Chapter 4

The Efficacy of Mechanical Cervical Traction for Spondylosis patients

4.1 Introduction

Cervical spondylosis (CS) is a common age-related condition that affects joints in the neck. It is a chronic disease of the cervical intervertebral disc causing axial neck pain. It is also called cervical osteoarthritis. Cervical spondylosis usually occurs in middle-aged and older people. The main symptoms include anxiety, postural problems, depression, psychological stress, dizziness, neck stiffness, headache, abnormal reflexes, and muscle spasm [Bosmia et al., 2015; Hafez, A. R., 2009].

Figure 4.1 Neck pain (Spondylosis Pain)

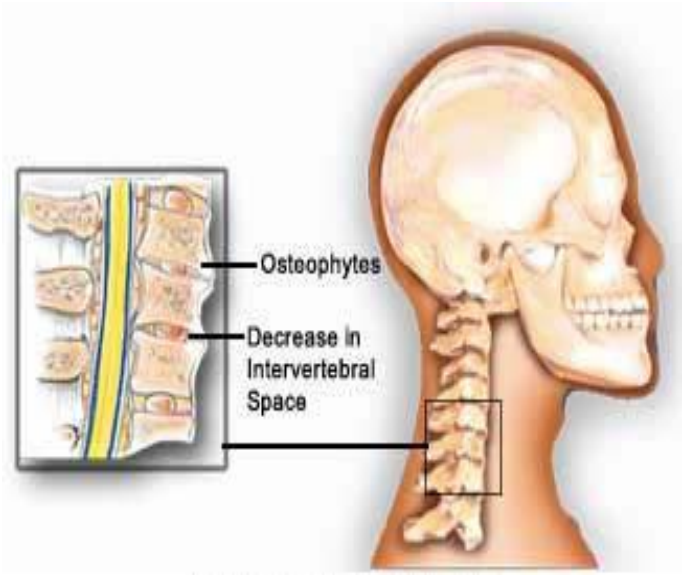

Figure 4.2 Cervical Spondylosis

Cervical traction is a therapeutic method used for the management of spondylosis pain in the physiotherapy department. In cervical traction treatment, stretching of the spine is done to separate the vertebrae for relaxing the neck muscles. It is used for cervical spine injuries, including cervical pain, radiculopathy, and spondylosis.

The different research has been done for the analysis of spondylosis pain, which is described below.

Jette et al. (1985) indicated that no significant change in muscle activity during traction treatment in the supine position. Nanno, (1994) showed a significant increase following the cervical traction treatment in patients whose pain was relieved. Shakoor et al. (2002) indicated that the improvement of the patients with chronic cervical spondylosis was more in cervical traction plus exercise than analgesics.

So, cervical traction & neck muscle strengthening exercises may have some more beneficial effects than NSAIDs (non-steroidal anti-inflammatory drugs) on chronic CS.

Atteya (2004) reported the different phases of cervical traction showed a significant decrease in EMG activity during the pull period of traction and after traction. Hafez and Zakaria (2009) reported that intermittent traction is more effective than sustained traction in the treatment of cervical spondylosis patients. Zhen-jun et al. (2009) observed the manipulation and traction of cervical vertebrae could effectively improve the clinical symptoms of the vertebroarterial type of cervical spondylosis with good effective therapy. Akbari et al. (2010) observed the significant differences in the improvement of cervical pain between the control group and the experimental group. Cai et al. (2011) showed that clinical prediction rule (CPR) may significantly enhance the efficacy of clinical decision making when considering home mechanical cervical traction (HMCT) as appropriate interventions for patients with neck pain.

