

Conclusion and Future Work

7.1 Conclusion

This thesis work mainly focuses on the various methods to identify and analyze the muscle fatigue associated with neck pain patients undergoing cervical traction treatment. The results were determined by three diagnostic groups having neck pain, cervical radiculopathy, and spondylosis pain. The overall objective of this thesis was to assess the efficacy of traction therapy for the reduction of neck pain.

Electromyography (EMG) is the most prominent technique to study the activity related to muscle. In this work, EMG data of the patients were acquired to analyze the muscle fatigue during their cervical traction treatment. EMG data were acquired from various patients suffering from neck pain with radiculopathy and without radiculopathy during traction therapy and were further processed for neck muscle fatigue analysis. The recorded EMG data was used to extract various features in the time and frequency domain. Features such as root mean square (RMS), mean absolute value (MAV), standard deviation (SD), mean frequency (MF) and median frequency (MDF) were calculated to extract the detailed information about the muscle fatigue. The results indicated a considerable decrease in time-domain features and an increased in frequency domain features. These changes revealed a significant reduction in neck pain as well as radiculopathy pain.

To assess the statistical test performed on neck pain and spondylosis pain, EMG data were recorded for patients in the sitting position during traction therapy. The various features in the time domain and frequency domain were

extracted from the acquired EMG data. In statistical analysis, the pre-test evaluation showed that there are no significant changes ($P>0.05$), and the post-test assessment showed a very high significant difference ($P<0.05$). Based on the results, it was observed that MAV, RMS, SD, MF features are effective for neck pain, whereas MAV, MF, and MDF features are effective for spondylosis pain.

A LabVIEW based quantifying system was established to identify the muscle fatigue status of different neck pain patients undergoing cervical traction treatment. Based on the recorded EMG data from the patients (i.e. pre and post data) and the extracted features, a LabVIEW block diagram was formulated to know the muscle fatigue relaxation status of patients. The front panel window of the LabVIEW shows the fatigue relaxation status from the uploaded pre and post EMG of the patients. The proposed system here provides a simple and efficient approach for the assessment of muscle fatigue.

Further, a classification of the EMG data was performed to assess the fatigue level of different neck pain patients while giving traction treatment. Using spectral features, two different classifiers are support vector machine, and a decision tree was implemented to know the fatigue level of various subjects. The classification accuracy and kappa value of both the classifiers were compared. The results showed that the accuracy of the support vector machine is higher than the complex tree classifier in the assessment of neck muscle fatigue.

7.2 Implication for future work

In the performed research work, the goals were mainly focused on the analysis of neck muscle fatigue as well as its correlation with different neck pains. The investigation was done in offline mode for monitoring the muscle fatigue status of 30 patients using extracted features in the time and frequency domain of their recorded EMG data.

Increasing the number of subjects and the number of extracted features in the future may significantly increase the accuracy of the analysis. Also, the system can be implemented in real-time, utilizing the classification technique to recognize the various levels of fatigue occurring in patients.