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Is it a "Disuse Pain syndrome" - A cause for Undiagnosed Knee Pain?

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Abstract

In a study ten patients of both the sexes in different age groups were selected to assess the isokinetic torques of muscles in undiagnosed knee pain and outcome after correction of the torque deficiencies. Patient selection was for a specific knee pain, mild to moderate felt during getting up from squatting and low seat or walking, without any orthopaedic or neurological disorders. All the patients were found to have reduced down their physical activities remarkably before developing pain. Isokinetic torques were measured in an isokinetic dynamometer which showed significantly low torque values on the affected side in comparison to the asymptometic side or control. Torque deficiencies were taken care of with exercises - making the patients completely symptom free in five to six weeks time. Looking at the fact that knee has an exceptionally high number of muscles attached to the capsule and muscles play a very important role in stabilising this joint, a conclusion can be drawn. It can be said that the change in the state of physical activities involving the lower limbs of an otherwise healthy person to a lower state or prolong sedentary habit may produce loss and imbalance of knee muscle strength. That is expressed in knee pain to be treated with restoration of the loss.

Key words : **isokinetic torque, concentric, eccentric, dynamometer, physical habit change.**

Introduction

In the knee joint two bones are required to be in better congruity taking the two menisci in between; so is the static and dynamic stability of the joint calling in for enhanced role of the capsule, ligaments and muscles of the joint. This raises a corollary where imbalances of muscle torque production in between agonists and antagonists in concentric or eccentric modes are to be considered in etiopathogenesis of knee pain with more emphasis.

In this study, isokinetic peak torques of quadriceps and hamstrings were estimated in the patients where a known cause for knee pain could not be established. Results were also observed after correcting the deficiencies.

Materials and Methods

Initially cases were detected in the out patients Department of Physical Medicine and Rehabilitation, AIIMS, New Delhi with knee pain diagnosed as osteoarthritis (O.A.) of knees by different practitioner out side the department. But those cases could not be taken as O.A. as their clinical features did not confirm with the diagnostic criteria of American Rheumatism Association for O.A. knees.

American Rheumatism Association criteria for O.A. (1987).

Clinical criteria Knee pain and at least 3 out of 6 criteria as below	Clinical and radiological criteria Knee pain osteophytes and 1 out of 3 criteria s below
1. age>50 years	1. age>50 years
2. stiffness<30 minutes	2. stiffness
3. crepitus	3. crepitus
4. bony tenderness	
5. bony enlargement	
6. no palpable warmth	

Later cases were found with knee pain who were taking NSAID on regular basis with partial

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or temporary relief. None of them had any established diagnosis for knee pain before they attended the out patient department for relief. They were selected for the present study according to the inclusion criteria and exclusion criteria as mentioned below. So far in last 14 months 10 cases were detected in the O.P.D. The cases were examined clinically, radiologically and in isokinetic dynamometer at two speeds - 60°/sec and 120°/sec.

Inclusion criteria

1. Localised knee pain of any duration.
2. Any age group and sex of the patient.
3. Apparently healthy person otherwise.

Exclusion criteria

1. Bony lesion at the affected joint e.g. osteoarthritis, rheumatiod arthritis.
2. Neurological disorder affecting the limb e.g. neuropathy, polio. etc.
3. Recent trauma (in the preceding 4 weeks) to the painful joint.
4. Knee pain diagnosed due to any of the following causes

Anterior knee pain

Osteoarthritis, Chondromalacia patellae
Prepatellar pretendinous bursitis
Quadriceps tendon tendinitis - jumper's knee
Osgood-Schlatter's disease
Hoffa's body inflammation
Plica syndrome
Tight lateral retinaculum
Unstable patella

Medial knee pain

Anserine bursitis
Medial meniscus tear
Medial collateral ligament bursitis
Semimembranosus bursitis

Lateral knee pain

Iliotibial tract syndrome
Bicipital tendon bursitis
Lateral meniscus tear, bursitis
Popliteal tendon bursitis

Therapeutic interventions

All the patients were managed with tablet Ibuprofen (400 mg) three tablets a day for initial 5 days to avoid the muscle soreness[1] at the initiation of exercise therapy and an exercise schedule as follows -

Isokinetic concentric exercise for both quadriceps and hamstrings at the speed of 120°/sec, 150 repetitions in one sitting and three sitting in a week for all the patients along with plyometrics (jumping in different heights) except three cases as they were more than 50 years of age, till the patients turned pain free. Only eccentric exercises were given where it was found to be deficient in comparison to concentric one.