Que et al. (2013) provided the viability and safety of needle therapy for neck pain caused by cervical spondylosis. Bosmia and Kotwal (2015) suggested that the effect of manual mulligan traction (MT) is better than intermittent electric traction (IET) in cervical spondylosis. Tunwattanapong et al. (2015) reported that the regular cervical traction treatment for four weeks could decrease neck pain and shoulder pain. Bagheripour et al. (2016) reported that sustained trained traction using an over the door home cervical traction unit was not significantly superior to the routine physical therapy for managing symptoms, including neck pain and disability in our

study group although applying traction can increase the rate of improvement in both outcomes. Xiaoxiao et al. (2016) showed SDS group and ordinary group were treated with SDS and general traction system for cervical traction. After a course of treatment, observed that non-surgical spinal decompression is significantly higher than the ordinary group. Qayyum et al. (2017) determined the most effective treatment in managing the radicular pain in cervical spondylosis at C5-C6 by comparing mechanical traction and manual therapy.

Haladaj et al. (2017) showed both methods (Saunders and HILT (High-intensity laser therapy) decreased the intensity of pain and increased the range of motion in cervical spine joints at a statistically significant level. The traction with the Saunders device and HILT and demonstrated analgesic efficacy, and improved global mobility and efficiency in patients with cervical spondylosis.

This survey discussed the comprehensive summary of the management of cervical spondylosis. This review showed the effect of different types of methods for relieving of spondylosis pain. Therefore the objective of this study was to assess the efficacy of cervical traction for neck pain and cervical spondylosis pain using acquired EMG data. Then evaluated the statistical significance test using extracted features in time domain and frequency domain features.

4.2 Methodology

Fourteen patients suffering from neck pain and spondylosis pain participated in this study. Two groups of patients, one group having eight neck pain patients, and other group having six cervical spondylosis pain patients. The EMG data were

recorded from their upper trapezius muscle using a wireless EMG sensor during cervical traction therapy.

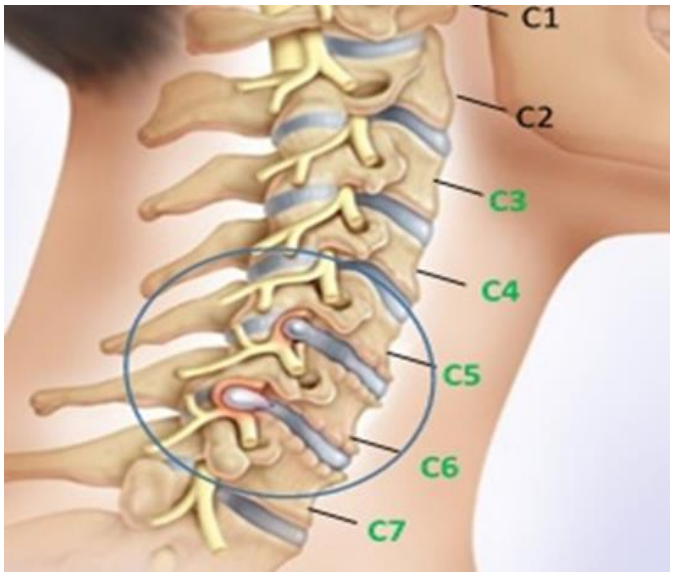

Fig 4.3 Positions of cervical pain

The sensor was placed on the C5 - C6 position of neck muscle for acquiring the EMG data. The traction treatment period session was of 15 minutes at a tension of 7 kg. The EMG data from the patients of the Institute of Medical Science (IMS), BHU were recorded for one week. Approval was taken from the Ethical Committee of IMS (BHU) before performing the experiment.

The obtained EMG data of 15 minutes were divided into intervals of pre and post 5 minutes. From the acquired EMG data, the various parameters in the time and frequency domain such as MAV, RMS, SD, MNF, and MDF were extracted for the assessment of neck muscle fatigue.

4.3 Statistical Analysis

The recorded EMG data was further analyzed for performing the statistical tests. The obtained data of 15 minutes was divided into intervals of pre-five minutes and post five minutes. The statistical significance tests were conducted using the graph pad prism software. The significant value was set at 0.05 with a 95% confidence interval, and the P value less than or equal to 0.05.

