altered condylar shape at both evaluations, p=.007. Intense enhancement was also

significantly associated with disease activity and the presence of erosions at both evaluations. The meaning of these statistical findings is that with active disease, more signs may be present than when in remission.

Critique/Bottom Line: It is hard to know without other tests performed whether the patient is in an active disease state or not but if there is presence of these signs such as decreased maximal mouth opening, it can be a screening tool used to send them back their doctor for further evaluation. Though this study did not compare many clinical findings to the MRI results, a physical therapist can perform a much more in depth evaluation of the TMJ if arthritic involvement is suspected in these children. Physical therapists can be used as screeners for TMJ involvement to obtain early detection and be a bigger part of the medical team for patients with JIA.

Reference #? Kuseler, A., Pedersen, T., Gelineck, J., & Herlin, T. (2005). A 2 year followup study of enhanced magnetic resonance imaging and clinical examination of the temporomandibular joint in children with juvenile idiopathic arthritis. *The Journal Of Rheumatology*, *32*(1), 162-169.

Is the purpose and background information sufficient?	
Appraisal Criterion	***Reader's Comments***
Study Purpose Stated clearly? Usually stated briefly in abstract and in greater detail in introduction. May be phrased as a question or hypothesis. A clear statement helps you determine if topic is important, relevant and of interest to you. Consider how the study can be applied to PT and/or your own situation. What is the purpose of this study?	The purpose of this study was to find correlation between findings from the clinical exam with MRI of the TMJ in children who have been diagnosed with JIA in the previous 3 years. This helps pertain to my case because I am wanting to make a screening of tests that can be validated to correlate well with the gold standard of MRI in evaluating involvement of the TMJ joint in children with juvenile idiopathic arthritis.
Literature Relevant background presented? A review of the literature should provide background for the study by synthesizing relevant information such as previous research and gaps in current knowledge, along with the clinical importance of the topic. Describe the justification of the need for this study	The literature presented in their background was scarce though did present the prevalence of JIA children with TMJ involvement and why it can become an issue if undetected. However, it was also stated that TMJ involvement in the early stages of the disease often comes without objective symptoms. This makes it difficult to have early detection for practitioners and presents the justification for a clinical exam that can correlate well with MRI findings.

Does the research design have internal validity?	
Appraisal Criterion	***Reader's Comments***
➢ **Discuss possible threats to internal validity in the research design. Include:** ➢ **Assignment** ➢ **Attrition** ➢ **History** ➢ **Instrumentation** ➢ **Maturation** ➢ **Testing** ➢ **Compensatory Equalization of treatments** ➢ **Compensatory rivalry** ➢ **Statistical Regression**	There is an internal validity threat of assignment in this study. The researchers had an experimental group of 15 children with a mean age of 12 however their control group was 3 adults without subjective TMJ symptoms. This makes the group unable to be compared and does not validate the results. Also, the groups were not treated equally in that the control group was only given an MRI, not the clinical examination as well. The study also lost 2 patients due to missing their appointments, giving them a 13% attrition rate which in a small study can seem significant.

Are the results of this therapeutic trial valid?	
Appraisal Criterion	***Reader's Comments***
69. Did the investigators randomly assign subjects to treatment groups? **a. If no, describe what was done** **b. What are the potential consequences of this assignment process for the study's results?**	No, the investigators did not randomly assign the treatment and control groups. The experimental group was selected due to their diagnosis and disease duration where as the control was selected because they reported no signs or symptoms of TMJ involvement. This makes it difficult for the study to have reliability as they biased their results by pre-selecting the groups.
70. Were the groups similar at the start of the trial? Did they report the demographics of the study groups? **a. If they were not similar – what differences existed?**	No the groups were not similar in this study. The experimental group was 13 children with a mean age of 12 and diagnosed with JIA where as the control group was 3 healthy adults. They did report this as a limitation to their study and claimed ethical reasoning.
71. Did the subjects know to which treatment group they were assign? **a. If yes, what are the potential consequences of the subjects' knowledge for this study's results**	Yes, the subjects knew what was going to occur to them before the study began. However is this type of comparison study there aren't consequences in terms of compensatory rivalry and what not because they can not change the results of their testing.

72. Did the investigators know who was being assigned to which group prior to the allocation? **a. If they were not blind, what are the potential consequences of this knowledge for the study's results?**	Yes the investigators knew who was going to be assigned to each group prior to the beginning of the study. The consequence for this however doesn't seem relevant as this is a comparison study of a specific disease and the difference in groups is needed.
73. Were the groups managed equally, apart from the actual experimental treatment? **a. If not, what are the potential consequences of this knowledge for the study's results?**	No the groups were not managed equally because the control group did not receive the clinical exam, only the experimental group did. It would have been better if the adults without TMJ symptoms were still given a clinical exam to see false negative or true positive results even though their MRI's were clear for TMJ involvement.
74. Was the subject follow-up time sufficiently long to answer the question(s) posed by the research? **a. If not, what are the potential consequences of this knowledge for the study's results?**	The subjects were followed for 2 years with 4 exams every 6-8 month period. I do feel this is a sufficient follow up time because that gives the subjects time to change in subjective symptoms as well as disease involvement and shows a good correlating factor between clinical signs and symptoms and MRI results.
75. Did all the subjects originally enrolled complete the study? **a. If not how many subjects were lost?** **b. What, if anything, did the authors do about this attrition?** **c. What are the implications of the attrition and the way it was handled with respect to the study's findings?**	Yes all subjects originally enrolled in the study completed the study in the same group they were originally allocated to. No subjects were lost however two children missed one of their appointments which decreased the amount of joints examined and the researchers say their results were excluded. This gives them a 13% attrition rate which does not place them at risk for study compromise.
76. Were all patients analyzed in the groups to which they were randomized (i.e. was there an intention to treat analysis)? **a. If not, what did the authors do with the data from these subjects?** **b. If the data were excluded, what are the potential**	Yes, all subjects were analyzed in the groups to which they were originally placed in. The authors suggested that the joints that were removed from the study were taken out of the statistics therefore an intention to treat may have been done, though not stated clearly. The consequences for excluding 2 children's results may not seem significant as it doesn't meet the 20% attrition rate

