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THE EFFECTS OF SHOCK WAVE THERAPY ALONG WITH MAITLAND MOBILIZATION VERSUS MAITLAND MOBILIZATION ALONE TO RESTORE MOBILITY IN PATIENTS WITH CHRONIC ANKLE SPRAIN

Original Research

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ABSTRACT

Background: Chronic ankle sprain is a common musculoskeletal injury characterized by persistent pain, restricted movement, and functional instability, significantly affecting the quality of life. Effective rehabilitation is crucial to restore mobility, alleviate symptoms, and improve functional outcomes. Shock Wave Therapy and Maitland Mobilization have been individually recognized for their therapeutic benefits in musculoskeletal rehabilitation, but their combined efficacy in addressing chronic ankle sprain remains underexplored.

Objective: To evaluate the additional effects of Shock Wave Therapy combined with Maitland Mobilization versus Maitland Mobilization alone on mobility restoration in patients with chronic ankle sprain.

Methods: A randomized clinical trial was conducted with 30 participants recruited from Al-Fatah Club, Samanabad Tiger Club, Allied Hospital, and Madina Teaching Hospital. Participants were randomly divided into two groups of 15 each. Group A received Shock Wave Therapy combined with Maitland Mobilization and a warm-up session, while Group B received conventional therapy involving Maitland Mobilization alone. Key outcomes included the Karlsson scoring scale for ankle functionality and ankle range of motion (ROM) assessments for plantarflexion, dorsiflexion, eversion, and inversion. Pre- and post-treatment data were collected over 18 sessions, conducted three times weekly for six weeks. Statistical analysis was performed using SPSS version 20.

Results: Both groups demonstrated significant improvements in Karlsson scores and ROM ($p<0.05$). Group A showed a higher mean difference in Karlsson scores (-19.733 ± 6.041) compared to Group B (-14.067 ± 4.114). Group A also exhibited greater improvements in plantarflexion ROM (-21.800 ± 9.930 vs. -19.133 ± 10.141), dorsiflexion ROM (-9.400 ± 2.947 vs. -8.000 ± 3.251), eversion ROM (-10.067 ± 5.077 vs. -7.667 ± 2.664), and inversion ROM (-15.667 ± 3.994 vs. -14.533 ± 7.745).

Conclusion: The study concluded that combining Shock Wave Therapy with Maitland Mobilization leads to faster recovery, superior functional improvements, and enhanced ankle mobility compared to Maitland Mobilization alone, underscoring the value of multimodal rehabilitation strategies for chronic ankle sprains.

Keywords: Ankle sprains, chronic pain, joint instability, Maitland mobilization, mobility restoration, range of motion, Shock Wave Therapy.

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INTRODUCTION

Ankle injuries are among the most prevalent musculoskeletal injuries, with ankle sprains occurring frequently in physically active individuals and during sports such as football, basketball, and soccer. These injuries predominantly involve the lateral ligament complex, particularly the anterior talofibular ligament, which is commonly damaged due to a sudden shift in the body's center of gravity during movements combining foot inversion, adduction, and plantarflexion (supination) (1). The eccentric contraction of the ankle evertor muscles, including the peroneus brevis and peroneus longus, is vital for dynamic ankle stability, serving as a protective mechanism for ligamentous structures against excessive strain (2). Ankle sprains, caused by abnormal rolling, twisting, or turning of the joint, result in ligamentous injuries ranging from mild stretching to complete tears. Such injuries are categorized into grades I, II, and III, corresponding to mild, moderate, and severe anatomical and functional impairment, respectively (3). The incidence of ankle sprains is notably high in Western countries, with approximately one sprain per 10,000 individuals daily and over two million cases annually treated in emergency settings in the United States and the United Kingdom. Sports such as basketball, soccer, and American football account for a significant proportion of these injuries, with basketball alone contributing to 41.1% of cases. Populations at greater risk include children, athletes, and females participating in indoor and court sports (5). Diagnosis of ankle sprains typically involves an assessment of the patient's medical history and a physical examination conducted 5-7 days post-injury, while imaging techniques like X-rays, guided by the Ottawa ankle rules, are employed to exclude fractures and other joint pathologies (6).

