

# Role of High Power Laser Therapy on Pain Reduction in Patients with Patellofemoral Pain Syndrome

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## ABSTRACT

**Background:** Patellofemoral pain syndrome also known as chondromalacia patella is a very common musculoskeletal disorder in adolescents and athletes. The underlying cause of PFPS is unknown, but some medical experts believe that pain in the knee area is caused by othersoft tissue, muscular, and biomechanical abnormalities. If PFPS is not treated in a controlledmanner, then it can cause quadriceps muscle weakness. PFPS affects both adults and teens with aprevalence rate of 23% for most people. The prevalence of PFPS is higher for women comparedto men. Usually, the diagnosis of PFPS is slow because there is a cluster of signs and symptoms.

**Aim:** To determine the effects of high power laser therapy on pain reduction in patientswith patellofemoral pain syndrome.

**Methodology:** It is a RCT (randomized controlled trial). There were two groups i.e. Control group (routine physiotherapy) and treatment group(routine physiotherapy + Hi power lasertherapy) with 33 patients in each group (total of 66 participants of study). VAS scoring was used to interpret the data. The data was analyzed statistically and then was compared to study the difference between two groups.

**Results:** The data was statistically analyzed and showed the difference between two groups of the study. The value of P is less than 0.05 which was considered significant.

**Conclusion:** It is concluded that the patients who receive HPLT (high power laser therapy) along with routine physiotherapy showed better results and progress in pain reduction than those who only receive routine physiotherapy treatment.

**Keywords:** High Power Laser therapy, Patellofemoral Pain Syndrome, Visual Analogue Scale

## INTRODUCTION

Patellofemoral pain syndrome also known as chondromalacia patella is a very common musculoskeletal disorder in young adults and athletes<sup>1</sup>. PFPS can affect the knee, hip, and ankle as the whole lower limbs work in collaboration to produce functional movements. The typical clinical symptom of PFPS include is commonly pain around the patella region which increases with physical activities particularly during running, that is why it is called runner's knee. Joint pain causes stiffness and mobility limitations in patients with PFPS<sup>2</sup>.

According to an estimate, it has been reported that high prevalence is found in elite athletes as 35.7%, adolescents as 28.9%, and military as 13.5%. PFPS affects both adults and adolescents having a prevalence rate of 23% in the general population<sup>3</sup>. In the treatment of pain Intensive laser therapy and other therapies are very effective and are widely used in the latest therapies. This study focused on evaluating the beneficial effects of HILT and other therapeutic interventions in the management of musculoskeletal pain<sup>4</sup>.

There are many risk factors associated with PFPS including greater hip adduction during running, increased navicular drop in military recruits, and increased forces at the level of the footduring both running and walking<sup>5</sup>. There are various ways and tests of assessing PFPS like the FSD (Forward Step Down) test which is positive in the case of patellofemoral joint dysfunction and ACL (Anterior Cruciate Ligament) injury and this test indicates high intra-raterreliability<sup>6</sup>.

Many other physiotherapy techniques have been applied for managing PFPS including kinesiotaping, post-isometric relaxation, and mobilization of the patella<sup>7</sup>. Physical therapy is very important in managing and treating musculoskeletal disorders like osteoarthritis, carpal tunnel syndrome (CTS), and patellofemoral pain syndrome. In past, HPLT was used to target only destroyed tissues, but in recent times, it is now being applied by physiotherapists for treating joint pain. It is more preferred by health professionals as it has a larger emission interval and a

short emission time. Therefore, this new feature of High-Intensity Laser Therapy (HILT) has shown more positive impacts on reducing discomfort and pain in patients with patellofemoral pain syndrome<sup>8</sup>.

Despite the laser therapy there are many treatment options for managing this musculoskeletal disorder and its related pain and functional disability. Physical therapy, cold therapy, orthotics, bracing, and taping are some of the non-pharmacological treatment options for treating this syndrome<sup>9</sup>. HPL shows immediate results and researchers have reported that a single session or use of HPL significantly improves quadriceps muscle function<sup>10</sup>.

Laser therapy is also known as phototherapy which in turn activates the muscle bioenergy and in this way, it can affect the biomechanical function of the tissues. High power laser therapy stimulates deeper and larger surfaces in a very short time. It has been observed that HPL (High Power Laser) therapy enhanced the functioning of quadriceps muscles. The HPL shows immediate effects and researchers have described that only one session or application of HPL significantly improves the functioning of quadriceps muscles<sup>11</sup>.

A study was conducted to compare the effects of high-intensity laser therapy (HILT), conventional physical therapy (CPT), and exercise therapy (ET) on pain and function in patients with knee osteoarthritis (KOA). They concluded that HILT was significantly more effective than the other groups in decreasing the VAS, increasing FROM and improving the scores of WOMAC (total and function subscale) both after treatment and after 12 weeks. HILT combined with exercise therapy, as a useful therapeutic approach, could have positive influences on KOA patients<sup>12</sup>.