The statistical analysis was done to compare pre and post values of neck pain and spondylosis pain patient's data. The extracted features are described in the form of Tables 4.1 and 4.3 with time and frequencies MAV, RMS, SD, MNF, and MDF.

4.4 Results and discussion

In this work, two groups of patients were included, one group having neck pain and other having spondylosis pain. For clinical analysis, EMG data were recorded for 15 minutes and were divided into intervals of pre 5 and post 5 minutes. Table 4.1 describes the extracted features in the time and frequency domain. These features were extracted on the MATLAB platform using the EMG data of the recorded patients. A statistical significance test was performed using these features.

Table 4.1 Time and frequency domain features between during traction in the sitting position

Subjects	**Time Domain Features**						**Frequency Domain Features**			
	MAV		**RMS**		**SD**		**MNF**		**MDF**	
	Pre	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**
1. Fd	1.590	1.320	1.849	1.792	6.896	5.107	0.037	0.046	2.608	2.784
Ld	1.721	1.718	1.84	1.79	6.89	5.1	0.015	0.027	2.183	2.186
2. Fd	1.990	1.445	2.104	1.532	3.045	1.564	0.047	0.083	8.054	8.876
Ld	1.99	1.44	2.65	1.57	6.85	2.24	0.040	0.086	8.031	8.516
3. Fd	1.420	1.410	1.642	1.575	6.505	5.422	0.021	0.031	7.795	8.042
Ld	1.42	1.41	1.5	1.47	4.88	4.11	0.017	0.023	8.070	8.669
4. Fd	1.421	1.398	1.490	1.478	3.446	3.259	0.010	0.012	8.129	8.837
Ld	1.42	1.39	1.55	1.48	6.7	5.05	0.025	0.034	7.557	7.597
5. Fd	3.75	1.658	2.266	2.251	5.706	4.52	0.011	0.013	0.030	0.042
Ld	1.700	1.658	2.39	2.11	1.92	1.56	0.055	0.062	7.492	7.514
6. Fd	3.760	2.829	2.458	2.380	8.910	7.185	0.021	0.028	0.044	0.059
Ld	3.76	2.82	4.84	3.5	4.31	2.72	0.069	0.089	7.911	8.278
7.Fd	2.213	2.187	1.488	1.465	4.563	4.284	0.019	0.0198	8.033	8.493
Ld	2.213	2.187	2.4	2.31	9.39	7.48	0.024	0.0314	7.937	8.239
8. Fd	2.254	2.202	1.924	1.753	1.389	1.371	0.066	0.072	7.669	7.930
Ld	2.25	2.2	2.34	2.26	7.16	5.65	0.008	0.013	0.005	1.228

