

Dr. Justin Arner:

Welcome everyone. I'm Dr. Justin Arner, from the University of Pittsburgh Medical Center in Pittsburgh, Pennsylvania.

Today, I have the pleasure of speaking with Dr. Michael Ciccotti, Chief of Sports Medicine and endowed professor at the Rothman Institute in Thomas Jefferson University in Philadelphia, Pennsylvania.

Dr. Ciccotti was the senior author of the two-part paper titled "Disabled Throwing Shoulder," 2021 update, with part one being "Anatomy in Mechanics" and part two being "Pathomechanics and Treatment," both of which are published in the May 2022 edition of the Arthroscopy Journal.

This is going to be a two part podcast series with part one being discussed now with Dr. Ciccotti.

Welcome Dr. Ciccotti, and thank you so much for joining me.

Dr. Michael Ciccotti:

Justin, it's great. It's an honor to be here so thank you for having me.

Dr. Justin Arner:

Yeah, this is going to be awesome. It doesn't get much more complicated and interesting, I think than the throwing shoulder, so thanks for your time. And first of all, I wanted to thank you for putting this together, and you have just an incredible group of authors.

Can you tell us a little bit about the backstory of how you guys got all organized and how you decided to write this clinical update for all of us?

Dr. Michael Ciccotti:

Well, I have to say, Justin, that really credit should go to Ben Tibler, because he's really the one that has been the mastermind behind this. And certainly with his focus on the throwing shoulder over literally decades and engaging each of the people that are part of this project in various ways.

And it's really a group of people that I'm honored to be included with, just academically focused and having a great interest in the throwing shoulder.

And as I had said, we have participated in a variety of educational programs and we've collaborated on all types of research over the past few decades. And we've consistently had the same perspective on the throwing shoulder and disability to the throwing shoulder. And this is really our effort to try to add some clarity to what you've said is a incredibly confusing topic, and to try to sift out, sort out fact from fiction so we have a most current perspective on how we might treat this very difficult problem.

Dr. Justin Arner:

Yeah, no question about that. It's an illustrious group and it's next level, really exciting new thought processes that sometimes get lost in our training.

So one thing I wanted to first ask you about is, you've taken care of professional baseball for a long time and obviously got to work under Dr. Job. Can you tell us a little bit about the history of your knowledge and the throwing athlete, and almost what you learned in fellowship and residency and what you've learned over the years taking care of the Phillies and so many special throwers? I think that'd be really interesting to hear.

Dr. Michael Ciccotti:

Yeah, that's a great question, Justin. And I would say to you that the generic complaint that the throwing athlete has, this dead arm syndrome, that we hear over and over and over that when I was starting my training was really like a grab bag and a poorly defined group of pathology. And part of it was anterior, whether it was impingement or bursitis and posterior, posterior bennett traction spurs, those are kind of the identified types of pathology. But focus early on in my career, having worked with Frank Job, was really on the anterior aspect of the shoulder, the anterior capsule, and this idea of impingement, at that time, Dr. Job felt, was really secondary to anterior micro instability.

And that led to his development of his anterior capsular shift procedure, open procedure, that really was effective in reducing pain but was not quite as effective in returning athletes to sport, particularly at their previous level of participation.

And at the same time, Jim Andrews was defining and identifying superior labral changes, superior labral tears, and under surface rotator cuff tears so then that idea of impingement morphed then into internal impingement. And with that then, also a focus on not so much the anterior aspect of the shoulder, but maybe the posterior aspect of the shoulder, the posterior soft tissues, the capsule and the cuff. And Ben Kibbler and Steve Burkhart and others really focusing on the posterior changes that occur and with that, thickening, tightening, micro-scarring of the posterior capsule leading to changes in our range of motion, loss of internal rotation. And then that morphing to not just internal rotation loss, but maybe total arc of motion changes that were important as well. So this progressive evolution. And through that whole time, also then, the focus was on the scapula rather than just the glenohumeral and this concept of scapular dyskinesis and opening our eyes to the importance of not just the glenohumeral joint, but everything beyond the glenohumeral joint, this concept of kinetic chain.