The researcher analyzes the efficacy of HILT in managing knee OA Various randomized control trials had been studied and included in the study. All six studies explicated that HILT is very useful in treating knee OA<sup>13</sup>.

Most studies focused in studying the effect of low-power laser therapy and explained how it proved useful in decreasing pain. This study will be very useful for future researchers as well as in filling the literature gap by elucidating the importance of high-power laser therapy HILT for a long interval of time.

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**METHODOLOGY**

It was a randomized controlled trial carried out from July 2021 to March 2022 at Ittefaq Hospital, Lahore and Bahria International Hospital, Lahore. The data was collected by purposive sampling technique. A total of 66 patients, 33 in each group were taken randomly by lottery method. The study was single blinded .The Inclusion Criteria were diagnosed patients with Anterior, retro-patellar or peri-patellar knee pain for more than 3 months age group 15 to 40 years, of both Genders having Pain aggravated by prolonged sitting, stair climbing, running, squatting, kneeling, hopping\jumping, overuse activities and relieved by rest. Insidious or gradual onset of symptoms with Presence of pain on palpation of patellar facets, on step down from a 25 cm step, or during a double legged squat.

Patients with Osteoarthritis, meniscal injury, joint effusion, autoimmune diseases, patellar subluxation/dislocation, intraarticular derangement and pathology, bursitis, patellar tendonitis were excluded. Patients who have had previous physical therapy, chiropractic treatment or massage therapy in the last 3 months having Neurologic disorders that can influence gait and similar disorders and recent trauma or surgery were also excluded. Visual Analogue Scale was used to measure pain.

Group A received routine physical therapy regime as a treatment for patellofemoral pain syndrome 40-45 minutes per session 4 sessions per week for four weeks that include Prone quadriceps stretch, IT Band Stretch, Calf stretch, Patellar mobilizations, 30 seconds hold with 5 repetitions. Quadriceps Strengthening, Straight leg raise, Hip Abduction and Adduction Exercise, Hamstrings Strengthening, Dumbbell squats and wall squats were also included with 5-10 repetitions.

Group B receives routine physical therapy with high intensity laser therapy (HPLT) for 8consecutive sessions with an interval of 3 days. Each participant of this group was exposed to 120 seconds of 10W- laser with 120J/cm2 per therapy. The patients were in supine position with knee in extension placing the patella in its resting position. Pulsed laser on patellar margins was used in circulatory movements. The distance of the applicator from the skin was 2 cm and the spot size was 0.8 cm2. Total four times readings were taken at the start of the study and after every 4<sup>th</sup> sessions.

**Statistical Analysis:** Data was analyzed using SPSS version 26.The quantitative variables were presented in the form of mean ±SD and qualitative variables like pain was presented in the form f frequency and percentage. Kolmogorov – Smirnova and Shapiro – wilk test were performed as the data was non-parametric. Comparative difference analyzed with Mann Whitney U Test for vas score. The within group difference for the VAS score was

analyzed by applying Wilcoxon Rank Test. P value < 0.05 is considered significant.

**RESULTS**

These statistics as per measured by Kolmogorov – Smirnova and Shapiro –wilk test of normality showed a non- parametric distribution of data as data will be considered normal for p value more than 0.05 and non-parametric for p value less than 0.05 (Table 1). The results regarding gender showed that there were 60.6% male, 39.4% female in routine physiotherapy group and therewere 45.5% male, 54.5% female hi laser with routine physical therapy group (Table 2).The results regarding age for the routine physical therapy group showed that the mean and standard deviation found to be 27.45±7.16 and 27.93±6.36 for the high laser with routine physical therapy (Table 3) Comparative difference analyzed with Mann Whitney U Test for VAS score showed that at baseline; the mean ranks were 33.05 and 33.95 for routine physical therapy group and hi laser with routine physical therapy group respectively, with a non-significant difference (p value 0.839) and at 2<sup>nd</sup> week the mean ranks were 34.88 and 32.12 for routine physical therapy group and hi laser with routine physical therapy group respectively with a non-significant difference (p value 0.531) while at 4<sup>th</sup> week VAS score the mean ranks were 41.11 and 25.88 for routine physical therapy group and hi laser with routine physical therapy group respectively with a significant difference (p value 0.001).while at 8<sup>th</sup> weeks VAS score the mean ranks were 47.56 and 19.44 for routine physical therapy group and hi laser with routine physical therapy group respectively with a significant difference (p value 0.000) (Table 4).The results regarding within group assessment of pain measured by VAS in Routine physical therapy group showed that there was significant improvement at all of measurement from baseline to 2nd week, 2nd to 4th and 4th to 8th week with a p value less than 0.05 ( Table 5). The results regarding within group assessment of pain measured by VAS in hi laser with Routine physical therapy group showed that there was significant improvement at all of measurement from baseline to 2nd week, 2nd to 4th and 4th to 8th week with a p value less than 0.05 (Table 6). The within group difference the VAS score was analysed applying Wilcoxon Rank Test showed a consistent improved in the painfrom 3.98 mean ranks at baseline to 2.94 at 2<sup>nd</sup> week and 2.08 mean ranks at 4<sup>th</sup> week and 1.00 mean rank for routine physical therapy group while for hi laser with routine physical therapy mean ranks at baseline found to be 4.00, at 2<sup>nd</sup> week at 2.98 and at 4<sup>th</sup> week 2.02 and at 8<sup>th</sup> weeks 1.00 with significant p value 0.000 at all levels of assessment for both groups (Table 7).