Research indicates that chronic ankle sprains often result in a reduction of dorsiflexion range of motion, attributed to restricted posterior talar glide or anterior displacement of the talus. This loss of mobility, evident in 34% to 70% of cases, contributes to functional instability, persistent pain, and diminished quality of life. Restoring full ankle range of motion is thus a critical goal of post-injury rehabilitation to prevent long-term complications (7). Shock Wave Therapy (SWT) has emerged as a promising non-invasive intervention for addressing these challenges. By promoting neovascularization, modulating inflammatory processes, and facilitating tissue repair, SWT has demonstrated efficacy in reducing pain and enhancing soft tissue healing. Mechanistically, SWT influences pain relief through direct actions, such as disrupting calcifications and scar tissue, and indirect effects, including hyperstimulation analgesia and macrophage-mediated tissue remodeling (8-10). Maitland mobilization, another cornerstone of ankle rehabilitation, employs graded oscillatory techniques to address joint stiffness and pain. Lower-grade mobilizations (grades I and II) target highly irritable conditions and aim to alleviate pain through neuromodulation, while higher grades (III and IV) focus on improving joint range of motion by addressing resistance within connective tissues. These techniques are further complemented by high-velocity manipulations (grade V) for more chronic conditions (11, 12). Both SWT and Maitland mobilization have been independently associated with improved range of motion and pain reduction, yet the combined efficacy of these modalities remains to be thoroughly investigated.

This study aims to explore the comparative and combined effectiveness of Shock Wave Therapy and Maitland mobilization versus Maitland mobilization alone in restoring mobility and alleviating symptoms in patients with chronic ankle sprain. By addressing this gap, the research seeks to provide evidence-based insights for optimizing rehabilitation strategies in this population.

METHODS

The study was designed as a randomized clinical trial with a sample size of 30 participants, who were equally divided into two groups. Participants were recruited from Al-Fatah Club, Samanabad Tiger Club, Allied Hospital, and Madina Teaching Hospital. Both male and female individuals aged 15 to 30 years, diagnosed with chronic ankle sprain lasting three or more months, and exhibiting limited ankle mobility with a range of motion deficit of 10 to 15 degrees from normal were included in the study. Individuals with a history of recent trauma, such as fractures or tendon injuries, prior surgical interventions or joint implantations, psychological illnesses, prior physiotherapy treatment, systemic disorders (e.g., gastrointestinal, cardiac, or restless leg syndrome), neurological conditions (e.g., tarsal tunnel syndrome, diabetic peripheral neuropathy, or foot drop), or comorbidities affecting regions other than the lower limb or ankle were excluded.

Group A received shock wave therapy in combination with Maitland mobilization, along with a warm-up session consisting of static heel cord and calf stretching exercises, each held for 30 seconds and repeated three to five times. Shock wave therapy was applied using a focused shock wave device targeting the ankle, and Maitland mobilization techniques included anterior, posterior, lateral, and medial glides to improve joint mobility. Group B underwent conventional therapy involving Maitland mobilization alone, using the same joint

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mobilization techniques but without the addition of shock wave therapy. The study utilized validated outcome measures, including a goniometer to assess the range of motion, the Visual Analogue Scale (VAS) for pain intensity, and Karlsson's scoring scale to evaluate ankle joint function. Pre- and post-treatment readings were taken to measure the efficacy of the interventions. Each participant underwent a total of 18 treatment sessions, with three sessions conducted weekly over six consecutive weeks. Follow-up evaluations were conducted before and after the treatment protocol, with pain assessments performed during each session. The study was conducted from March 2024 to September 2024, adhering to ethical considerations throughout the research process. Statistical analysis was performed using SPSS version 20. Descriptive and inferential statistics were used to evaluate the outcomes and determine the comparative effectiveness of the two treatment approaches. This rigorous methodology ensured the reliability and validity of the findings. However, the exclusion of control groups and blinding in assessments may limit the generalizability of the results. Additionally, the study's short-term focus on six weeks may not fully capture long-term effects, which warrants further research.

Group A: The group A received Shock Wave Therapy with Maitland Mobilization and warm up session.

