Journal of Hand Therapy 26 (2013) 81–83

Contents lists available at SciVerse ScienceDirect

Journal of Hand Therapy

journal homepage: www.jhandtherapy.org

Letters to the Editor

An exercise program for carpometacarpal osteoarthritis based on biomechanical principles

To the Editor:

I was excited to see the article *An Exercise Program for Carpometacarpal Osteoarthritis Based on Biomechanical Principles* in the July–September 2012 issue of the *Journal of Hand Therapy* and always appreciate the time, effort, and dedication it takes to prepare such an article. I eagerly read the article looking for precise exercise recommendations for patients with thumb carpometacarpal (CMC) osteoarthritis (OA) to see if they correlated with the conclusions I have drawn from my own less formal but extensive literature review and from my many years of clinical practice. I read and re-read many of the references, but still was unable to appreciate direct correlation of some of the exercises recommended in the illustrated Appendix B to the content of the article.

Recommended use of ACSM guidelines

The authors clearly state that the goal of the paper is "specific recommendations for a hand exercise program for individuals with CMC OA based on a biomechanical analysis of the CMC joint of the thumb in accordance with ACSM guidelines" even though the authors admit that "direct evidence for exercise alone in the treatment of hand OA is lacking."

The authors clarify that the studies on which the ACSM guidelines are based were on "large muscles acting on large joints" and are devised for "healthy adults," although they state that "the recommendations may apply to persons with certain chronic diseases or disabilities" with modification. I was unable to identify where and how the thumb exercises in Appendix B were adequately modified to be patient or even diagnosis specific. My additional concern is whether it is appropriate to apply ASCM guidelines developed for large stabilizing muscles in healthy subjects to the eight finely balanced muscles that must work in synchrony to stabilize the thumb CMC joint with OA.

Exercise assumptions

Although we recognize that active range of motion provides the stimulation needed for normal human cartilage nutrition, can we assume that working for full range of motion in a patient with the diagnosis of thumb CMC OA is the best treatment? The core problem of the thumb CMC joint with osteoarthritis is instability. Do we want to take an already unstable joint and work toward full range of motion in all directions? Would we instruct a patient to stretch an unstable large joint to maximum range?

Dr. Margery Lockard in her article in the *Journal of Hand Therapy* in 2000 entitled *Exercise for the Patient with Upper Quadrant Osteoarthritis*[1] [referenced by the authors] states: "Since arthritic joints are not normal joints and have articular and perhaps periarticular degenerative changes, therapists must be careful that the amount of range of motion sought is appropriate for each individual patient." Dr. Lockard goes on to say: "A goal of full, or 'normal,' joint range of motion may not be desirable at all joints for all patient. An appropriate goal is maximum stable and pain free joint motion that is sufficient to support the patient's functional needs" and "…if increased range of motion results in painful motion, the motion gained buy the exercise is of no functional benefit to the patient."[1]

Since the singularly most common deformity of the thumb CMC joint is dorsal subluxation/dislocation of the metacarpal base on the trapezium with flexion/adduction of the 1st metacarpal, why would we want to instruct a patient with thumb CMC OA to touch the base of the little finger with the thumb tip—an exercise that applies exactly the deforming forces?

Strengthening thumb abductors and extensors

The authors provide a focused statement with which I agree: "The thumb extensors and abductors should be strengthened." Unfortunately, in the thumb it is not easy to isolate key muscles that create these motions.

A specific example is the ability of the extensor pollicis longus (EPL) to adduct the thumb CMC joint. If the patient endeavors to fully extend/abduct the thumb, but is unable to counteract the adductor moment arm of the EPL at the thumb CMC joint (primarily with power of the abductor pollicis brevis), the attempted exercise reinforces the exact opposite purpose of the exercise.

Resistive strengthening through range

As the authors state and I agree, the flexor/adductor forces in the thumb are greater than abduction/extension forces. Why instruct patients to pinch or squeeze putty through range which resists flexion/adduction? Our daily tasks require resistance to flexion and adduction, so to create a better balance in the thumb, should we not focus only on exercises that bring the thumb CMC joint into abduction and extension, favoring the naturally weaker motions?

If muscle/joint imbalance exists (which is true of many thumbs with CMC OA), resistive strengthening exercises will not be helpful. If the imbalance already accentuates the greater adduction/flexion power at the thumb CMC joint, resistive exercise only reinforces the evolving deformity. Again Dr. Lockard provides insight: "…it is important to make sure that normal joint mechanics occur at all the joints involved in an exercise … the involved joints must be stable during movement and under applied load."[1]

The authors do not mention thumb collapse patterns which are commonly seen when the thumb is under load and which increase the load on the thumb CMC joint cartilage. Would not a static isometric muscle contraction to maintain a balanced thumb posture under controlled load serve the patient better than reinforcing the imbalance by squeezing something? Dr. Lockard is specific on this question: "Another example in which the compressive load across the joint during an exercise may be detrimental is the use of gripping and pinching exercise for hand strengthening."[1]

What about those with advanced thumb CMC OA?