Table 1: Tests of Normality

Kolmogorov-Smirnov				Shapiro-Wilk		
Tests of Normality	Statistic	df	Sig.	Statistic	Df	Sig.
Baseline Vas score	.223	66	.000	.869	66	.000
2nd week VAS score	.240	66	.000	.864	66	.000
4th week VAS score	.210	66	.000	.910	66	.000
8th week VAS score	.163	66	.000	.909	66	.000

Table 2: Gender

Treatment Group		Frequency	Percent	Valid%	Cumulative%
Routine PhysicalTherapy (RP)	Valid	Male	20	60.6	60.6
		Female	13	39.4	39.4
		Total	33	100.0	100.0
Hi Laser with Routine Physical Therapy (RP)	Valid	Male	15	45.5	45.5
		Female	18	54.5	54.5
		Total	33	100.0	100.0

Table 3: Age

Treatment Group	Mean	Std. Deviation
Routine Physical Therapy(RP)	27.4545	7.16367
Hi Laser with RoutinePhysical Therapy (RP)	27.9394	6.36366

Table 4: Comparison of VAS pain score between Routine Physical Therapy (RP) and HILASER with Routine Physical Therapy (RP)

	TreatmentGroup	Mean	Std. Deviation	Mean Rank	P value	Mann Whitney U
Baseline Vasscore	RP	7.7879	.85723	33.05	0.839	529.500
	Hi Laserwith RP	7.8182	.95048	33.95		
2nd week VAS score	RP	6.4545	.79415	34.88	0.531	499.000
	Hi Laserwith RP	6.3636	.82228	32.12		
4th week VASscore	RP	5.2424	.86712	41.11	0.001	293.500
	Hi Laser with RP	4.3636	1.05529	25.89		
8th week VASscore	RP	2.7879	.64988	47.56	0.000	80.500
	Hi Laserwith RP	.9091	1.25906	19.44		

Table 5: Within Group Comparison of Pain in Routine Physiotherapy (RP)

TreatmentGroup	(I) VAS	(J) VAS	Mean Difference (I-J)	Std. Error	Sig.b	95% Confidence Interval for Difference	
						Lower Bound	Upper Bound
Routine Physical Therapy(RP)	1	2	1.333*	.104	.000	1.042	1.625
		3	2.545*	.175	.000	2.054	3.036
		4	5.000*	.151	.000	4.576	5.424
	2	1	-1.333*	.104	.000	-1.625	-1.042
		3	1.212*	.129	.000	.850	1.574
		4	3.667*	.135	.000	3.286	4.047
	3	1	-2.545*	.175	.000	-3.036	-2.054
		2	-1.212*	.129	.000	-1.574	-.850
		4	2.455*	.151	.000	2.029	2.880
	4	1	-5.000*	.151	.000	-5.424	-4.576
		2	-3.667*	.135	.000	-4.047	-3.286
		3	-2.455*	.151	.000	-2.880	-2.029

Table 6: Within Group Comparison of Pain in Hi Laser with Routine Physical Therapy(RP)

TreatmentGroup	(I) VAS	(J) VAS	Mean Difference (I-J)	Std. Error	Sig.b	95% Confidence Interval for Difference	
						LowerBound	Upper Bound
Hi Laser with Routine PhysicalTherapy(RP)	1	2	1.455*	.107	.000	1.152	1.757
		3	3.455*	.214	.000	2.854	4.055
		4	6.909*	.232	.000	6.257	7.561
	2	1	-1.455*	.107	.000	-1.757	-1.152
		3	2.000*	.169	.000	1.526	2.474
		4	5.455*	.200	.000	4.892	6.017
	3	1	-3.455*	.214	.000	-4.055	-2.854
		2	-2.000*	.169	.000	-2.474	-1.526
		4	3.455*	.180	.000	2.949	3.961
	4	1	-6.909*	.232	.000	-7.561	-6.257
		2	-5.455*	.200	.000	-6.017	-4.892
		3	-3.455*	.180	.000	-3.961	-2.949