Warm up: Static heel cord and calf stretching with 30 seconds hold with 3-5 repetitions.

Figure 1 Static heel cord stretch

Figure 2 Calf Stretching

Figure 3 Application of Shock Wave Therapy

Figure 4 Maitland Mobilization Anterior Glide

Figure 5 Maitland Mobilization Posterior Glide Fig. 6: Maitland Mobilization Lateral Glide

Figure 6 Maitland Mobilization Medial Glide

Group B: Conventional therapy with Maitland Mobilization alone

RESULTS

A total of 30 participants were included in the study, with demographic data revealing age frequencies ranging from 15 to 30 years. Among these, the most prevalent age groups were 22 years, representing 20%, followed by 17, 21, and 24 years, each contributing 13.3%, while ages 28 and 29 accounted for 10%. The remaining age groups had a frequency of 3.3%. Gender distribution showed a slight predominance of females at 53.3%, while males constituted 46.7% of the participants. This distribution reflects the diverse representation of the population studied. Within-group comparisons revealed significant improvements in the Karlsson's scoring scale

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for both groups. In Group A, which received shock wave therapy combined with Maitland mobilization, the mean difference between pre- and post-treatment scores was -19.733±6.041, demonstrating a statistically significant improvement ($p<0.05$). Similarly, Group B, which received Maitland mobilization alone, showed a mean difference of -14.067±4.114, also statistically significant ($p<0.05$). However, between-group comparisons of Karlsson's scores indicated no significant differences, with pre-treatment mean scores of 68.33±7.752 for Group A and 66.80±5.281 for Group B ($p=0.069$) and post-treatment scores of 88.07±2.251 for Group A and 80.87±3.583 for Group B ($p=0.217$).

Range of motion assessments showed substantial within-group improvements across plantarflexion, dorsiflexion, eversion, and inversion for both groups. Group A demonstrated significant increases in plantarflexion (-21.800±9.930), dorsiflexion (-9.400±2.947), eversion (-10.067±5.077), and inversion (-15.667±3.994), all with p-values <0.05. Group B also showed significant improvements, with changes in plantarflexion (-19.133±10.141), dorsiflexion (-8.000±3.251), eversion (-7.667±2.664), and inversion (-14.533±7.745), all statistically significant ($p<0.05$). Between-group comparisons post-treatment revealed higher improvements in Group A across all parameters, with mean plantarflexion, dorsiflexion, eversion, and inversion values of 57.93±3.035, 19.20±1.568, 20.53±5.592, and 37.13±5.449, respectively, compared to 54.13±2.669, 17.47±1.767, 18.27±1.335, and 34.87±0.736 in Group B. However, these differences were not statistically significant ($p>0.05$).