All the patients were completely symptom free and the tenderness also disappeared in 4 to 6 weeks time except case no 6 who discontinued after 4 weeks time when his pain was reduced by about 70% and dynamometry also showed improvement. The dynamometric estimation was done after the patient turned symptom free and discharged from exercise schedule to continue at home with exercise walking only 4-5 km at a stretch in a day within 30-40 minutes time.

Observations

1. All the patients reduced down their physical activities involving lower limbs (walking, running etc.) in 6 months to 4 years time before they developed pain symptom in the knees, one patient (case 2) never walked more than quarter of a kilometer per day in last thirty years of her life.
2. In case of unilateral knee pain the affected knee muscles were unable to produce more than 20% torques in relation to the opposite side both at concentric and eccentric modes (cases 1,2,3,4,5).

3. In case of bilateral knee pain affected quadriceps generated 20% less torque in comparison to control of same sex, age group, body weight and habit pattern but having no history of habit change regarding walking, running etc. (cases 8,10).
4. All the patients were advised to take Tab. Ibuprofen if required for pain after initial 5 days, but no body required any after the initial days.
5. There was isolated loss of isokinetic eccentric strength of quadriceps in a couple of patients presented with knee pain during walking only, unlike the previous group. But they had similar tenderness at the medial joint line and below. (cases 9, 10).
6. In 5-6 weeks of exercise regime deficiencies of isokinetic torque production was made up and a symmetry was established between two sides in unilateral affection. In bilateral affection torque production in both the sides became as good as normal being, seen in control. (unilateral cases - cases 1-7 and 9, Table - 2 and Table-4; bilateral cases - cases 8 and 10 Table-2, Table-3 and Table-4).
7. In a group of two patients who were regularly on sports activities before stopping them due to one disease or injury, developed pain after total confinement to bed for a period and starting normal activities (cases.7,8)
8. Maintenance was with brisk and uninterrupted walking daily as an exercise for five kilometers in thirty to forty minutes time period.

TABLE - 1

Clinical features of the Patients

Case	*Age (Years)*	*Sex*	*Symptom*	*Duration*	*Habit Change*	*Tenderness/ Grade*	*Site*
1	22	M	A(L)	4m	+ (4Y)	0	0
2	52	F	A,B(L)	6m	-	$+1^0$	MTC(L)
3	31	M	A(L)	6m	+ (1.5Y)	$+1^0$	MJL(L)
4	39	F	A,B(L)	15D	+ (2Y)	$+1^0$	MTC(L)
5	55	F	A,B,C(R)	3m	+(6m)	$+1^0$	MTC(R) MJL (R)
6	56	M	A,B(L)	3m	+ (2Y)	$+1^0$	MJL(L) MTC(L)
7	13	F	A,B,C(R)	4m	+ (5m)	$+2^0$	LJL(R)
8	16	M	A,B,C(R,L)	6m	+ (8m)	$+1^0$	MJL(R,L)
9	34	M	B(R)	1Y	+ (1Y)	$+1^0$	MJL(R)
10	35	M	B,C(R,L)	1.5m	+ (1.5Y)	$+1^0$	MJL(R)

Abbreviations used in Table - 1

A: symptom of pain during getting-up from squatting and climbing stairs.
B: symptom of pain in th eknee/knees during walking.
C: symptom of pain in the knee/knees at rest.
M: male. F: female.
L: left. R: right.
MTC: medial tibial condyle. MJL: medial joint line.
LJL: lateral joint line. PUP: patellar upper pole.
m: month. Y: year. D: day.

TABLE - 2

Features of dynamometry before therapy

Case	Mode	Speed	Muscle Torque (ft-lb) Hamstrings/Quadriceps (H/Q)		% Difference Between Two Sides	Eccentric-Concentric Ratio (E/C)			
						60°/sec		120°/sec	
			R	L		R	L	R	L
1	CON	60°/sec	47/112	44/75	33% L D	0.4	0.6	0.8	1.2
		120°/sec	31/70	27/52	25% L D				
	ECC	60°/sec	42/49	42/42	14% L D				
		120°/sec	44/62	38/63	1.6% L U				
2	CON	60°/sec	30/48	29/22	54% L D	0.6	1.0	1.1	2.8
		120°/sec	21/36	10/9	75% L D				
	ECC	60°/sec	27/29	36/22	24% L D				
		120°/sec	23/40	43/25	37% L D				
3	CON	60°/sec	48/73	35/54	26% L D	0.9	1.2	1.5	2.0
		120°/sec	35/54	30/41	24% L D				
	ECC	60°/sec	54/71	65/67	6% L D				
		120°/sec	50/83	78/82	1% L D				
4	CON	60°/sec	36/57	28/28	50% L D	0.9	0.6	0.3	0.7
		120°/sec	32/51	35/32	37% L D				
	ECC	60°/sec	32/55	20/19	65% L D				
		120°/sec	39/16	38/25	36% L U				
5	CON	60°/sec	8/9	18/23	60% R D	1.1	1.3	2.6	1.0
		120°/sec	7/7	11/14	50% R D				
	ECC	60°/sec	13/10	20/30	66% R D				
		120°/sec	26/18	19/15	16% R U				

