

The Use of a Non-Impact Exercise Device to Return a Professional Athlete to Playing Condition Following Arthroscopic Knee Surgery: A Case Study

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Introduction

This case study involves an infielder for the Arizona Diamondbacks of Major League Baseball. For two seasons preceding the 2007 campaign, the player averaged 150 games, with 24 home runs, 76 runs batted in, and a .295 batting average. In July of 2007, he suffered a debilitating knee injury to the articular cartilage of his right lateral femoral condyle, and his lateral meniscus, effectively terminating his season.

In September of 2007, the player underwent surgery involving microfracture of the condyle, a lateral release of his iliotibial band, and repair of his meniscus. Following a fairly inactive winter, the player pushed himself to return to playing rehab games during late April of 2008, with a full return to play in May of that year.

According to Major League Baseball, the player “hit his stride in July of 2008, when he hit .351, but he slumped to .183 in August as the games caught up to him.” The player finished the 2008 season having completed only 88 games, with a .267 batting average, 8 home runs, and 39 runs batted in.

Two primary factors have been attributed to the player’s difficulties during 2008. First, his relatively poor physical condition, as a result of the knee surgery and an inability to train effectively, resulted in general fatigue and reduced performance capacity over the course of the lengthy season. Second, his subjective ratings of knee pain averaged a 7 (significant pain and dysfunction) on a ten-point scale prior to surgery, and a 3 (noticeable pain and compensation) for the full season following surgery.

The player committed to an intensive off-season training program in order to arrive at 2009 spring training in peak physical condition. His concern, however, was that his knee could not tolerate the stress of off-season conditioning, and that any pain he felt during the process would hinder his achieving significant enough training intensity to stimulate real changes in his physical condition.

For this reason, a program involving early non-impact exercise was developed, to be implemented for the winter months of 2008 and 2009. In order to create a high-intensity, non-impact training environment, the Cybex Arc Trainer was selected as the training device. According to Graves and Juris, the Arc Trainer produces forces that balance the work performed by the hip and knee muscles, while limiting stress at the knee joint. Additionally, the Arc’s high power capacity (900 watts) provides an excellent training stimulus for a professional athlete.



Methods

The goal of this off-season (November through January) program was to prepare a post-surgical MLB Player, with a history of severe knee pain, for the upcoming 2009 regular season. The immediate task was to improve his overall fitness level and lower body strength in a pain free environment. It was essential to avoid swelling and further damage to his right knee, which, as a left-handed hitter, is his lead leg, potentially inhibiting his swing, and negatively affecting his regular season performance.

The program consisted of two Cybex Arc training sessions per week for eight weeks. There was a week off in the middle of the program for the Thanksgiving holiday. Because of his ongoing knee discomfort, and concerns over re-injuring his leg, the player initially exhibited reluctance to perform a submaximal strength test at the start of the program. Thus, a ten point relative pain scale was employed during the exercise sessions. In this scale, a score of zero indicated that he was pain free, while a score of ten meant that he was experiencing severe pain and disability. The player was asked to rate his knee pain before, during, and after each exercise session.

The Arc sessions were conducted on Monday and Thursday of each week, and were integrated into an overall program of sports conditioning and return to function. The Arc sessions were completed on the same days as the player's strength exercises. All of the sessions were conducted at a constant cadence of 120 strides per minute. The variables that were manipulated were incline and resistance, in order to establish target power levels in watts.

Once the settings of the Arc were established, training sessions consisted of a series of interval routines, composed of one or more sets of work intervals, interspersed with periods of rest. The duration of the work interval varied in accordance with the power requirements of the set and the training goal for that session. The recovery period lasted until the player's heart rate returned to a steady rate of 120 BPM.

The exercise progressions can be seen in the accompanying chart.