So over those years, to see it evolve from anterior structures to posterior structures, to really the total glenohumeral joint to then the scapula and then the kinetic chain, that's really the evolution that I've seen during my career. And I would say that's really been a part of, or parallel, the evolution that we've had in our treatment of our elite level athletes. I think initially with this concept of SLAP tears early on, there was a tremendous enthusiasm. There was a momentum to fix SLAP tears. Inherent in being a surgeon, to correct this disorder. And yet the intermediate results really showed low return to prior performance, recurrent injury, recurrent pain. And I would say to you, that was probably a function of several things that we were diagnostically inaccurate, that we had probably equivocal indications that our early surgical techniques were really over constraining.

Our postop rehab was really just focused on the glenohumeral joint. It was very narrow and we probably did a really poor job of imprecisely scoring or assessing our outcomes. And so now, as we evolve, we look at those areas and we try to improve our diagnostic ability. We try to have very precise indications. Our surgical techniques are better than they were. Our rehab is broader, involving the whole kinetic chain. And we're much more granular in how we assess how these athletes return. And that's again, how our treatment algorithms have evolved with specifically the elite level players and the Phillies.

Dr. Justin Arner:

Well that's awesome. It's exciting to think what we still have to learn because a lot of this, as you mentioned in other talks that I've heard, we still are learning a lot and I'd like to obviously dive into a lot of those things you mentioned. Its great. So you mentioned history being important in these patients in a lot of the other talks and lectures I've heard. Can you tell us a little bit about specific, essential things that you want to gather when you're asking these throwers, how you can determine what pathologies may or might not be an issue for them?

Dr. Michael Ciccotti:

Yeah, absolutely. First of all, when you evaluate these players, I think it's really important to ask them, have they had a prior history of injury involving the glenohumeral joint? Have they had a disability in their throwing shoulder before? And if they have, how was it treated? Did they rest for any period of time? How long did they take any oral anti-inflammatories? Did they receive any types of injections, either local anesthetic and or corticosteroid or biologic and what kind of rehab did they have? Not just did they have rehab, but what did they do? Did they do something that was focused on myopic on just the glenohumeral joint, upper extremity, or did they do their entire kinetic chain? So I think those things are really important to start with and then getting more granular with actually the current injury. Where is their pain?

Is it anterior? Is it deep? Is it posterior? This concept of what we've formally called superior labral tears. And now as our article alludes to clinically significant labral injury, it most often causes a deep and a posterior pain. When do they have their pain? When they're throwing? We know that likely the greatest stresses on the superior and the posterior labrum, which is where the majority of these injuries occur in throwers, not just the superior labrum, but now we're realizing, extending into the posterior labrum, but they most often occur in the late cocking phase to ball release. Do they have any type of mechanical symptoms: clicking, popping, catching? Suggesting the labrum may be interposed between the humeral head and the glenoid. And then specifically with respect to their performance, if they have decreased velocity, decreased control, which is perhaps more ominous and may be more consistent with needing some type of really focused treatment, whether it's focused non-operative or ultimately operative care.

Dr. Justin Arner:

That's great. The different shoulder pathologies, you've mentioned, that we're looking for. So to step back, you mentioned the kinetic chain and it's something that probably we lose track of because we're so focused on the shoulder, but can you tell us a little bit about how you evaluate the kinetic chain and what, on the rehab side of things, what you really want people to focus on?

Dr. Michael Ciccotti:

Yeah, that's a great question because obviously the athlete comes into our office, Justin, with a complaint of a shoulder problem. And so it's easy to get lost in the glenohumeral joint, but you really have to step back and step out of it. And we realize now how vitally important it is to consider the entire athlete. We know that the velocity that the athlete imparts on the ball starts at the ground up and anywhere along that kinetic chain, in any type of ankle dysfunction, any hamstring tightness, any decreased flexibility in the hip, any core weakness, oblique strain, those things all increase the force that's required in the glenohumeral joint to create that same velocity. So we really have to focus on those areas. It's hard to go through a whole kinetic chain evaluation in the office, but one of the tests that I think is really the most effective is a single leg squat test and very easy to do.

And obviously an athlete that has reasonable core strength and lower extremity strength. So a functioning kinetic chain will be able to do a single leg squat and stay balanced over that limb. If they have any type of pelvic tilt or any corkscrewing, then that's a quick assessment or maybe indication of some type of kinetic chain deficit. That test is also what I have found, just anecdotally, it's really helpful to get an athlete and or his or her family or coaches or whoever's with them to buy into this concept of kinetic chain. Because you can have these athletes look incredibly fit and you ask them to do a single leg squat test and they nearly fall over and they can't do it. So it's a way of buying into this concept of

kinetic chain. So I think single leg squat test is a great test. I will say to you though, that if you're going to demonstrate it, you want to make sure you can do it well, that you show them how to do it.