Table 7: Within Group Comparison Wilcoxon Rank Test

Treatment Group		MeanRank	Chi-Square	P value
Routine Physical Therapy (RP)	Baseline Vas score	3.98	97.361	0.000
	2nd week VAS score	2.94		
	4th week VAS score	2.08		
	8th week VAS ore	1.00		
Hi Laser withRoutine Physical Therapy (RP)	Baseline Vas score	4.00	98.708	.000
	2nd week VAS score	2.98		
	4th week VAS score	2.02		
	8th week VAS score	1.00		

## DISCUSSION

The purpose of this research is to explore the effects of high-power laser therapy on pain and functional disability in patients with Patellofemoral Pain Syndrome. However, there are many types of research relating to PFPS, but no strong evidence exists to favor any specific treatment. The severity of pain intensity improved in VAS and at the end of the treatment session, only 3 patients had moderate pain. It has been proved by different researcher that physiotherapy alone is not very effective. The researcher has found that the addition of laser therapy decreased the pain intensity to a larger extent with other therapies<sup>14</sup>.

High-Intensity Laser Therapy has shown superior effects on pain intensity and functional disability in PFPS patients. This modality is also very helpful in treating Knee Osteoarthritis (KOA). A remarkable decrease in pain intensity has been observed in patients with PFPS<sup>15</sup>.

The effectiveness of therapeutic exercises for treating PFPS is proved by many researches. The strength training program proved to be very effective in managing Patellofemoral Pain

Syndrome. A low pain score was recorded in the study group and the research participants after the interventions can easily run and climb stairs. Hence, the strengthening exercises of hip external rotators and hip extensors have beneficial effects in reducing pain intensity<sup>16</sup>.

High Laser Therapy for managing knee osteoarthritis very effective. The researchers have combined the HILT with Glucosamine Sulfate and the outcomes were amazing. Six months treatment protocol was given to the patients. A significant reduction in pain has been reported on VAS<sup>17</sup>.

High-Intensity Laser Therapy is very useful for managing pain in these patients and making their activities of daily living easy. It is elucidated by researchers that Hi laser therapy along with exercise is very useful in treating PFPS patients. High-Intensity Laser Therapy is very effective in managing such disorders<sup>18</sup>.

The researcher studied the efficacy of low-level laser therapy for treating knee osteoarthritis (OA). The results of this article greatly favored that laser therapy is very helpful and has

remarkable advantageous effects on various MSK conditions. Laser is a non-invasive approach and can easily be applied directly over the degenerative joint or tissue. Further, it has been studied by the researchers that laser is the best alternative to medicines and anti-oxidative property makes it more useful. Hence, it can be deduced from this paper that low-level laser therapy is a good means for treating bone and joint-related diseases<sup>19</sup>.

Cabello et al described the efficacy of diathermy in managing pain and functional disability in patients with patellofemoral pain syndrome. Hence, this study has shown that diathermy by emission of radio-frequency is a good option that should be applied on large scale for treating other musculoskeletal issues as well<sup>20</sup>.

A study was conducted on patients with tennis elbow and evaluate the effects of high and low power laser therapy on pain, grip and tenderness. Thirty patients with tennis elbow were divided into two equal groups randomly. Paired t-tests and independent t-tests were used to find and compare variables in both groups. The results of the study showed a statistically significant reduction in pain, tenderness and the increase in the grip force of the patients. They concluded that Both low-power and high-power laser therapy along with physiotherapy treatments were effective in the reduction of pain and tenderness and increase in the grip force of tennis elbow patient and they did not show any significant differences<sup>21</sup>.

Keeping in view all these researches mentioned there are many different techniques to treat and manage pain related to PFPs and OA of Knee. Hence, High intensity and High Power laser therapy has also shown significant results in managing the condition and decreasing the functional limitations and other associated complains. Concerning the previous data and information produced by current research, it can be considered that HILT/ HPLT could give an effective treatment in managing knee pain, range of motion, and functionality. Although the complex pathophysiology of patellofemoral Pain Syndrome needs more studies to confirm whether improved clinical benefits can be acquired by using routine physiotherapy and Hi laser therapy. Considering previous literature, many musculoskeletal disorders have been treated with laser therapy, so we can consider this treatment protocol to be valid in the management of joint function and pain.

## CONCLUSION

The study has elucidated that the combination of routine physiotherapy and Hi Power laser therapy has shown very excellent results and a remarkable decrease in pain intensity has been observed in patients. Functional disability has also been improved in routine and Hi laser therapy group.

By keeping in view all the previous research work and this study. It has been identified through the result that High power laser therapy is beneficial in treating the pain in PFPs, the addition of routine physiotherapy with Hi Power laser therapy yield very impressive results for PFPs management and treatment, encouraging future researchers to follow this study approach.

**Conflict of Interest:** There is no conflict of interest

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