consequences for this study's results?	however in a small study, that loss can significantly change the results .
Are the valid results of this RCT important?	
Appraisal Criterion	***Reader's Comments***
77. What were the statistical findings of this study? **a. When appropriate use the calculation forms below to determine these values** **b. Include: tests of differences? With p-values and CI** **c. Include effect size with p-values and CI** **d. Include ARR/ABI and RRR/RBI with p-values and CI** **e. Include NNT and CI** **78. What is the meaning of these statistical findings for your patient/client's case? What does this mean to your practice?**	This study did not use statistics in the true form, they reported percentages in each of their categories most often. The results reported no correlation between total MRI score and total clinical score therefore they were not reported. This study gave no p value or confidence interval as no statistical results were reported. The meaning of this study's "statistics" tells me that their testing was not done well and will not be transferrable past their individual study. With no correlation found it is safe to assume that their study will not be helpful in my overall research.
79. Do these findings exceed a minimally important difference? **a. If not, will you still use this evidence?**	There is no minimally important difference for clinical signs found in children or adults. The non-correlative findings between MRI and clinical exam will not be helpful therefore no, I will not use this evidence.
Can you apply this valid, important evidence about an intervention in caring for your patient/client? What is the external validity?	
Appraisal Criterion	***Reader's Comments***
80. Does this intervention sound appropriate for use (available, affordable) in your clinical setting?	Yes, the intervention of the clinical exam used in this study is available, affordable, and realistic to use in clinic.
81. Are the study subjects similar to your patient/ client? **a. If not, how different? Can you use this intervention in spite**	Yes the study subjects in the experimental group were similar to my patient however they had been diagnosed for almost three years where as my patient had only been

of the differences?	diagnosed for one week. I believe I could still use this intervention in spite of that difference.
82. Do the potential benefits outweigh the potential risks using this intervention with your patient/client?	The benefits definitely outweigh the risks because the clinical exam will not worsen or cause TMJ symptoms however it can catch TMJ involvement potentially so it is time worthy and cost worthy.
83. Does the intervention fit within your patient/client's stated values or expectations? **a. If not, what will you do now?**	I believe the intervention fits in my patients values of wanting to make sure no further joint degradation is occurring as well as minimizing pain of involved joints.
84. Are there any threats to external validity in this study?	The treat to external validity in this study is that their control group was in no way similar to the children tested.
What is the bottom line? What pedro score would you give this trial?	
Appraisal Criterion	***Reader's Comments***
85. Summarize your findings and relate this back to clinical significance	The findings of this study will not be used in clinic because of the methods of their research. Therefore I found minimal clinical significance.

PEDro Internal Validity Scale	**No**	**Yes**
45. Eligibility criteria were specified		1
46. subjects were randomly allocated to groups (in a crossover study, subjects were randomly allocated an order in which treatments were received)	1	
47. allocation was concealed	1	
48. the groups were similar at baseline regarding the most important prognostic indicators	1	
49. there was blinding of all subjects	1	
50. there was blinding of all therapists who administered the therapy		1
51. there was blinding of all assessors who measured at least one key outcome		1
52. measures of at least one key outcome were obtained from more than 85% of the subjects initially allocated to groups		1
53. all subjects for whom outcome measures were available received the treatment or control condition as allocated or, where this was not the case, data for at least one key outcome was analysed by "intention to treat"		1
54. the results of between-group statistical comparisons are reported for at least one key outcome	1	
55. the study provides both point measures and measures of variability for at least one key outcome		

PEDro Score:	5/10

Reference #? Kuseler, A., Pedersen, T., Gelineck, J., & Herlin, T. (2005). A 2 year followup study of enhanced magnetic resonance imaging and clinical examination of the temporomandibular joint in children with juvenile idiopathic arthritis. *The Journal Of Rheumatology*, *32*(1), 162-169.

(Bibliography #?): In text: (Kuseler et al., 2005)

Level of evidence: 3b PEDro Scale: 5/10

Purpose: The purpose of this study was to find correlation between findings from a clinical exam with MRI of the TMJ in children who have been diagnosed with JIA in the previous 3 years. They wanted to find a way to classify which patients could benefit from further diagnostic methods in order to be able to diagnose involvement of the TMH as early as possible.

Methods: They originally had 28 children who qualified though only 15 chose to participate. These children were all diagnosed with JIA and had a mean age of 12 years old. Those subjects had to be older than 8 with a disease duration not exceeding three years. These children underwent a clinical exam given by an orthodontist who examined swelling, tenderness, and limitation of movement of the subjects' TMJ's. They also underwent a contrast MRI which was evaluated by a radiologist to determine enhancement of the synovial membrane, condylar morphology, presence of pannus, and intraarticular fluid. The researchers also had a control group of three healthy adults who did not report TMJ signs or symptoms and underwent the MRI but did not have a clinical exam performed.

Results: This study found no correlation between total score for the clinical examination and total score of the MRI. However, they found involvement of the TMJ in every subject other than the control group, regardless of disease duration or type. They also determined that clinical examination seems to be more reliable than asking for symptoms, since all patients showing mild to severe findings by clinical examination also had pathological signs on the postcontrast MRI.

Critique/Bottom Line: The bottom line of this study is that clinical examination findings are difficult to correlate with MRI findings when determining TMJ involvement. However, though not statistically significant, the children that had significant MRI findings also had moderate clinical findings and therefore could be screened to determine further diagnostic testing was needed. I feel that although early detection will not be possible for all cases, the culmination of various clinical tests can determine if a patient should get further medical care. The risks of undetected TMJ involvement in patients with JIA outweigh the risks of taking 5-10 minutes in clinic to determine if the child should be further seen. Furthermore, over-cautious

practitioners should not be seen poorly as the risk for further complications with aging in these children would outweigh the costs of medical treatments in my opinion.