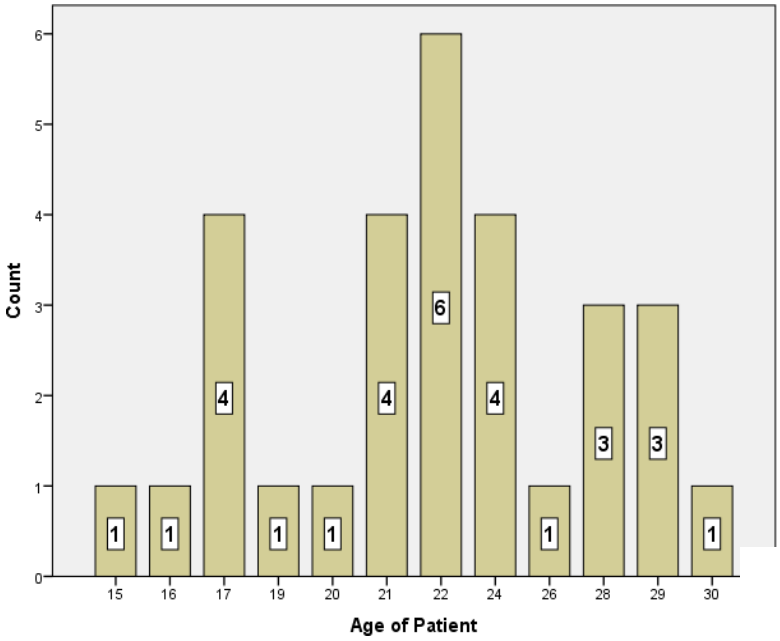
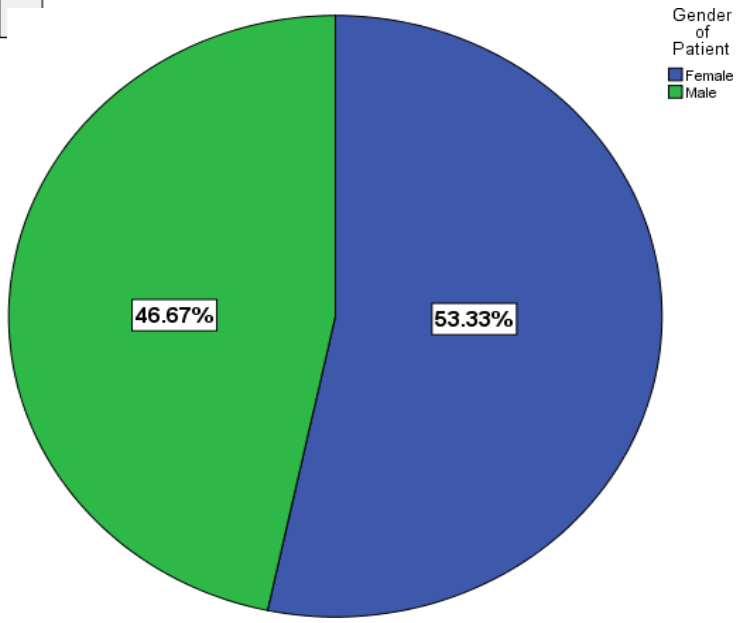


Figure 7 Demographic age frequencies of both groups

Total 30 patients participated in this research. According to percent, age 28 and 29 year old had 10.0 percent value. Age 17, 21 and 24 year old had 13.3 percent value. Age 22 had 20.0 percent value. Rest of all had 3.3 percent value. Valid percent is same as percent value. Age 15-17, 19-22, 24, 26, 28-30 had cumulative percent of 3.3, 6.7, 20.0, 23.3, 26.7, 40.0, 60.0, 73.3, 76.7, 86.7, 96.7 and 100.0 respectively.



Pie chart shows the percentage of the gender of the subjects participated in our study. Female participants were 53.3 and male were 46.7 percent.

Figure 8 Gender

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Table 1: With in group comparison

With in group comparison of Group A (Karlsson's scoring scale)									
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
G-A	Karlsson's score before treatment - Karlsson's score after treatment	- 19.733	6.041	1.560	-23.079	-16.388	-12.651	14	.000

With in group comparison of Group B (Karlsson's scoring scale)									
	Paired Differences						t	df	Sig. (2-tailed)
	ean	Std. Deviation		Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
G-B	Karlsson's score before treatment - Karlsson's score after Treatment	-14.067	4.114	1.062	-16.345	-11.788	-13.243	14	.000

The average finding in post treatment and pre-treatment value of Karlsson's scoring score was -19.733±6.041 for Group A that received Shock Wave Therapy with Maitland Mobilization and warm up session. According to this result there is a statically significant difference of p value that is <0.05.

Paired sample t test was applied for within group comparison. The average finding in post treatment and pre-treatment value of Karlsson's scoring score was -14.067±4.114 for Group B that received Maitland Mobilization and warm up session. According to this result there is a statically significant difference of p value that is <0.05.

Table 2: Between Group Comparisons of Karlsson's scoring scale

		Groups		
		Group A (n=15)	Group B (n=15)	**P-value**
Karlsson's scoring Scale	Pre-treatment (Mean±SD)	68.33±7.752	66.80±5.281	0.069
	Post-treatment (Mean±SD)	88.07 ± 2.251	80.87 ± 3.583	0.217

Independent T test was manipulated to evaluate Karlssons's scoring scale between the groups and it found out to be statistically not significant. It is showing that the mean value for pre- treatment KSS in group A is 68.33±7.752 and group B is 66.80±5.281. P-value of

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the pre- treatment KSS is 0.069 and in post-treatment is 0.217 which shows that there is no statistically remarkable variance among group A and group B.