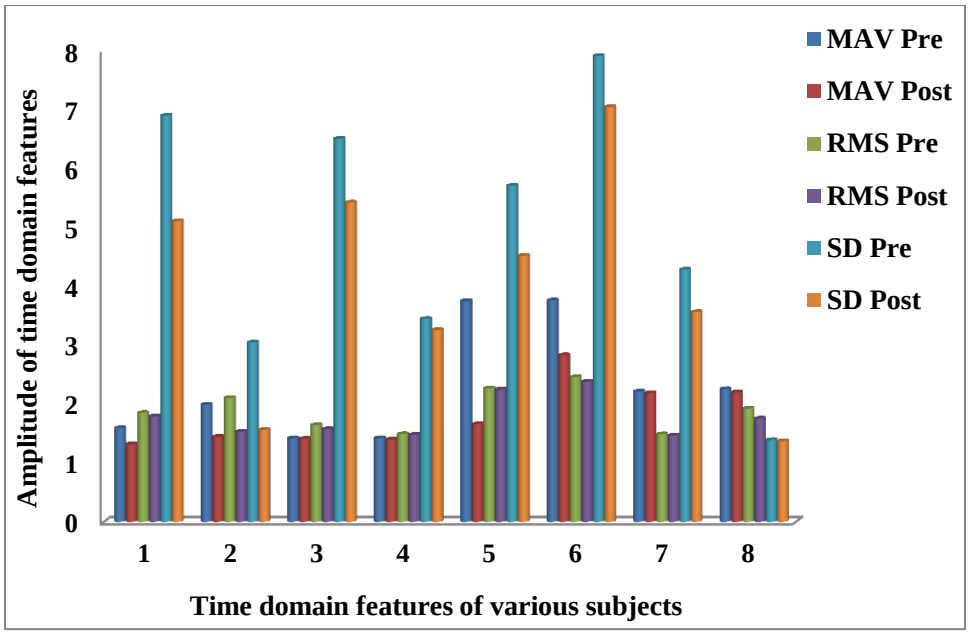

Figure 4.4 (a) Time domain features during traction in sitting position for the first day

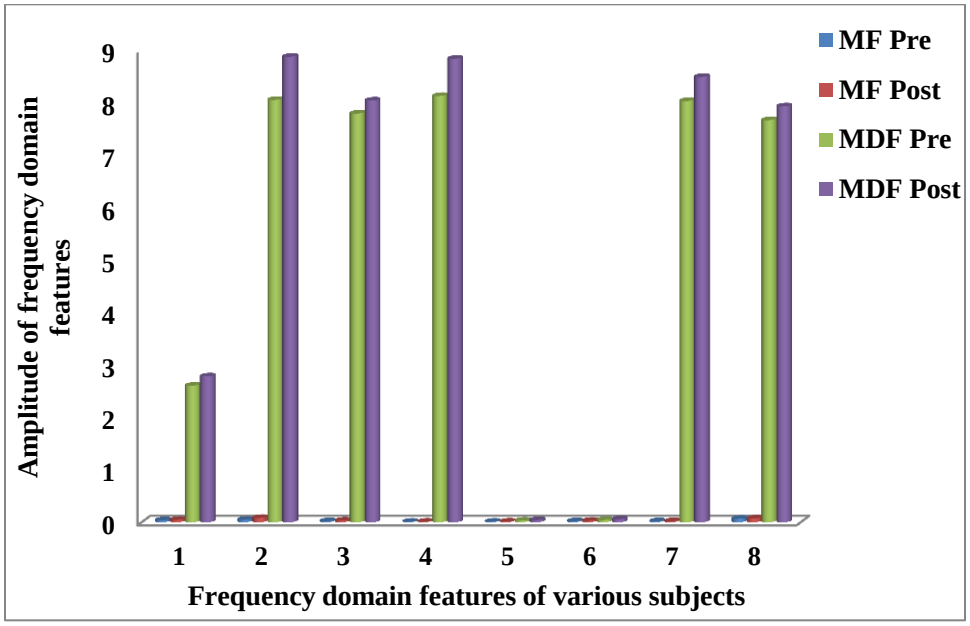

Figure 4.4 (b) Frequency domain features during traction in sitting position for the first day