Reference #? Steenks, M. H., Giancane, G., de Leeuw, R. R., Bronkhorst, E. M., van Es, R. J., Koole, R., Wulffraat, N. M. (2015). Temporomandibular joint involvement in Juvenile Idiopathic Arthritis: reliability and validity of a screening protocol for the rheumatologist. *Pediatric Rheumatology*, *13*(1). https://doi.org/10.1186/s12969-015-0011-2

Is the purpose and background information sufficient?	
Appraisal Criterion	***Reader's Comments***
Study Purpose Stated clearly? Usually stated briefly in abstract and in greater detail in introduction. May be phrased as a question or hypothesis. A clear statement helps you determine if topic is important, relevant and of interest to you. Consider how the study can be applied to PT and/or your own situation. What is the purpose of this study?	The purpose of this study was to test their TMJ examination protocol for internal consistency, reliability and concurrent validity against the JADAS-27 protocol, which reflects the overall JIA activity and does not include assessment of the masticatory system, in a consecutive series of patients diagnosed with JIA.
Literature Relevant background presented? A review of the literature should provide background for the study by synthesizing relevant information such as previous research and gaps in current knowledge, along with the clinical importance of the topic. Describe the justification of the need for this study	There was plenty of relevant background presented that stated the importance of early detection of TMJ involvement in patients with JIA and the prevention of facial asymmetries and masticatory dysfunction. They stated the relevance of having a screening protocol that would be quick and accurate to put into a follow-up appointment when these patients see their rheumatologist. They intended for this to be a 3 minute protocol.

Does the research design have internal validity?	
Appraisal Criterion	***Reader's Comments***
➢ **Discuss possible threats to internal validity in the research design. Include:** ➢ **Assignment** ➢ **Attrition** ➢ **History** ➢ **Instrumentation** ➢ **Maturation**	There were only 2 patients who dropped out of 76 therefore there is no threat of attrition in this study. All patients were assessed once causing no maturation to occur. There were no assigned groups in this study as its an observational. There is a threat to internal validity associated in testing because the same rheumatologist did not examine every

➢ **Testing** ➢ **Compensatory Equalization of treatments** ➢ **Compensatory rivalry** ➢ **Statistical Regression**	participant therefore that changes results within their study. Also, these examiners only received a 2 hour training on the protocol prior to the study, not allowing their skills to be fully developed or consistent.

Are the results of this therapeutic trial valid?	
Appraisal Criterion	***Reader's Comments***
86. Did the investigators randomly assign subjects to treatment groups? **a. If no, describe what was done** **b. What are the potential consequences of this assignment process for the study's results?**	There was only one group examined in this study therefore they were all chosen due to their diagnosis of JIA. The consequences are a decrease in evidence level due to no comparison of healthy individuals or reference against the gold standard of contrast MRI.
87. Were the groups similar at the start of the trial? Did they report the demographics of the study groups? **a. If they were not similar – what differences existed?**	There is only one group examined therefore their characteristics were all similar in being under the age of 18 and diagnosed with JIA, though all subtypes were used.
88. Did the subjects know to which treatment group they were assign? **a. If yes, what are the potential consequences of the subjects' knowledge for this study's results**	The subjects knew they were getting their TMJ evaluated though did not know further reasoning of the study.
89. Did the investigators know who was being assigned to which group prior to the allocation? **a. If they were not blind, what are the potential consequences of this knowledge for the study's results?**	The investigators did know that the subjects all had JIA though not their disease activity. The dentist was blinded to the results of the rheumatologists testing though still understood the diagnosis of the subjects. The potential consequence could be that the examiners were looking for results and not measuring accurately as it is known that patients with JIA commonly have TMJ dysfunction.
90. Were the groups managed equally, apart from the actual experimental treatment?	The singular group was not managed completely equally. Some participants had to get a blood test at the time of examine,

a. If not, what are the potential consequences of this knowledge for the study's results?	which can change a child's mental state, while others were able to use previously acquired blood tests. Other than this, all subjects were treated equally.
91. Was the subject follow-up time sufficiently long to answer the question(s) posed by the research? **a. If not, what are the potential consequences of this knowledge for the study's results?**	There was no subject follow-up time in this study as it all occurred in one day and did not require subsequent visits. This was not a potential risk for this study.
92. Did all the subjects originally enrolled complete the study? **a. If not how many subjects were lost?** **b. What, if anything, did the authors do about this attrition?** **c. What are the implications of the attrition and the way it was handled with respect to the study's findings?**	All subjects originally enrolled in the study completed the study. However, two patient's results were excluded following examination due to dental abcess and suspected inner ear involvement. This creates a very low attrition rate and does not affect the study's results.
93. Were all patients analyzed in the groups to which they were randomized (i.e. was there an intention to treat analysis)? **a. If not, what did the authors do with the data from these subjects?** **b. If the data were excluded, what are the potential consequences for this study's results?**	All patients were analyzed in their original group thought the patients that were excluded also had their results excluded.
Are the valid results of this RCT important?	
Appraisal Criterion	***Reader's Comments***
94. What were the statistical findings of this study? **a. When appropriate use the calculation forms below to determine these values** **b. Include: tests of differences? With p-values and CI** **c. Include effect size with p-**	The statists found a .78 internal consistency with all items though excluding asymmetry and retrognathia brought the statistic to .85, for completion and protocol purposes the researchers suggest not taking these items out however. Inter-observer reliability of history items was between .46-.87 and of examination items was .25-.73. Agreement

values and CI **d. Include ARR/ABI and RRR/RBI with p-values and CI** **e. Include NNT and CI** **95. What is the meaning of these statistical findings for your patient/client's case? What does this mean to your practice?**	between reference examiner and rheumatologist was .46 although the measurements of MMO correlated significantly at .61. MMO measured by the rheumatologist correlated negatively with JADAS-27. Sensitivity and specificity of the TMJ protocol was .52 and .80 respectively. The p value used was <.05 meant significant. The meaning of these statistical findings is that the TMJ protocol can accurately say there is TMJ involvement and correlates with the disease activity score of JADAS-27 where it is determined that an increase is disease activity causes increased instance of TMJ involvement. This means that a PT can use this short protocol in clinic to quickly screen a patient with JIA for TMJ involvement and determine if further medical testing or services are needed.
96. Do these findings exceed a minimally important difference? **a. If not, will you still use this evidence?**	The minimally important difference for mouth opening is 7mm for adults though not fully determined in children yet. This was used to determine reliability of measurements between the RE and the rheumatologist though also could be used to signify a change in a child's TMJ involvement and potential disease activity. Though this study did not have a pre and post test, I can use this evidence as a screening protocol and rather than a one time, use it as measuring change over time to see a change in MMO measurements.
Can you apply this valid, important evidence about an intervention in caring for your patient/client? What is the external validity?	
Appraisal Criterion	***Reader's Comments***
97. Does this intervention sound appropriate for use (available, affordable) in your clinical setting?	Yes, this intervention sounds appropriate for me to use in clinic as it is quick, causes minimal or short duration pain, and can be of major benefit to the patient. It is free for patient and clinician other than time spent, which is also minimal, and requires skills that the PT learns in their doctorate education where no specialization is required.