Should all the range of motion (ROM) exercises in Appendix B be used with patients with later stages CMC osteoarthritis? (The authors caution against lateral and key pinch exercises with advanced CMC OA.) With publication in the *Journal of Hand Therapy*, the exercises in Appendix B may be seen by inexperienced therapists as the appropriate recommendations for all patients with the diagnosis of thumb CMC osteoarthritis. If the Appendix B exercises are appropriate for all patients with this diagnosis, where is the necessity for a skilled therapist to evaluate the patient and create a patient-specific exercise program?

The complexity of the human thumb defies a simple exercise program that is accurate for all patients with thumb CMC osteoarthritis. We, as skilled hand therapists, need to develop an algorithm relating exercise prescription to evaluation findings. In my opinion, to this we need to add the influence of an orthosis to alter dynamic loading (not an orthosis to immobilize) and to serve as a mechanism to help the patient learn to maintain a balanced posture under load. As many would say: we need to treat the kinetic chain!

In conclusion I would like to offer some suggestions to enhance/modify the authors' exercise recommendations:

- Instruct patient on isometric fingertip pinch with both the MP and an IP joints in slight flexion which places the CMC joint in best posture for load distribution and avoids a flexed posture of 1st metacarpal. Instruct in this exercise only if the patient can correctly accomplish the isometric pinch. Assure the isometric exercise does not cause a collapse deformity and provide resistance only to the point where the balanced posture can be maintained.
- Use an orthosis to keep the thumb CMC joint in mid-range during functional loading. Be sure the orthosis design allows the thenar muscles to contract in this balanced stabilized posture and does not impede other joint motion. Determine if use of an orthosis at the thumb MP or IP joint instead of the CMC joint better shifts the load at the CMC joint and establishes a non-painful balanced pinch posture.
- Determine if the EPL provides overpowering adduction forces at the thumb CMC joint. If not, instruct in active thumb extension/abduction exercises. (Flexor pollicis longus is strengthened with the isometric tip-tip pinch and needs no additional flexion exercise.)
- Provide passive ROM (PROM) only for CMC joint abduction and extension *if PROM is appropriate* based on the severity of the disease. Also include PROM for any limitations in MP and IP joints, *if appropriate.*
- Avoid any resistive exercise that strengthens adduction or flexion.

To close, I concur with many conclusions the authors put forth but differ with some of the exercise recommendations.

Reference

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http://dx.doi.org/10.1016/j.jht.2012.10.002

Response to "An exercise program for carpometacarpal osteoarthritis based on biomechanical principles"

Dear Editor:

We would like to thank Ms. Colditz for her comments regarding our recently published paper on the exercise considerations for CMC OA based on biomechanical studies.

We hope that all therapists who read the article will digest it with an equally critical eye when determining how the exercise programs can be modified or used by their individual patients based upon their current level of function, stage of OA, and level of deformity if present. The quest to find the perfect balance between prescribed exercises and the optimal outcome achieved by performing the exercises is a reality that we as hand therapists face on a daily basis. Do we perform exercises for 3 sets of 10 repetitions because we have always done it that way or do we try to determine what the tissue response is to exercise and modify the program accordingly? Dr. Brody has taught us that optimal exercise programs should include key program design considerations regarding the determination of a stable baseline before progression and consideration of optimal load and intensity of the exercises and therapist must integrate these principles when prescribing exercise effectively in the presence of pathology, injury, or otherwise unhealthy tissue.[1]

The decision to use the American College of Sports Medicine (ACSM) guidelines when developing our exercise recommendations was based upon two factors. Kjeken[2] and colleagues in their systematic review evaluated CMC exercise programs according to the ACSM guidelines and the search for guidelines for the development for small joint specific exercise programs was fruitless. The ACSM methodological approach was determined to be the most useful approach.

Opposition to the base of the small finger is accomplished through combining thumb opposition and thumb flexion. The

opponens pollicis is described by Smutz[3] and colleagues as a thumb flexor and an abductor, and they describe the flexor pollicis longis as a pure flexor, and the flexor pollicis brevis is a flexor and adductor. Additionally, we found no biomechanical studies that recommended this thumb posture should be avoided.

The forces that occur during resistive grip and pinch tasks were thoroughly described in the article and clinicians were encouraged to carefully consider these forces when prescribing resistive exercises. Furthermore, it was recommended that resistive strengthening should be avoided in individuals with stage 3 or 4 deformity. Not all individuals with CMC OA possess sufficient strength to perform their required activities of daily living. The judicious application of resistive exercises may be beneficial in helping these individuals improve their level of function.

The purpose of our review was to compile many of the results of the biomechanical research studies that have been performed by numerous researchers regarding the thumb and to design an exercise program based upon the evidence found in the literature. The program presented is based upon on the results and findings of those studies and should be interpreted as such. The exact prescription of exercises is dependent upon the clinician's sound clinical reasoning skills to determine the right mix between science and the "art" of practice.

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http://dx.doi.org/10.1016/j.jht.2012.10.006