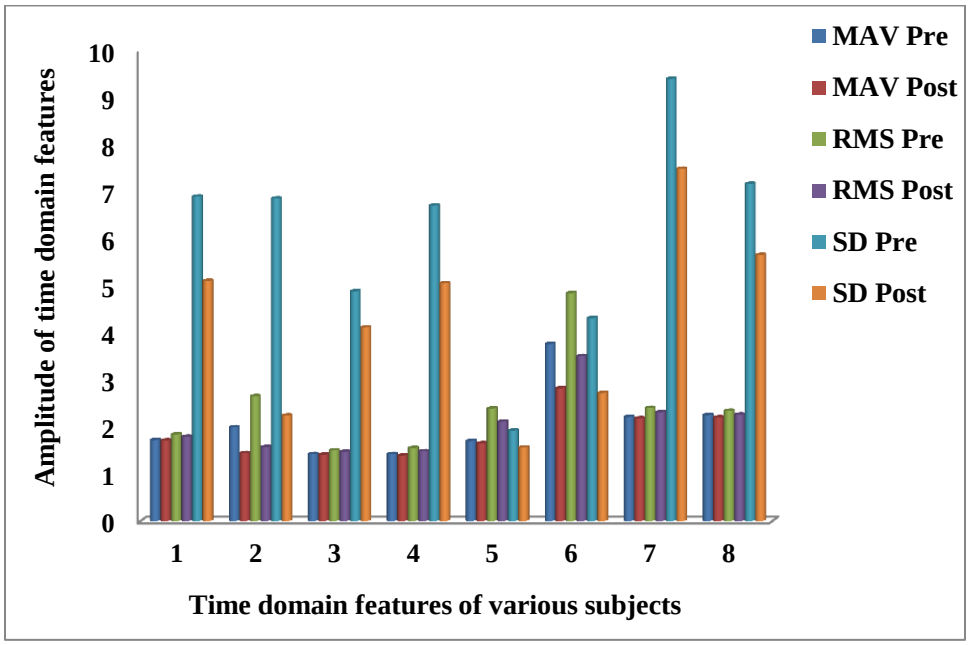

Figure 4.4 (c) Time domain features during traction in sitting position for the last day

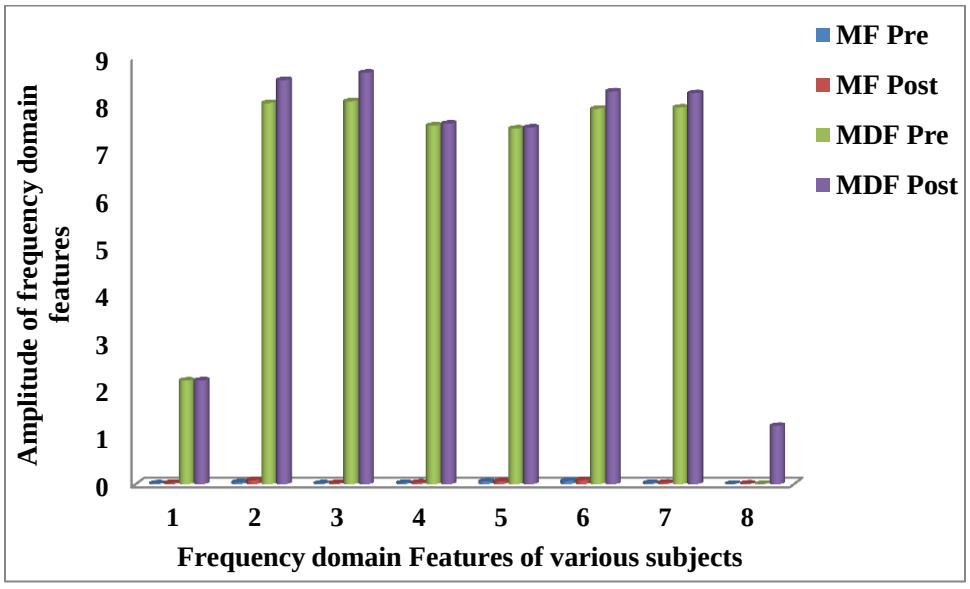

Figure 4.4 (d) Frequency domain features during traction in sitting position for the last day

For the first group, EMG data of neck pain patients undergoing traction treatment (in sitting position) were recorded. The extracted features in the time domain and frequency domain features using recorded EMG data, which is shown in Table 4.1. Figure 4.4 (a) and 4.4 (c) shows a decrease in time-domain features, whereas figure 4.4(b) and 4.4(d) indicates an increase in the frequency domain features from the first day to the last day of traction treatment.

Table 4.2 Significance test of time and frequency features

Features	**P-Value (First day)**	**P-Value (Last day)**	**Comments**
MAV	0.07	0.001	significant
RMS	0.006	0.001	significant
SD	9.03	0.01	significant
MNF	0.0009	0.002	significant
MDF	3.56	9.33	insignificant

A P-value of less than 0.05 was observed for the conducted statistical analysis, which showed a significant difference in the values of the MAV, RMS, SD, and MNF features. From these results, it can be shown a statistically significant reduction ($P<0.05$) in neck pain.