98. Are the study subjects similar to your patient/ client? **a. If not, how different? Can you use this intervention in spite of the differences?**	Yes, the study subjects are similar to my previous patient as well as a patient I would see in clinic with JIA. They matched well with age and gender as they are usually under the age of 16 and female.
99. Do the potential benefits outweigh the potential risks using this intervention with your patient/client?	The benefits far outweigh the risks in this protocol as early detection can help prevent facial asymmetries and masticatory dysfunction in the present and as the child ages. The risks for the use of this protocol would be minimal, other than pain caused during the testing.
100. Does the intervention fit within your patient/client's stated values or expectations? **a. If not, what will you do now?**	The intervention fits well into my patients values as they would want to be aware of any further joint degradation occurring and whether or not to be concerned of future impairments.
101. Are there any threats to external validity in this study?	Threats to external validity include the inability to compare their protocol results on healthy subjects as whether or not it may still determine TMJ involvement.
What is the bottom line? What pedro score would you give this trial?	
Appraisal Criterion	***Reader's Comments***
102. Summarize your findings and relate this back to clinical significance	The findings of this study state that although diagnosing TMJ arthritis is not possible with clinical assessment alone, this can be a screening tool used by clinicians to determine involvement and further medical services if needed. An MRI will not always be available or feasible therefore a screening as to whether or not that service is necessary can help families and patients.

PEDro Internal Validity Scale	**No**	**Yes**
56. Eligibility criteria were specified		1
57. subjects were randomly allocated to groups (in a crossover study, subjects were randomly allocated an order in which treatments were received)	1	
58. allocation was concealed	1	
59. the groups were similar at baseline regarding the most important prognostic indicators		1
60. there was blinding of all subjects		1
61. there was blinding of all therapists who administered the therapy		1

62. there was blinding of all assessors who measured at least one key outcome		1
63. measures of at least one key outcome were obtained from more than 85% of the subjects initially allocated to groups		1
64. all subjects for whom outcome measures were available received the treatment or control condition as allocated or, where this was not the case, data for at least one key outcome was analysed by "intention to treat"		1
65. the results of between-group statistical comparisons are reported for at least one key outcome	1	
66. the study provides both point measures and measures of variability for at least one key outcome		
PEDro Score:	7/10	

Reference #? Steenks, M. H., Giancane, G., de Leeuw, R. R., Bronkhorst, E. M., van Es, R. J., Koole, R., Wulffraat, N. M. (2015). Temporomandibular joint involvement in Juvenile Idiopathic Arthritis: reliability and validity of a screening protocol for the rheumatologist. *Pediatric Rheumatology*, *13*(1). https://doi.org/10.1186/s12969-015-0011-2

(Bibliography #?): In text: (Steenks et al., 2015)

Level of evidence: 2b PEDro Scale: 7/10

Purpose: The purpose of this study was to test their TMJ examination protocol for internal consistency, reliability and concurrent validity against the JADAS-27 protocol, which reflects the overall JIA activity and does not include assessment of the masticatory system, in a consecutive series of patients diagnosed with JIA.

Methods: Seventy-eight patients with JIA were recruited from an outpatient clinic of the pediatric department of rheumatology & immunology in the Netherlands. Due to consent received and other factors, only 76 patients ended up participating in the study. The pediatric rheumatologists were trained for TMJ examination prior to the study and tested against there reference examiner for consistency of results. The clinical exam consisted of five history questions and six clinical examination items with a score of one assigned for yes (positive) and zero assigned for no (negative). The JADAS-27 was also given to patients to examine the activity of their disease in their current state and was referenced against the rheumatologist's results to determine correlation.

Results: The internal consistency of this study was adequate at .78 for all items tested. The statistical values for reliability of the history and function related items varied between .42 (fair) and .87 (almost perfect), causing a wide range and limited validity of the results. Agreement between reference examiner and rheumatologist was .46 although the measurements of MMO correlated significantly at .61. MMO measured by the rheumatologist correlated negatively with JADAS-27. Sensitivity and specificity of the TMJ protocol was .52

and .80 respectively. Concurrent validity was found to be fair to good between the dentist and pediatric rheumatologist of examination of results. By using the "at least 2 positive scores" on the examination testing, the results faired much better than by using one as this caused an increased correlation of most items.

Critique/Bottom Line: The findings of this study state that although diagnosing TMJ arthritis is not possible with clinical assessment alone, this can be a screening tool used by clinicians to determine involvement of the TMJ and further medical services if needed. An MRI will not always be available or feasible therefore a screening as to whether or not that service is necessary can help families and patients. This study and many of the other ones found indicate that physical therapists are not, as of now, being involved in the screening process however we are commonly seeing these patients for other reasons and should be involved in the medical team. I believe it is unknown to other providers what a PT's skills involve and therefore using screening protocols such as this one can indicate our importance in the optimal care for these patients.

Reference #? Shaffer, S. M., Brismée, J.-M., Sizer, P. S., & Courtney, C. A. (2014). Temporomandibular disorders. Part 2: conservative management. *The Journal of Manual & Manipulative Therapy*, *22*(1), 13–23. https://doi.org/10.1179/2042618613Y.0000000061

Is the purpose and background information sufficient?	
Appraisal Criterion	***Reader's Comments***
Study Purpose Stated clearly? Usually stated briefly in abstract and in greater detail in introduction. May be phrased as a question or hypothesis. A clear statement helps you determine if topic is important, relevant and of interest to you. Consider how the study can be applied to PT and/or your own situation. What is the purpose of this study?	This study's purpose was to review all methods related to conservative management of the temporomandibular joint used by physical therapists including: irritability, joint mobilization, soft tissue mobilization, trigger point dry needling, friction massage, therapeutic exercise, and patient education. This study relates to my patient in attempting to give the best overview of all management strategies currently in the literature. However, the article does state that there is not satisfactory research out about the "proper" way to manage these patients and that a multimodal approach has proven best.
Literature Relevant background presented? A review of the literature should provide background for the study by synthesizing relevant information such as previous research and gaps in current knowledge, along with the clinical importance of the topic.	There was not much literature presented in the background however throughout the article in talking about each management strategy, they were backed by evidence. Though no management strategy was backed by specific RCT evidence, the instance of lacking research on most of these topics

Describe the justification of the need for this study	hinders this articles research.