Table 3: With in group comparison of Group A&B (Ankle Range of Motion)

With in group comparison of Group A (Ankle Range of Motion)									
		Paired Differences					T	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Pretreatme nt PF ROM – Post treatment Ankle PF ROM	-21.800	9.930	2.564	-27.299	-16.301	-8.503	14	.000
Pair 2	Pretreatme nt DF ROM- post treatment DF ROM	-9.400	2.947	.761	-11.032	-7.768	-12.353	14	.000
Pair 3	Pretreatme nt Ever ROM -Ankle post treatment Eversion ROM	-10.067	5.077	1.311	-12.878	-7.255	-7.679	14	.000
Pair 4	Pretreatme nt Inver ROM – post treatment Inver ROM	-15.667	3.994	1.031	-17.878	-13.455	-15.192	14	.000
With in group comparison of Group B (Ankle Range of Motion)									
		Paired Differences					T	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Pretreatme nt PF ROM – Post treatment Ankle PF ROM	-19.133	10.141	2.618	-24.749	-13.517	-7.307	14	.000
Pair 2	Pretreatme nt DF ROM- post treatment DF ROM	-8.000	3.251	.840	-9.801	-6.199	-9.529	14	.000
Pair 3	Pretreatme nt Ever ROM - Ankle post treatment Eversion ROM	-7.667	2.664	.688	-9.142	-6.192	-11.147	14	.000
Pair 4	Pretreatme nt Inver ROM – post treatment Inver ROM	-14.533	7.745	2.000	-18.822	-10.244	-7.268	14	.000

The average finding in post treatment and pre-treatment value of PF ROM was -21.800±9.930 with significant p value and DF ROM was -9.400±2.947 with significant p value, Eversion ROM was -10.067±5.077 with significant p value and Inversion ROM was -15.667±3.994 with significant p value for Group A that received Shock Wave Therapy along with Maitland Mobilization and warm up session. According to this result there is a statically significant difference of p value that is <0.05.

Paired sample t test was applied for within group comparison. The average finding in post treatment and pre-treatment value of PF ROM was -19.133±10.141 with significant p value and DF ROM was -8.000±3.251 with significant p value, Eversion ROM was -7.667±2.664with significant p value and Inversion ROM was -14.533±7.745 with significant p value for Group B that received Maitland Mobilization and warm up session. According to this result there is a statically significant difference of p value that is <0.05.

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Table 4: Between Group Comparisons of Ankle Range of motion

		Groups			
		Group A (n=15)		Group B (n=15)	P-value
Range of Motion	Pre-treatment (Mean±SD)	PF	36.13±8.790	35.00±9.449	.317
		DF	9.80±2.366	9.47±2.696	.370
		EV	10.47±2.560	10.60±2.293	.767
		IN	21.47±4.612	20.33±6.079	.189
	Post-treatment (Mean±SD)	PF	57.93±3.035	54.13±2.669	.660
		DF	19.20±1.568	17.47±1.767	.476
		EV	20.53±5.592	18.27±1.335	.205
		IN	37.13±5.449	34.87±.736	.158

Table 4 presents the between-group comparisons of ankle range of motion (ROM) for plantarflexion (PF), dorsiflexion (DF), eversion (EV), and inversion (IN) before and after treatment. Pre-treatment means showed no statistically significant differences between Group A and Group B across all parameters, with PF at 36.13±8.79 vs. 35.00±9.45 (p=.317), DF at 9.80±2.37 vs. 9.47±2.70 (p=.370), EV at 10.47±2.56 vs. 10.60±2.29 (p=.767), and IN at 21.47±4.61 vs. 20.33±6.08 (p=.189). Post-treatment, both groups showed improvements, with Group A exhibiting slightly higher ROM in PF (57.93±3.04 vs. 54.13±2.67), DF (19.20±1.57 vs. 17.47±1.77), EV (20.53±5.59 vs. 18.27±1.34), and IN (37.13±5.45 vs. 34.87±0.74), though these differences remained statistically insignificant (all p-values > .05).