TABLE - 2 *(Continuation)*

Case	Mode	Speed	Muscle Torque (ft-lb) Hamstrings/Quadriceps (H/Q)		% Difference Between Two Sides	Eccentric-Concentric Ratio (E/C)			
						60°/sec		120°/sec	
			R	L		R	L	R	L
6	CON	60°/sec	28/41	20/38	7% L D	1.19	0.9	2.33	2.4
		120°/sec	12/24	11/21	12% L D				
	ECC	60°/sec	38/49	33/36	26% L D				
		120°/sec	44/56	37/51	9% L D				
7	CON	60°/sec	49/50	44/68	26% R D	0.7	0.6	0.8	0.4
		120°/sec	40/50	35/72	30% R D				
	ECC	60°/sec	32/36	30/41	12% R D				
		120°/sec	51/40	30/30	25% R U				
8	CON	60°/sec	47/75	52/100	25% R D	0.4	0.5	0.2	1.8
		120°/sec	40/69	17/46	33% L D				
	ECC	60°/sec	38/33	31/55	40% R D				
		120°/sec	31/20	65/83	75% R D				
9	CON	60°/sec	75/127	92/159	20% R D	0.4	0.4	0.4	1.0
		120°/sec	57/96	59/112	14% R D				
	ECC	60°/sec	66/45	77/58	22% R D				
		120°/sec	75/43	104/112	61% R D				
10	CON	60°/sec	58/92	43/63	31% L D	0.5	0.6	0.3	0.9
		120°/sec	51/72	37/50	30% L D				
	ECC	60°/sec	47/50	43/38	24% L D				
		120°/sec	59/26	23/49	46% L U				

Abbreviations used in Table-2
RU: right sided torque value up LU: left sided torque value down
RD: right sided torque valude down LD: left sided torque value down

TABLE - 3
Showing the torque values of the control subjects for bilateral knee pain

Case	Age (Years) /sex	Mode	Speed	Torque Hamstrings/quadriceps	
				R	L
C8	16/M	CON	60°/sec	58/82	50/72
			120°/sec	60/75	64/79
		ECC	60°/sec	52/88	61/86
			120°/sec	55/62	68/77
C10	35/M	CON	60°/sec	67/112	76/113
			120°/sec	61/95	63/101
		ECC	60°/sec	66/91	79/87
			120°/sec	71/95	83/102

TABLE - 4
Dynamometric findings after the therapy

Case	Mode	Speed	Isokinetic torque (ft-lb) Hamstring/quadriceps (H/Q)		% torque raised from before in quadriceps		% of torque difference betweent two sides	Eccentric/concentric ratio (E/C)			
								60°/sec		120°/sec	
			R	L	R	L		R	L	R	L
1	CON	60°/sec	74/112	78/112	0%	33%	0%	1.0	0.9	1.1	1.2
		120°/sec	56/74	55/89	6%	71%	16% L U				
	ECC	60°/sec	72/113	91/109	76%	159%	3% LU				
		120°/sec	76/85	89/112	37%	76%	23% LU				
2	CON	60°/sec	32/51	26/31	6%	40%	39% RU	0.8	1.4	1.5	0.7
		120°/sec	24/40	25/47	11%	422%	14% LU				
	ECC	60°/sec	32/41	34/44	41%	50%	6% LU				
		120°/sec	52/60	32/33	50%	32%	45% RU				
3	CON	60°/sec	76/108	64/93	47%	72%	13% RU	1.0	1.0	0.8	1.5
		120°/sec	73/110	69/90	103%	119%	18% RU				
	ECC	60°/sec	65/110	66/108	54%	61%	2% RU				
		120°/sec	70/92	71/142	10%	73%	56% RD				