Does the research design have internal validity?	
Appraisal Criterion	***Reader's Comments***
➢ **Discuss possible threats to internal validity in the research design. Include:** ➢ **Assignment** ➢ **Attrition** ➢ **History** ➢ **Instrumentation** ➢ **Maturation** ➢ **Testing** ➢ **Compensatory Equalization of treatments** ➢ **Compensatory rivalry** ➢ **Statistical Regression**	This is article shows no threats to internal validity as it is a systematic review of current research. It stated no conflicts of interest in presenting their article. There was no testing performed nor instrumentation used.

Are the results of this therapeutic trial valid?	
Appraisal Criterion	***Reader's Comments***
103. Did the investigators randomly assign subjects to treatment groups? **a. If no, describe what was done** **b. What are the potential consequences of this assignment process for the study's results?**	There were no groups assigned in this article, it is a systematic review of current research about physical therapy TMD management strategies.
104. Were the groups similar at the start of the trial? Did they report the demographics of the study groups?	There were no groups assigned in this article, it is a systematic review of current research about physical therapy TMD management

a. If they were not similar – what differences existed?	strategies.
105. Did the subjects know to which treatment group they were assign? **a. If yes, what are the potential consequences of the subjects' knowledge for this study's results**	There were no subjects assigned in this article, it is a systematic review of current research about physical therapy TMD management strategies. The consequence of not explaining the research behind this article is less generalizability to all clients.
106. Did the investigators know who was being assigned to which group prior to the allocation? **a. If they were not blind, what are the potential consequences of this knowledge for the study's results?**	There were no subjects assigned in this article, it is a systematic review of current research about physical therapy TMD management strategies.
107. Were the groups managed equally, apart from the actual experimental treatment? **a. If not, what are the potential consequences of this knowledge for the study's results?**	There were no groups assigned in this article, it is a systematic review of current research about physical therapy TMD management strategies.
108. Was the subject follow-up time sufficiently long to answer the question(s) posed by the research? **a. If not, what are the potential consequences of this knowledge for the study's results?**	There were no groups assigned in this article, it is a systematic review of current research about physical therapy TMD management strategies.
109. Did all the subjects originally enrolled complete the study? **a. If not how many subjects were lost?** **b. What, if anything, did the authors do about this attrition?** **c. What are the implications of the attrition and the way it was handled with respect to the study's findings?**	There were no subjects assigned in this article, it is a systematic review of current research about physical therapy TMD management strategies.
110. Were all patients analyzed in	There were no groups assigned in this article,

the groups to which they were randomized (i.e. was there an intention to treat analysis)? **a. If not, what did the authors do with the data from these subjects?** **b. If the data were excluded, what are the potential consequences for this study's results?**	it is a systematic review of current research about physical therapy TMD management strategies.
Are the valid results of this RCT important?	
Appraisal Criterion	***Reader's Comments***
111. What were the statistical findings of this study? **a. When appropriate use the calculation forms below to determine these values** **b. Include: tests of differences? With p-values and CI** **c. Include effect size with p-values and CI** **d. Include ARR/ABI and RRR/RBI with p-values and CI** **e. Include NNT and CI** **112. What is the meaning of these statistical findings for your patient/client's case? What does this mean to your practice?**	In this study there are no statistical findings given for each management strategy. This is a systematic review of the treatments used in physical therapy for patients with temporomandibular disorders. The meaning I take from this review is to see that there is a gap in research about best management of these patients but also that a multimodal approach would work best, just as in many other diagnosis'. This means that taking each patient individually and assessing their impairments will best determine which approach to use and then go from your clinical experience from there.
113. Do these findings exceed a minimally important difference? **a. If not, will you still use this evidence?**	There is no minimally important difference on the changes of TMJ symptoms unless you choose a specific parameter such as pain, in which case a VAS scale can be used. There are other scales used for pain to palpation of mastication muscles however there are again no minimally important differences found for those either as of now.
Can you apply this valid, important evidence about an intervention in caring for your patient/client? What is the external validity?	
Appraisal Criterion	***Reader's Comments***
114. Does this intervention sound appropriate for use (available, affordable) in your clinical setting?	Yes, the many interventions presented in this article sound appropriate for use in my patient. However, more care would need to

	be taken not to exacerbate their joint as I am dealing with a child with JIA, instead of normal joint complications.
115. Are the study subjects similar to your patient/ client? **a. If not, how different? Can you use this intervention in spite of the differences?**	There were no sujects assigned in this article, it is a systematic review of current research about physical therapy TMD management strategies.
116. Do the potential benefits outweigh the potential risks using this intervention with your patient/client?	I feel the potential benefits outweigh the risks in most cases. There are some treatments presented such as dry needling that do impart more risk and would need to be evaluated for appropriateness on an individual basis.
117. Does the intervention fit within your patient/client's stated values or expectations? **a. If not, what will you do now?**	These management strategies are aimed at reducing pain, dysfunction and correcting joint alignment therefore I believe it would fall into my patients values appropriately.
118. Are there any threats to external validity in this study?	The threats to external validity in this review are the lack of explanation of individual studies' results throughout the presentation of each treatment strategy described.
What is the bottom line? What pedro score would you give this trial?	
Appraisal Criterion	***Reader's Comments***
119. Summarize your findings and relate this back to clinical significance	My findings from this review state that each patient needs to be managed according to their individual characteristics and impairments. I would also need to choose appropriate interventions for the patient population I am seeing such as a child with JIA who may need even more conservative management than the average client.