Arc Trainer Exercise Progressions								
Week	Day	Sets	Intervals	%Inc	Resistance	Watts	Time	Pain
1	1	1	6	2	38	233	:30	1
	2	1	6	2	42	256	:30	1
2	1	1	6	2	45	273	:45	0
	2	1	6	2	48	291	:45	0
3	1	1	3	2	48	291	:45	0
		2	3	8	64	378	:45	0
	2	1	4	2	52	313	:45	0
		2	2	2	8	64	378	:45
OFF								
5	1	1	4	2	54	324	:45	0
		2	4	8	67	394	:45	0
	2	1	4	2	54	324	:45	0
		2	4	8	67	394	:45	0
6	1	1	4	2	54	324	1:00	0
		2	4	8	73	424	:45	0
	2	1	4	2	54	324	1:00	0
2		4	8	73	424	:45	0	
7	1	1	3	2	54	324	1:00	0
		2	5	8	76	439	:45	0
	2	1	4	2	54	324	1:00	0
		2	6	8	83	473	:45	0
8	1	1	4	2	54	324	1:00	0
		2	6	8	83	473	:45	0

Results

As indicated in the chart, volume, intensity, and duration of exercise increased during the eight week period. This is also depicted graphically in the attached figure.

During the first two training weeks, the incline and resistance levels were kept low so that the player could acclimate to the machine. Additionally, low incline settings on the Arc require greater muscular effort by the hip extensors, since the gravitational effects on body weight do not contribute to the movement. These settings helped, therefore, to efficiently recruit the posterior chain.

Once the resistance levels were at or above 64%, the incline was increased to level eight on the Arc, which is a significant incline. The higher incline increases the range of motion around the hip and knee joints, but also permits some use of body weight to aid in propulsion. This gravitational assist is matched with an increase in resistance.

By the end of week three, the player began to show greater confidence regarding is right knee during each session, along with a strong desire to push himself without hesitation. As indicated in the table, all subjective pain scores were at 1 or 0 throughout the program.

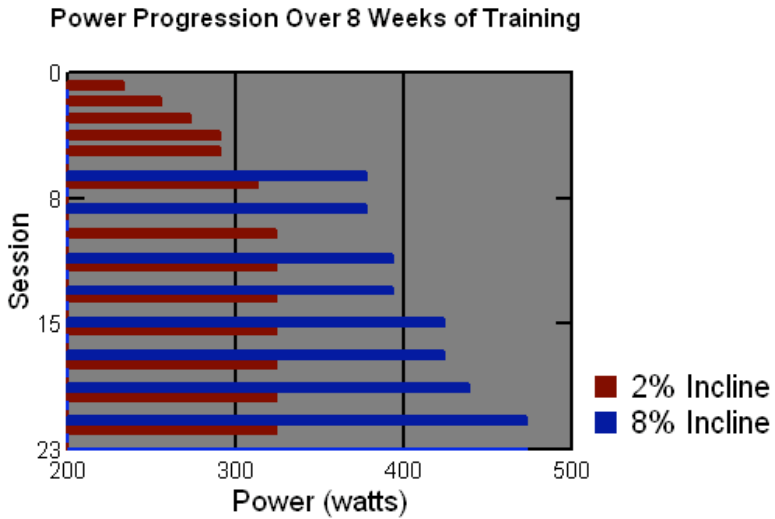
Week four was designed to be an active recovery session in the form of a light, continuous run. The Arc trainer protocol was omitted during this time. Leading into

week five, the player began to notice significant strength gains in his lower body along with improved fitness levels.

Additionally, recovery time between each working set, during the first five weeks, was based on heart rate returning to 120 BPM, which on average, required over two minutes. Beginning week six, however, the recovery was fixed at two minutes, as the player showed fitness

improvements resulting in his heart rate reaching 120 BPM in less than two minutes.

The last two training sessions served as confidence boosters as the player completed each session, commenting that he could have exercised at an even higher intensity.



Conclusions

- The player was able to exercise at extremely high intensities with little to no pain during each Cybex ARC Trainer workout
- The player never had a score higher than one on the pain scale during or after any training session
- The player displayed an increase in overall fitness levels as well as leg strength at the end of eight weeks
- The player experienced no knee pain during his first offseason batting cage session in mid-December
- The player did not have access to an Arc Trainer during the month of January but was able to continue to make strength and fitness improvements based on his initial offseason program. He had access to an Arc Trainer at the beginning of February and during his first two workouts he completed eight repetitions of twenty seconds each peaking at well over 700 watts with no pain.
- According to the manager of the Arizona Diamondbacks, "This offseason he has been able to work out harder. He was never at a point last year where he was 100 percent, or a guy that could go out there and play for a week straight. I think we're past that now. I think you're going to see him go out this year and post outstanding numbers,"

References

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