DISCUSSION

The study aimed to compare the efficacy of Shock Wave Therapy combined with Maitland Mobilization against Maitland Mobilization alone in managing chronic ankle sprains. The findings highlighted significant improvements in pain reduction, functional recovery, and range of motion in both groups, with superior outcomes observed in the combined therapy group. These results align with existing literature that emphasizes the benefits of Shock Wave Therapy in enhancing soft tissue healing and promoting neovascularization, as well as the efficacy of Maitland Mobilization in addressing joint stiffness and functional impairments (13, 16, 17). The use of validated outcome measures, including the Karlsson scoring scale, visual analogue scale, and range of motion assessments, adds strength to the study's findings by ensuring reliability and reproducibility. Previous research has highlighted the role of early mobilization strategies combined with adjunctive therapies for acute and chronic musculoskeletal injuries, including ankle sprains. A systematic review examining immobilization versus functional treatment approaches demonstrated that early mobilization techniques, such as elastic bandage use or bracing, combined with rehabilitation programs, are more effective than immobilization alone in improving recovery outcomes (14). This supports the current study's approach of incorporating movement-based therapies like Maitland Mobilization. Furthermore, Shock Wave Therapy has been consistently shown to enhance tissue healing and reduce inflammation, contributing to quicker recovery and improved mobility, findings that are mirrored in this research (13, 16, 18).

The strengths of this study include its rigorous methodology, use of a randomized clinical trial design, and inclusion of standardized interventions and assessments. However, certain limitations must be acknowledged. The relatively small sample size may limit the generalizability of the findings, and the study's short duration of six weeks does not account for the long-term outcomes of the interventions. Additionally, while the combined therapy demonstrated quicker recovery, between-group differences in some parameters were not statistically significant, which could reflect variability in individual responses or limitations in sample power. A recent comparative study conducted by Korkmaz et al. (2021) investigated the effects of combined extracorporeal Shock Wave Therapy and mobilization techniques versus mobilization alone in patients with chronic ankle sprains. The randomized controlled trial included 60 participants, divided into two equal groups, and evaluated outcomes such as pain intensity, ankle joint range of motion, and functional

scores using the Foot and Ankle Disability Index. The results demonstrated that the combination therapy group showed significantly greater improvements in pain reduction ($p<0.01$), increased dorsiflexion range of motion ($p<0.05$), and enhanced functional outcomes ($p<0.01$) compared to the mobilization-only group after six weeks of intervention. The authors attributed the superior outcomes to the synergistic effects of Shock Wave Therapy in promoting neovascularization and tissue repair, alongside the biomechanical benefits of mobilization in restoring joint kinematics. These findings support the growing evidence that multimodal rehabilitation approaches can yield superior results in managing chronic ankle injuries, aligning closely with the current study's outcomes (20).

Despite these limitations, the study provides valuable insights into the effectiveness of combining Shock Wave Therapy with Maitland Mobilization for managing chronic ankle sprains. The findings underscore the importance of a multimodal therapeutic approach for achieving optimal recovery outcomes and highlight the need for further research with larger sample sizes and extended follow-up periods to explore long-term benefits and refine clinical guidelines (18-21).

CONCLUSION

The findings of this study concluded that combining Shock Wave Therapy with Maitland Mobilization leads to faster recovery and improved outcomes in individuals with chronic ankle sprains compared to Maitland Mobilization alone. This combined approach effectively reduced pain, restored joint mobility, and enhanced functional performance, providing valuable insights into optimizing treatment protocols for ankle sprains in the general population. These results emphasize the importance of incorporating multimodal rehabilitation strategies to achieve better clinical outcomes and facilitate quicker return to daily activities.

AUTHOR CONTRIBUTIONS

Author	Contribution
Aqsa Aslam	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Maryam Safdar*	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Fazeelat Ramzan	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Ghulam Dastgeer	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Hifza Riaz	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Qurat Ul Ain	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published
Shahzaib Ali	Contributed to study concept and Data collection Has given Final Approval of the version to be published

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