PEDro Internal Validity Scale	**No**	**Yes**
67. Eligibility criteria were specified		
68. subjects were randomly allocated to groups (in a crossover study, subjects were randomly allocated an order in which treatments were received)		
69. allocation was concealed		
70. the groups were similar at baseline regarding the most important prognostic indicators		
71. there was blinding of all subjects		
72. there was blinding of all therapists who administered the therapy		

73. there was blinding of all assessors who measured at least one key outcome		
74. measures of at least one key outcome were obtained from more than 85% of the subjects initially allocated to groups		
75. all subjects for whom outcome measures were available received the treatment or control condition as allocated or, where this was not the case, data for at least one key outcome was analysed by "intention to treat"		
76. the results of between-group statistical comparisons are reported for at least one key outcome		
77. the study provides both point measures and measures of variability for at least one key outcome		
PEDro Score:	N/A	

Reference #? Shaffer, S. M., Brismée, J.-M., Sizer, P. S., & Courtney, C. A. (2014). Temporomandibular disorders. Part 2: conservative management. *The Journal of Manual & Manipulative Therapy*, *22*(1), 13–23. https://doi.org/10.1179/2042618613Y.0000000061

(Bibliography #?): In text: (Shaffer et al., 2014)

Level of evidence: 3a PEDro Scale: N/A

Purpose: This study's purpose was to review all methods related to conservative management of the temporomandibular joint used by physical therapists including: irritability, joint mobilization, soft tissue mobilization, trigger point dry needling, friction massage, therapeutic exercise, cervical spine management, and patient education.

Methods: The researchers reviewed studies that looked at each individual management strategy to determine its reasoning and effectiveness. No specific results were presented of each study analyzed nor was there specific guidelines given on what was taken out of the methods from these studies.

Results: The determination of the overall review was that a multimodal approach taking all strategies analyzed and combining according to the patient would be the best practice. A series of studies demonstrated that over a minimum of five 30-minute sessions, multimodal management of TMD including soft tissue mobilization, muscle stretching, gentle isometric tension exercises against resistance, guided opening and closing, manual joint distraction, disc/condyle mobilization, postural corrections, and relaxation techniques were helpful in reducing symptoms associated with dysfunction of the TMJ.

Critique/Bottom Line: The bottom line that I take from this review is that each patient needs to be managed according to their individual characteristics and impairments. There would also need to be appropriate interventions chosen for the patient population I am seeing, such as a child with JIA who may need even more conservative management than the average

client. With most clients in a physical therapy setting, there is not a one and done treatment that solves all of their problems, and TMD is no different. The other thing to be taken from this review is that there is a significant gap in research about proper ways to manage these clients and what has shown significant relief of symptoms. Outside of a multimodal approach by physical therapists also lays the referral to other health care professionals. A TMJ dysfunction often may not be one we can help on our own but calling in dentists, orthodontists, rheumatologists and other providers to aid in our therapy may give the best results for the patient.

Reference #? Stoustrup, P., Kristensen, K. D., Verna, C., Kuseler, A., Herlin, T., & Pedersen, T. K. (2012). Orofacial Symptoms Related to Temporomandibular Joint Arthritis in Juvenile Idiopathic Arthritis: Smallest Detectable Difference in Self-reported Pain Intensity. *The Journal of Rheumatology*, *39*(12), 2352–2358. https://doi.org/10.3899/jrheum.120437

Is the purpose and background information sufficient?	
Appraisal Criterion	***Reader's Comments***
Study Purpose Stated clearly? Usually stated briefly in abstract and in greater detail in introduction. May be phrased as a question or hypothesis. A clear statement helps you determine if topic is important, relevant and of interest to you. Consider how the study can be applied to PT and/or your own situation. What is the purpose of this study?	Yes, the purpose of this study was clearly stated as a prospective observational study to evaluate and describe the frequency, the main complaints, and the localization of TMJ arthritis related orofacial symptoms. They estimated the smallest detectable differences for minimal, average, and maximal pain from these patients with diagnosed JIA.
Literature Relevant background presented? A review of the literature should provide background for the study by synthesizing relevant information such as previous research and gaps in current knowledge, along with the clinical importance of the topic. Describe the justification of the need for this study	There was relevant background presented on the need to determine a SDD for the VAS scale used in orofacial pain symptoms for those with TMJ issues and JIA. The need for having this measurement comes with the need for clinicians to have a reference for change in their patients. However, pain is not always associated with TMJ arthritis in those with JIA therefore can only be used with the population complaining of pain due to their TMJ issues.

Does the research design have internal validity?	
Appraisal Criterion	***Reader's Comments***
➢ **Discuss possible threats to internal**	The possible threat to internal validity in this

validity in the research design. Include: ➢ **Assignment** ➢ **Attrition** ➢ **History** ➢ **Instrumentation** ➢ **Maturation** ➢ **Testing** ➢ **Compensatory Equalization of treatments** ➢ **Compensatory rivalry** ➢ **Statistical Regression**	study lays in instrumentation. The evidence of the survey used in their study was not given and therefore there is not background as to whether it's a sufficient tool to measure subjective representation of symptoms. Other than that, due to this being an observational study with one group, there are no other threats to internal validity.

Are the results of this therapeutic trial valid?	
Appraisal Criterion	***Reader's Comments***
120. Did the investigators randomly assign subjects to treatment groups? **a. If no, describe what was done** **b. What are the potential consequences of this assignment process for the study's results?**	There were no groups assigned in this observational study. There was one group of 35 patients with diagnosed JIA and orofacial pain due to TMJ arthritis who were assessed due to pain symptoms on the VAS scale to determine the Smallest Detectable Difference (SDD).
121. Were the groups similar at the start of the trial? Did they report the demographics of the study groups? **a. If they were not similar – what differences existed?**	The group was similar to each other in diagnosis and symptoms stated however some variances laid in their disease duration and TMJ symptom onset.
122. Did the subjects know to which treatment group they were assign? **a. If yes, what are the potential consequences of the subjects' knowledge for this study's results**	It is not clear as to whether or not the subjects were aware of the reasoning of this study however due to no treatment group, it should not have made a difference in the results.
123. Did the investigators know who was being assigned to which group prior to the allocation? **a. If they were not blind, what**	The investigators were not blinded to the patients diagnosis prior to evaluating their disease characteristics.