Table 4.3 Time and frequency domain features during traction of spondylosis patients

Subjects	Time Domain Features						Frequency Domain Features			
	MAV		RMS		SD		MNF		MDF	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
1.Fd	2.208	1.086	2.302	2.118	6.513	3.573	0.014	0.008	2.605	2.467
Ld	1.278	1.382	1.462	1.426	7.520	3.563	0.045	0.015	3.258	2.556
2.Fd	7.842	3.578	6.158	4.943	1.453	4.710	0.186	0.204	0.094	0.099
Ld	9.372	2.933	1.224	3.686	1.215	3.218	0.238	0.235	0.151	0.093
3.Fd	3.288	1.329	1.313	1.338	2.532	1.495	0.009	0.004	2.489	2.427
Ld	1.928	1.321	5.437	1.348	5.436	2.675	0.066	0.013	2.495	2.048
4.Fd	1.329	1.463	1.587	1.628	7.182	8.222	0.040	0.043	9.042	9.652
Ld	1.731	1.736	1.758	1.764	3.097	3.111	0.096	0.092	7.421	7.421
5.Fd	3.406	1.408	3.022	1.599	2.514	7.628	0.399	0.044	0.055	3.102
Ld	1.399	1.303	1.957	1.431	9.646	3.298	0.133	0.019	3.848	2.531
6.Fd	1.820	1.310	1.500	1.478	4.884	4.119	0.023	0.017	8.042	7.795
Ld	1.434	1.549	1.575	1.642	6.505	5.422	0.031	0.021	8.669	8.070

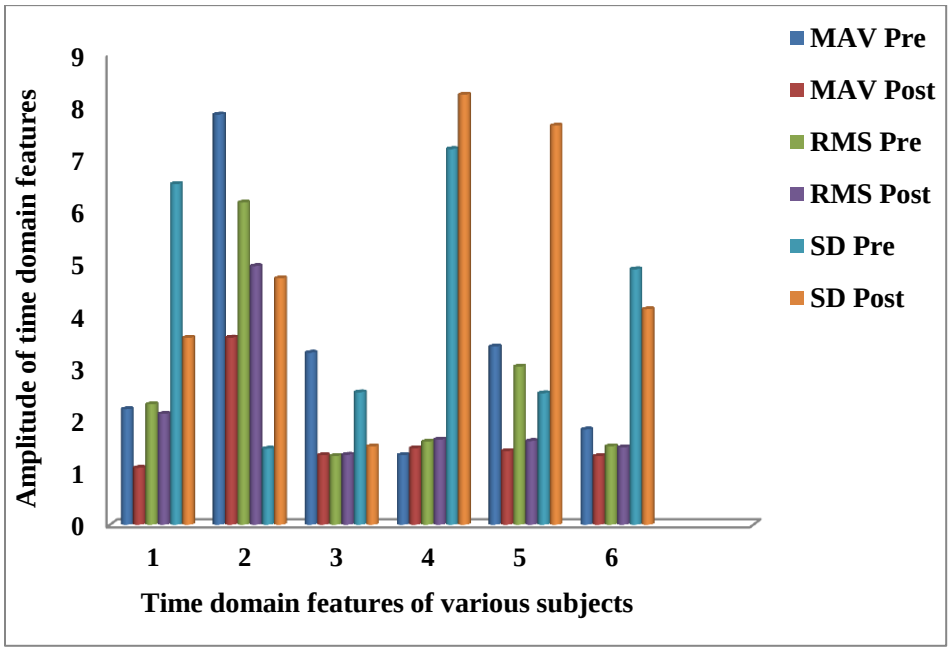

Figure 4.5 (a) Time domain features during traction in sitting position for the first day