So you've got to practice your single leg squat test, but-

Dr. Justin Arner:

[inaudible 00:12:31].

Dr. Michael Ciccotti:

-It's a great test. Yeah. And another test we use is single leg hop test for distance, both forward and side to side. Thirdly, you can do a plank. Those are just simple things in the office that we do that are pretty quick and give us a good sense. If you really want to become... you can get very granular though, then you really have to enlist the help of either an ATC or a physical therapist, and they can do formal hop testing for distance and time. They can do a functional movement screening evaluation. They can assess stride length in a throwing position, which should be about 80 to 85% of the athlete's height. So that's a more granular assessment, but again, single leg squat tests, I think, is something we can do in the office that's pretty straightforward.

Dr. Justin Arner:

That's a great explanation. One thing you mentioned about physical therapists or someone that's really an expert at evaluating this, I've been lucky to be able to ride on Dr. Bradley's coattails with good throwing physical therapists. And I'm sure it's not easy to develop that relationship. So can you tell us a little bit about finding a physical therapist that really is an expert in throwing and you can rely on, and I guess it depends on interests and you just get to know those people, but just tell us the importance of that or if you have any advice about finding something like that.

Dr. Michael Ciccotti:

Great. That's a great question and vitally important. The reality is too, Justin, that our pro-athletes, professional baseball players. They have the greatest therapists and trainers at their fingertips, 24 hours a day, but the rest of us, we don't have that. And if you have a high school athlete or a recreational athlete that really needs focused care, it's important you identify someone that can provide that care that's in the community, and that can be challenging to do. And I say there's a couple ways of doing it. Number one is that just by reaching out in an educational programming way, in your community, to send out information to local physical therapy centers or athletic training facilities about having a think-tank on throwing athlete or having an educational program and inviting them. And you'll find that people who have interest will show up or will engage you.

And then just, even within a few sessions, you can figure out who's really knowledgeable and who's interested. That's one way to do it at a grassroots level. Another way to do it though, is just to reach out to either a college or university, the athletic training department, the athletic trainers that take care of the throwing athletes at those schools. Division one schools usually have the broadest network. And ask them who in the community they send their athletes to when they have to outsource physical therapy care, and or if they have a professional team in your community, just reach out to the athletic training staff of those professional baseball teams. And they're really helpful identifying therapists and athletic trainers in the community that aren't employed by those professional teams, but who are really knowledgeable and helpful for the rest of us athletes.

Dr. Justin Arner:

That's great advice because I think it's just so essential. The outcomes, as we'll talk about with surgery, aren't ideal. So if you're not giving them appropriate, non-operative treatments, either way it's going to make a huge difference. So it's great advice and certainly important. Can you tell us a little bit about the function of the superior labrum? You mentioned the different pathologic issues and how sometimes it's difficult to determine the superior and posterior labrum. Tell us the normal pathomechanics and your thoughts about that.

Dr. Michael Ciccotti:

Yeah, that's a great question, Justin. And I will say to you that we've learned more and more about the labrum in general and what it does and how it helps to balance and support the entire glenohumeral joint. And in terms of anatomy itself, we think about the labrum, we think about the superior half and the inferior half of the labrum, and they're different. The superior half of the labrum has really very limited bony attachment. And the attachment is on the glenoid rim, it's not on the face, and it's much more mobile than the inferior labrum. It's essentially concave at its articular surface and it's really meant to withstand tension. It's been affectionately termed the mobile orbit of tension. And there are a variety of anatomic variants that we see in the anterior half of the labrum, particularly the anterior superior quadrant absence or lack of attachment in the anterior superior quadrant.

We can have a sublabral foramen, a Buford complex, which is really a more substantial lack of attachment with a very thick, cord-like middle glenohumeral ligament emanating from the superior labrum at the bicipital root. And so there's a variety of anatomic variance in that superior half of the labrum. And interestingly too, we've come to realize that the biceps. As it attaches to this superior labrum, has its fibers that really interdigitate and continue well down the posterior part of the labrum. It's really led us to this concept now of the posterior labrum being as much, if not more important than, purely a superior labrum. So again, the superior half of the labrum is really withstanding tension and is more mobile. The inferior half of the labrum is very rigid and it's attached to the glenoid at the face and on the rim, and it's actually convex and it is meant to be loaded in compression, it withstands compression.