TABLE - 4 *(Continuation)*

Case	Mode	Speed	Isokinetic torque (ft-lb) Hamstring/quadriceps (H/Q)		% torque raised from before in quadriceps		% of torque difference betweent two sides	Eccentric/concentric ratio (E/C)			
								60°/sec		120°/sec	
			R	L	R	L		R	L	R	L
4	CON	60°/sec	39/63	32/55	10%	96%	14% RU	1.03	1.03	1.03	1.02
		120°/sec	35/52	39/48	2%	50%	8% RU				
	ECC	60°/sec	52/65	40/57	18%	200%	14% RU				
		120°/sec	49/54	50/49	237%	96%	10% RU				
5	CON	60°/sec	24/39	26/44	333%	91%	11% LU	1.05	0.09	1.0	1.06
		120°/sec	32/30	30/30	328%	114%	0%				
	ECC	60°/sec	18/41	22/48	310%	60%	17% LU				
		120°/sec	33/30	29/32	66%	113%	6%				
6	CON	60°/sec	44/68	34/64	65%	68%	8% RU	1.02	1.12	0.9	1.2
		120°/sec	53/60	43/55	150%	161%	8% RU				
	ECC	60°/sec	42/70	40/72	42%	100%	3% LU				
		120°/sec	57/58	56/66	4%	29%	12%				
7	CON	60°/sec	56/88	52/79	76%	16%	10% RU	0.9	0.9	1.02	0.9
		120°/sec	63/72	55/74	44%	3%	3% LU				
	ECC	60°/sec	75/80	68/76	122%	85%	5% RU				
		120°/sec	64/74	68/66	85%	120%	11% RU				
8	CON	60°/sec	62/92	58/109	23%	9%	18% LU	0.9	0.8	0.9	0.9
		120°/sec	64/86	55/96	25%	108%	12% LU				
	ECC	60°/sec	74/85	78/92	157%	67%	8% LU				
		120°/sec	68/79	81/90	295%	8%	14% LU				
9	CON	60°/sec	84/141	93/160	11%	1%	12% LU	0.9	0.8	0.9	1.0
		120°/sec	78/106	82/114	10%	2%	7% LU				
	ECC	60°/sec	78/138	89/132	206%	127%	4% RU				
		120°/sec	91/98	105/118	127%	5%	17% LU				
10	CON	60°/sec	76/108	64/93	11%	1%	12% LU	0.9	0.8	0.9	1.0
		120°/sec	73/110	69/90	10%	2	7% LU				
	ECC	60°/sec	65/110	66/108	206%	127%	4% RU				
		120°/sec	70/72	71/142	127%	5%	17% LU				

Discussion

This has been well known that weak quadriceps may produce pain in the knee joint by producing repeated synovitis - as described by Lewin in 1952.[2]

In cases of anterior knee pain where no well defined orthopedic lesion could be identified eccentric component was found to be 85% less than the concentric torque by Bennett and Stauber in 1986.[3] In their study the rehabilitation programme was eccentric training till the pain was relieved. It has been theorised that eccentric loss has been due to neurophysiological deficiency - removal of which alleviates pain. Success rate of 93% with full reversal of deficiencies have been claimed by the authors.[3]

But this 85% reduced eccentric torque in relation to concentric one bearing responsibility for knee pain, has been questioned by Truddelle and Jackson in 1989 as they found 35-54% of normal population showed such deficiency.[4] Conway et al found eccentric and concentric ratio to be more than 0.95 in all the 30 cases of their study on patello-femoral pain.[5]

A pain-free healthy knee joint has an average isokinetic strength of the muscles. The isokinetic strength represented by the isokinetic torque is to be in proper proportion in between antagonising muscles/muscle groups.[6] The balance is disrupted due to lesser use of knee joint in daily activities for month to years back. This is analogous to deconditioning as by disuse or lesser use, quadriceps and hamstrings become less strong and efficient to produce torque to maintain knee in proper functional stability. In other way it is to be suggested that imbalance and deficiencies of the opposing muscles are to be inculpated for the pain in the present study. As the eccentric action of the quadriceps plays a vital role in shock absorption during heel strike phase of gait cycle isolated eccentric loss of muscle strength can produce pain during walking only. When there are both eccentric and concentric loss of muscle strength for obvious reason pain appears during getting up from squatting, low seat and also during walking. One eccentric - concentric ratio as E/C has been used in this study which becomes abnormally low in case of eccentric loss. Usually it varies from 1.3-1.7 upper limit being considered 2.0 in case of a normal knee in the velocities used here.[7]

With the limitation of the study comprising a very small number of patients, lack of long follow up and adequate control we can still well conclude that change of physical habit in using the lower limb or sedentary habit for long period of life may derange the isokinetic strength of knee muscles producing pain in the knee. This may occur either unilaterally or bilaterally for the reason unknown; restoration of these deficiencies makes the joint pain-free.

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