are the potential consequences of this knowledge for the study's results?	
124. Were the groups managed equally, apart from the actual experimental treatment? **a. If not, what are the potential consequences of this knowledge for the study's results?**	The one group had equal management of all subjects throughout the study.
125. Was the subject follow-up time sufficiently long to answer the question(s) posed by the research? **a. If not, what are the potential consequences of this knowledge for the study's results?**	This was a one time meeting therefore no follow up time was necessary.
126. Did all the subjects originally enrolled complete the study? **a. If not how many subjects were lost?** **b. What, if anything, did the authors do about this attrition?** **c. What are the implications of the attrition and the way it was handled with respect to the study's findings?**	No, all subjects who originally enrolled did not complete the study. Two subjects were dropped due to their symptoms not being attributed to TMJ inflammation but rather other issues in the joint not associated with their JIA. The study does not explicitly state what happens to their data therefore I am to assume that no intention to treat analysis was done.
127. Were all patients analyzed in the groups to which they were randomized (i.e. was there an intention to treat analysis)? **a. If not, what did the authors do with the data from these subjects?** **b. If the data were excluded, what are the potential consequences for this study's results?**	There was only one group made therefore all subjects were analyzed in their original group. Since no clear statement of exclusion of evidence was made there may be discrepancies in their data collection to serve a more positive result.
Are the valid results of this RCT important?	
Appraisal Criterion	***Reader's Comments***
128. What were the statistical	The statistical findings of this study found

findings of this study? **a. When appropriate use the calculation forms below to determine these values** **b. Include: tests of differences? With p-values and CI** **c. Include effect size with p-values and CI** **d. Include ARR/ABI and RRR/RBI with p-values and CI** **e. Include NNT and CI** **129. What is the meaning of these statistical findings for your patient/client's case? What does this mean to your practice?**	that the mean scores of minimal and average orofacial pain rose between the first and the second assessment, which is in contrast to the mean scores of maximal pain. The mean VAS scores of average orofacial pain significantly increased between surveys. There was a test of difference between each patients minimal, average, and maximal pain scores down with a 95% CI and standard deviation shown. The p-value incorporated for this study was <0.05, which is consistent with most studies. The only group that found a significant change, higher than the SDD was the average pain reported, which was found to be 13mm on the VAS scale. These findings mean that if I am to evaluate a patient who is having TMJ related orofacial pain due to their JIA, that I need to have a difference of at least 13mm on the VAS scale to know I have made a significant difference in their pain levels. This is a good value to know as no other study has attempted to find the SDD for the VAS scale in this population of patients.
130. Do these findings exceed a minimally important difference? **a. If not, will you still use this evidence?**	There is no minimally important difference for this study as it was creating its own standard through their proceedings. I will use the results of this study when pain is involved in my patients symptoms however it is well known that pain is not always associated with TMJ dysfunction in those with JIA.
Can you apply this valid, important evidence about an intervention in caring for your patient/client? What is the external validity?	
Appraisal Criterion	***Reader's Comments***
131. Does this intervention sound appropriate for use (available, affordable) in your clinical setting?	There was no intervention given in this observational study however their results of the SDD to use with the VAS score will be cheap and easy to use in the clinic.
132. Are the study subjects similar	The study subjects were very similar to my

to your patient/ client? **a. If not, how different? Can you use this intervention in spite of the differences?**	patient in being of the same age range, diagnosis group, and gender.
133. Do the potential benefits outweigh the potential risks using this intervention with your patient/client?	The potential benefits far outweigh the minimal to no risk that comes with having a VAS score reported for these patients.
134. Does the intervention fit within your patient/client's stated values or expectations? **a. If not, what will you do now?**	This tool would definitely be useful to my client and fit within their values if their goal was to decrease their orofacial pain due to their TMJ dysfunction.
135. Are there any threats to external validity in this study?	The threats to external validity lay in the fact that this is a very specific population of patients. Along with that, this population is narrowed down even more due to pain not being relevant for all patients within this population.
What is the bottom line? What pedro score would you give this trial?	
Appraisal Criterion	***Reader's Comments***
136. Summarize your findings and relate this back to clinical significance	The clinical significance of this study is that I can use their results as a background reference for amount of change that needs to be seen in their VAS score when rating pain related to their TMJ dysfunction in patients with JIA.

PEDro Internal Validity Scale	**No**	**Yes**
78. Eligibility criteria were specified		1
79. subjects were randomly allocated to groups (in a crossover study, subjects were randomly allocated an order in which treatments were received)	1	
80. allocation was concealed	1	
81. the groups were similar at baseline regarding the most important prognostic indicators		1
82. there was blinding of all subjects		1
83. there was blinding of all therapists who administered the therapy	1	
84. there was blinding of all assessors who measured at least one key outcome	1	
85. measures of at least one key outcome were obtained from more than 85% of the subjects initially allocated to groups		1
86. all subjects for whom outcome measures were available received the treatment or control condition as allocated or, where this was not the case, data for at least one key outcome was analysed by "intention to treat"		1

87. the results of between-group statistical comparisons are reported for at least one key outcome		
88. the study provides both point measures and measures of variability for at least one key outcome		1
PEDro Score:	6/10	

Reference #? Stoustrup, P., Kristensen, K. D., Verna, C., Kuseler, A., Herlin, T., & Pedersen, T. K. (2012). Orofacial Symptoms Related to Temporomandibular Joint Arthritis in Juvenile Idiopathic Arthritis: Smallest Detectable Difference in Self-reported Pain Intensity. *The Journal of Rheumatology*, *39*(12), 2352–2358. https://doi.org/10.3899/jrheum.120437

(Bibliography #?): In text: (Stoustrup et al., 2012)

Level of evidence: 3b PEDro Scale: 6/10

Purpose: The purpose of this study was stated as a prospective observational study to evaluate and describe the frequency, main complaints, and localization of TMJ arthritis related orofacial symptoms. They estimated the smallest detectable differences for minimal, average, and maximal pain from these patients with diagnosed JIA.

Methods: The methods of this study involved using a survey to determine the patient's subjective thoughts about their TMJ symptoms as well as an examination by an orthodontist to determine TMJ arthritis was the reason for their pain. The survey evaluated things such as the frequency and location of their pain and then incorporated the VAS scale where they reported their minimal, average, and maximal pain due to their TMJ symptoms. The orthodontic evaluation was done to make sure that no other pathologies were occurring to lead to their symptoms and that it could be correlated back to their diagnosis of JIA. They were given a second survey, just 45 minutes after their first, where they were asked the same questions and to do the VAS scale again to be used as a comparison to their first survey.

Results: The statistical findings of this study found that the mean scores of minimal and average orofacial pain rose between the first and the second assessment, which is in contrast to the mean scores of maximal pain. The mean VAS scores of average orofacial pain significantly increased between surveys. There was a test of differences between each patients minimal, average, and maximal pain scores done with a 95% CI and standard deviation shown. The p-value incorporated for this study was <0.05, which is consistent with most studies. The only group that found a significant change, higher than the SDD, was the average pain reported, which was found to be 13mm on the VAS scale. The results for where the patients pain occurred and and the frequency of the pain differed significantly between patients.