And so that's sort of the macro structure of the labrum, but from a microscopic perspective, there are multiple layers. The deep layer is attached to the bone and withstands compression. And the intermediate layer has these longitudinal bands that are oriented to fibers to withstand compression, but really distribute the load. And then the most superficial has more of a mesh-like. It's a combination and it deforms and it conforms to pressure, sort of like a washer. And why that's all important is that the labrum, we're beginning to realize, has seemingly then both a dynamic and a static role. That's really important in the function of the glenohumeral joint. Obviously it detaches, it's a bicep attachment, it deepens the glenoid, it distributes the glenohumeral contact forces, like that washer effect, to attachment for the glenohumeral ligaments in the capsule, there's proprioceptive fibers. But with the biceps, maybe most importantly, is involved in this concavity compression force. And so in a thrown shoulder, it's structure, macroscopically and microscopically, and these functions, are so vitally important. And the bottom line is that's why we have to do what we can to preserve the labrum in these throwers.

Dr. Justin Arner:

All so essential when we're doing surgery too, to remember those specifics that you mentioned. You mentioned the important role of the biceps attachment there. There's certainly, as everyone's aware, been some push to perform tenodesis in some athletes and even throwers. And I think a lot of you folks

that were involved in these papers have some strong feelings about the biceps. So can you tell us a little bit about your thoughts about the role of the biceps in the thrower or even in general, in the shoulder?

Dr. Michael Ciccotti:

Right. And that's a great question. And if you look at labral pathology in throwers, there's study after study after study, that shows that there's some common injuries that occur. And perhaps the most common is some type of injury to the biceps. And there has clearly been a focus, more recently, on biceps tenodesis and perhaps performing biceps tenodesis, even in the throwing athlete. And I would say it's probably highlighted by Pascal Boileau's study in 2009, which really, I think, generated a huge amount of interest and momentum for biceps tenodesis where he and his co-authors looked at SLAP repair versus biceps tenodesis. And with respect to outcome and return to play, biceps tenodesis was statistically significantly better than repair. But if you really look at that study in a very deep, granular way, it was a very small study, number one, but also the average age of these patients, the SLAP patients were average age of 37 and the average age of the biceps tenodesis patients were 52.

That is just not the population that we're talking about tonight, these young throwing athletes. And subsequent studies that have focused more on younger athletes, the throwing athlete, have shown again and again, that superior labrum and addressing it, trying to repair it, and or the posterior labrum, wherever the clinically significant labor injury occurs, and the biceps and addressing it are really, really important.

And biceps function, as we just talked about, it helps to optimize the glenohumeral stability, particularly in the cocking phases through ball release. And it's a humeral head depressor, it dynamizes the superior labrum that we said is already is a mobile organ in adapting to tension, it centers the humeral head and extremes of motion. And the biceps is really essential in dynamic glenohumeral stability by potentiating that glenohumeral concavity compression function. So to just tenodesis in these athletes and remove it, really may be doing them a disservice. Now, as we get into this further, we'll talk about where there's more severe pathology in the biceps that may necessitate some type of biceps procedure, but just to do biceps tenodesis in the absence of severe biceps pathology, is not really the appropriate way to address these disabled throwing shoulders.

Dr. Justin Arner:

Well it's certainly a complicated scenario. And it's not a one size fits all type procedure, it seems.

Dr. Michael Ciccotti:

Right.

Dr. Justin Arner:

So can you tell us a little bit about the arc of motion you mentioned? The evolving concepts, I guess this has been quite a while of GERD, and now we've more appreciated the total arc of motion being more important. Can you tell us about how you evaluate that in clinic and how those thoughts have changed and the importance of the posterior capsule on these throwers?

Dr. Michael Ciccotti:

Yes. We alluded to that initially, but how the evolution of this disabled throwing shoulder, looking initially at internal rotation deficit and then total arc of motion. So this idea of glenohumeral internal rotation deficit, and studies suggesting that dominant loss of 20 degrees or more compared to the

nondominant arm may constitute an internal rotation deficit. And we realize, and more recent studies have shown, that may not be a precise way of assessing dysfunction. It may be more the total arc of motion and smaller differences from side to side, even as much as five degrees of difference in the dominance of the non-dominant shoulder may represent functional disability. And recent studies have really shown that, but also now the idea of external rotation that we really shied away from in the past, but external rotation may be important. So a loss of five degrees of external rotation and rotation, rotational loss, or rotational changes, are a function of a variety of anatomic adaptations.