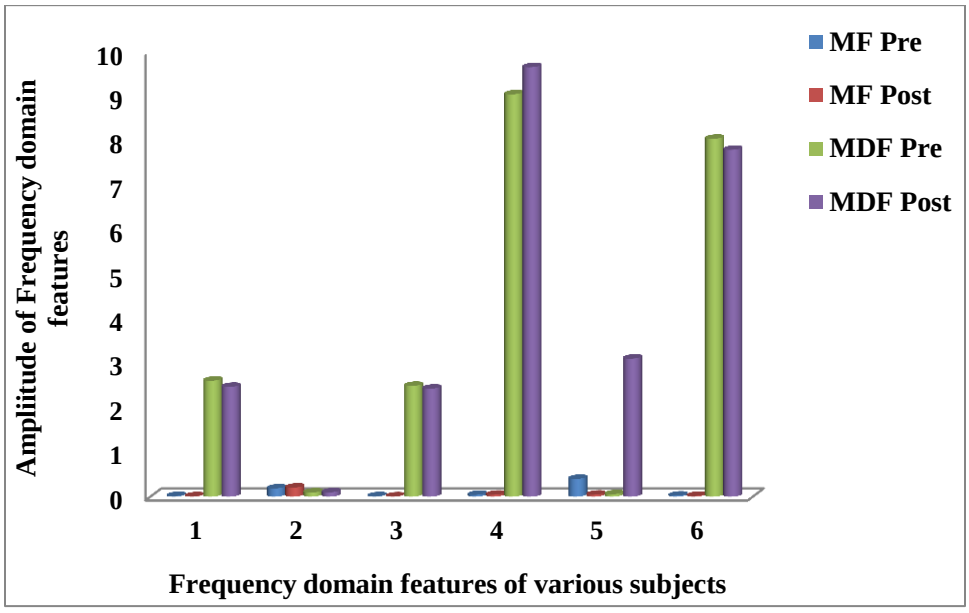

Figure 4.5 (b) Frequency domain features during traction in sitting position for the first day

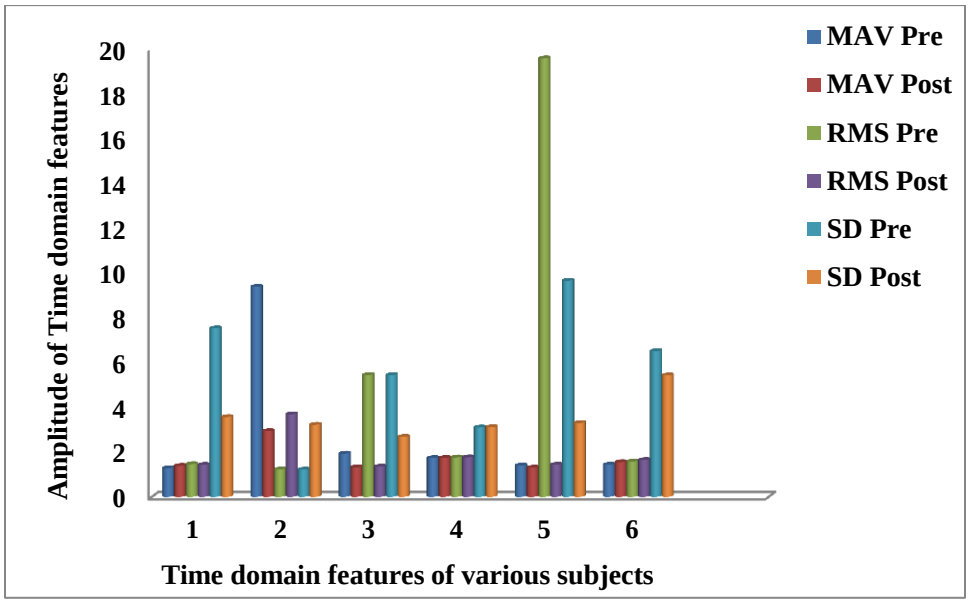

Figure 4.5 (c) Time domain features during traction in sitting position for the last day