Critique/Bottom Line: These findings mean that if I am to evaluate a patient who is having TMJ related orofacial pain due to their JIA, that I need to have a difference of at least 13mm on the VAS scale to know I have made a significant difference in their pain levels. This is a

good value to know as no other study has attempted to find the SDD for the VAS scale in this population of patients. This study gives me a reference in the clinic however, their results also signify that the minimal and maximal pain experienced in these patients varies significantly so in using it for those values it is not justified. This reference will be useful for pre and post-therapeutic responses to determine if a difference in their pain is occurring, although reduction of pain may not be the major focus of therapy for these patients.

	Study & Origin	Oxford Level of Evidence	Pedro Score	Purpose of Study	Outcome Measures	Results	Accept Results to Answer Clinical Question
1	Keller, H., et al.(2015) Switzerland	3a	7/10	The study's purpose was wanting to determine early diagnosis of TMJ involvement in those with JIA using clinical testing and symptoms against the gold standard of contrast MRI.	-Mouth Opening Capactiy -Standard statistical software packages SPSS version 20.0.0 -Shapiro-Wilk test -Kolmogorov-Smirnov tests -one-way ANOVA with Bonferroni post-hoc correction -Chi-square test	-On MRI a total of 54/76 (71 %) patients and 92/152 (61 %) joints had signs of TMJ involvement. MRI showed enhancement in 85/152 (56 %) and deformity in 39/152 (26 %) joints. MOC, asymmetry and restriction in condylar translation showed significant correlation to TMJ enhancement and deformity.	Yes
2	Abramowicz et al., (2013) USA	2b	4/10	To associate the presence of TMJ synovitis in a contrast MRI with physical findings in children with diagnosed JIA.	- Pearsons x^2 - Fishers exact test - Multiple regression - Independent Sample -- T-test	Decreased mouth incisal opening was significantly associated with present synovitis in the TMJ on MRI. Deviation in mouth opening was also found to be significantly associated with the presence of synovitis. When both characteristics were found, all subjects had synovitis present on their MRI's, giving it a 1.0 on positive predictive value.	Yes
3	Koos, B., et al. (2014) Germany	2b	7/10	To test the reliability of clinical findings, as a concise screening protocol, in diagnosing TMJ arthritis in those with Juvenile Idiopathic Arthritis (JIA) as compared with the reference method of contrast MRI.	-Power analysis with GPower 3 - Fisher's exact test - Sensitivty/specificity values - false positive/negative values - Cohen's K	This study found high correlation with asymmetric mouth opening and TMJ arthritis found on contrast MRI in those patients with JIA. However, the best findings in terms of highest sensitivity and specificity came when all 5 clinical exam results were compared to contrast MRI findings. The sensitivity of the combination of all the tests was .85 while the specificity was .70, showing a very accurate cluster of tests in determining TMJ arthritis in those children with JIA.	Yes
4	Zwir, L. et al. (2015) Brazil	2b	8/10	The study's purpose was to perform a comprehensive evaluation of the TMJ and to investigate the association between the clinical and MRI findings in the TMJ's of patients with JIA	-Chi square or Fisher's exact test - multivariant ANOVA - multiple comparison of Duncan - T test - Kolmogorov- Smirnov test - Kappa test	The study found a significance in the association between maximal mouth opening and the presence of active disease as determined by contrast MRI. They also found that most of the patients with JIA had increased signs of TMJ involvement on MRI though less than have of the patients reported symptoms. The researchers also found an association between signs of TMJ involvement present in all groups in both evaluations, signifying that TMJ involvement is prevalent in this population.	Yes

5	Kuseler, A., et al. (2005) Denmark	3b	5/10	The purpose of this study was to find correlation between findings from the clinical exam with MRI of the TMJ in children who have been diagnosed with JIA in the previous 3 years	- Modified version of the Helkimo index for reporting of clinical exam scores -Percentages given of patient involvement of each category tested. Correlation was to be calculated though no significance found or reported.	- No correlation was found between total score for the clinical examination and total score of the MRI examination in the TMJ's of children with Juvenile Idiopathic Arthritis.	No
6	Steenks, M.H., et al. (2015) Netherlands	2b	7/10	The purpose of this study was to test their TMJ examination protocol for internal consistency, reliability and concurrent validity against the JADAS-27 protocol, which reflects the overall JIA activity and does not include assessment of the masticatory system, in a consecutive series of patients diagnosed with JIA.	-Cronbach Alpha - Cohen Kappa - Pearson's Correlation	- .78 internal consistency with all items - Inter-observer reliability of history items was between .46-.87 and of examination items was .25-.73 - Agreement between reference examiner and rheumatologist was .46 although the measurements of MMO correlated significantly at .61 - MMO measured by the rheumatologist correlated negatively with JADAS-27 - Sensitivity and specificity of the TMJ protocol was .52 and .80 respectively.	Yes
7	Shaffer, S.M., et al. (2014) USA	3a	N/A	To review all methods related to conservative management of the temporomandibular joint used by physical therapists including: irritability, joint mobilization, soft tissue mobilization, trigger point dry needling, friction massage, therapeutic exercise, and patient education	-Various outcomes looked at such as joint alignment, pain with masticatory movements, pain to palpation, and occlusion alignment for the different strategies discussed	-The results of this SR indicate that a multimodal approach to treatment of TMD is best. They state that there is limited research about the proper management of this condition and that each client shall be treated appropriately based on their individual characteristics.	Yes
	Stoustrup et al., 2012	3b	6/10	To evaluate and	- VAS scale - ANOVA	- Mean VAS scores of average orofacial pain	Yes

8	Denmark			describe the frequency, main complaints, and localization of TMJ arthritis related orofacial symptoms. They estimated the smallest detectable differences for minimal, average, and maximal pain from these patients with diagnosed JIA.	- SEM was calculated as the square root of the estimate - SDD was estimated for each of the variables of interest	significantly increased between surveys. - The only group that found a significant change, higher than the SDD was the average pain reported, which was found to be 13mm on the VAS scale.	

Table 1. Results / Article Summaries