So the bony changes that we talk about, increased humeral retro torsion, or increased glenoid retroversion that can occur even early in a young thrower with repetitive throwing. That can lead to internal rotation loss. That's arguably unalterable or less alterable than the soft tissue changes that we see. So the posterior capsule that gets thickened and stiffened over time, almost like a reactive scar tissue that can lead to GERD or glenohumeral internal rotation deficit. But as a soft tissue contracture, that's arguably modifiable. There's been focus on muscular changes, throwing causes this acute response in the muscle. There's an increased muscle pennation angle, this concept of fixed atrophy. So increased muscle stiffness that's based on repetitive throwing? Again, modifiable. So these rotational differences that we see that have moved from internal to total arc, and maybe now external, are important for us to evaluate and the soft tissue aspects, the capsule and the muscle are ones that we can arguably modify.

And when we evaluate these throwers in the office, we do all of that. We evaluate side to side in a scapular plane, in a supine position so the scapula is stabilized, their total arc of motion. We look at their internal rotation as well. We look at their external rotation and lastly, with their forearm pronated. And these are specific assessments that we will do with our athletic trainers to get an overall sense of motion. But those numbers: GERD, again 20 degrees dominant to non-dominant, total arc of motion, five degrees loss and external rotation, five degrees of loss. Those are the numbers that we look at, and we begin to think about an athlete whose shoulder is at risk. And we begin to think about ways of modifying those motions, particularly with respect to the soft tissue causes.

Dr. Justin Arner:

It's so amazing how much we learn. And it seems like the more we learn, the more we realize that we don't know regarding the glenoid and the humeral torsion and the muscular changes are really, really amazing, what the body does in these young throwers.

Dr. Michael Ciccotti:

Exactly, exactly.

Dr. Justin Arner:

One thing you mentioned, Ben Kibler has been such a pioneer, teaching us about the scapula. And you mentioned that before. Can you teach us a little bit about how you evaluate the scapula and some pathology see specifically in throwers?

Dr. Michael Ciccotti:

Yeah, absolutely. This idea of scapular dyskinesis. So an abnormal, which essentially is defined as abnormal motion of the scapula during shoulder movement. And there are ways of just quickly assessing it by just visually looking at the shoulder blade. So having the patient's back exposed so you can see both sides and just looking at rest, where is the scapula sitting and dominant to nondominant arm? If they

have any type of significant winging, then there's some type of neurologic issue involved, but for the most part, you won't see it at rest. It's really with some type of repetitive motion.

So what we'll do is forward flexion or abduction several times, and we'll watch how the scapula on the dominant arm moves with respect to either the non-dominant arm and noticing is it elevated, does it move on the chest symmetrically compared to the other side? And it's not even as much as they elevate their arm, as far as flexion, but maybe more importantly, as they lower their arm, does the inferior pole, the scapula lift up at all or any subtle winging? And you can accentuate that by even giving them a weight, a two pound weight or five pound weight and watching them do it. So watching it at rest and then watching them with repetitive motion, not just elevation, but also lowering of the arm and seeing if there's any subtle winging of the inferior pulls of the scapula.

Dr. Justin Arner:

Great tips for sure. I just want to thank you, Dr. Ciccotti, for your knowledge. And this study is certainly a lot of coordinated efforts over decades and decades of work from such illustrious colleagues. So thanks so much for spending the time talking with us about this. I know you're so busy and I can't show you enough appreciation for doing that for us.

Dr. Michael Ciccotti:

Well, Justin, as I said, it's an honor and a pleasure for me to be here and talking to you about this and absolutely an honor for me to participate in this two part series on the stable throwing shoulder that once again, really Ben Kibbler is the one who focused this whole group together and with Aaron Sasha and JT Tokish, John Kelly, Steve Thomas, Mike Reinhold, and Jim Bradley, just a wonderful, great, brilliant group of people that I'm honored to work with.

Dr. Justin Arner:

Great. Thank you so much, Dr. Ciccotti.

Speaker 3:

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