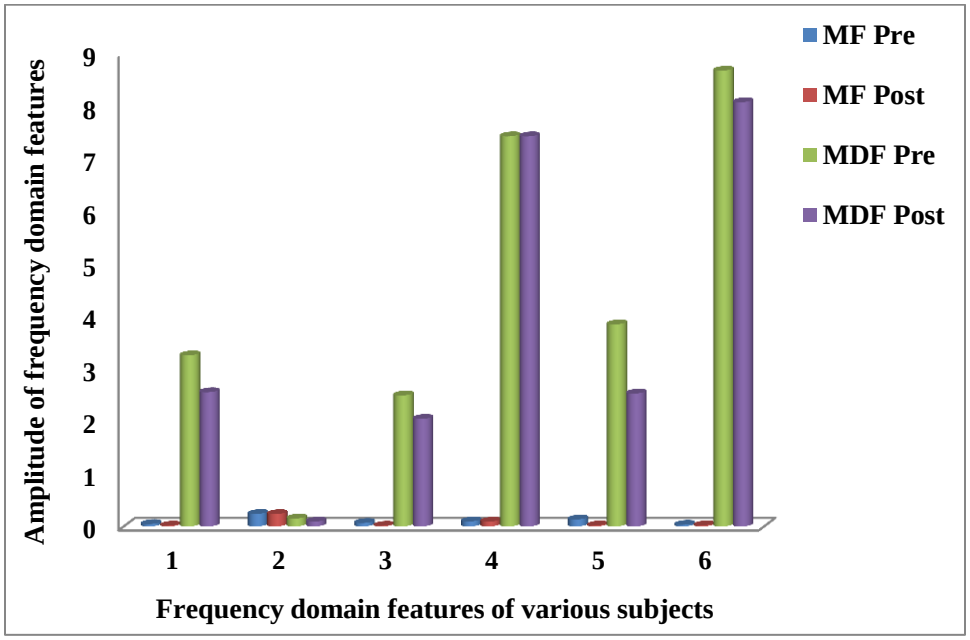

Figure 4.5 (d) Frequency domain features during traction in sitting position for the last day

For the second group, six patients suffering from spondylosis pain participated in this study. Table 4.3 shows the extracted features in time and frequency domain using MATLAB software platform. Figure 4.5 (a, c) shows that variation in the time domain features; figure 4.5 (b, d) indicates the variation in the frequency domain features, from first to the last day of the treatment session.

Table 4.4 Significance test of time and frequency features (spondylosis patients)

Features	P-Value (First day)	P-Value (Last day)	Comments
MAV	0.007	0.001	Significant
RMS	0.003	0.518	Insignificant
SD	0.614	0.658	Insignificant
MNF	0.466	0.02	Significant
MDF	0.004	0.001	Significant

In statistical analysis, some significant changes in muscle activities during applied traction therapy. For statistical treated, based on Table 4.4, MAV, MF, MDF features are significant compared to RMS, SD.

The current study was done to assess the effectiveness of traction therapy for neck pain and cervical spondylosis pain. The activity of the neck muscle was recorded during traction treatment for one week. The time and frequency domain features were extracted for analysis of neck muscle fatigue using recorded EMG data. A decrease in the time domain parameters and an increase in the frequency domain parameters were observed for neck pain, which is clear from Table 4.1. Whereas for

spondylosis patients no such notable changes in time and frequency domain features were detected, which is mentioned in Table 4.3. A statistical significance test of extracted features for both the diseases was also performed, whose results are indicated in Table 4.2. The statistical analysis of MAV, RMS, SD, and MF feature was found effective for neck pain, whereas for spondylosis pain the features like MAV, MF, and MDF showed statistical significance.

4.5 Conclusion

To investigate the efficacy of traction therapy for neck pain and spondylosis pain patients, the time and frequency domain features were determined using their acquired EMG data. In the statistical analysis, some significant changes in time and frequency domain features were observed. Based on the results of this study, it can be concluded that MAV, RMS, SD, MF features show significant changes for neck pain and MAV, MF, and MDF features indicate substantial changes for spondylosis pain.