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Influence of duration of pain on postural sway in individuals with mechanical neck pain

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SUMMARY

Purpose. The study investigated the influence of duration of neck pain on postural control in individuals with mechanical neck pain.

Methods. Seventy-two patients with mechanical neck pain were categorized into three groups (acute, subacute, and chronic) based on symptom duration. Postural sway was recorded in standing on a posturography platform. Centre of pressure (COP) measurements in the Antero-posterior and Medio-lateral directions were measured with eyes closed. Influence of duration on neck pain was analyzed using one-way analysis of variance.

Results. There were no significant group differences for COP measurements in patients across all the three groups. The mean COP excursion in the anteroposterior direction was (0.64± 0.15), (0.58± 0.15) (0.61 ± 0.23) for the acute, sub-acute and chronic groups respectively (p-value >0.05). However, individuals with chronic neck pain had slightly greater COP excursions compared to the other groups.

Conclusion. There was no difference in postural sway across acute, subacute and chronic neck pain. The study paves the way for the exploration of other mechanisms for altered postural sway in neck pain.

KEY WORDS

cervical pain, sensorimotor control, postural control, nonspecific neck pain

BACKGROUND

Neck pain (NP) is experienced by 20-70% of the population at some period of life and presents with high recurrence rates as well as greater chronicity (1,2). Symptoms of the cervical spine arise from various structures such as intervertebral discs, facet joint, myofascial, and nerve roots (3). However, a single pathoanatomical source for neck pain is difficult to establish, due to inadequate diagnostic criteria (4). Therefore, the diagnosis of mechanical neck pain (MNP) is commonly considered after exclusion of red flags that includes cervical fracture or myelopathy and nerve root involvement (4).

Management of mechanical neck pain (MNP) involves the identification and correction of various physical impairments associated with the pain. Deficits are observed in mobility, motor control, proprioception, and postural stability (4). In the previous two decades, a considerable amount of research is being conducted to understand the mechanisms of sensory-motor control in neck pain. A systematic review identified studies that reported increased postural sway (measured as the center of pressure (COP) displacement) in nonspecific neck pain when compared to healthy controls (5). Proposed reasons for altered postural control (postural sway) in neck pain are 1) reduced proprioceptive input from the cervical spine as result of the structural damage to proprioceptors 2) pain interference, where the activation of pain pathways may inhibit the firing of the motor units required to maintain the COP within the physiological limits (6).

Several factors seem to affect postural control in individuals with NP. However, currently, there is a limited understanding of these potential factors. Longer duration of neck pain is considered to have an unfavorable prognosis (7). Previous studies (5,6) reported increased postural sway in chronic neck pain. However, the influence of duration on postural sway has never been explored. Therefore, the present study

aimed to examine the difference in postural sway among individuals with acute, sub acute, and chronic neck pain.

METHODS

Participants

Individuals with MNP of any duration and intensity were requested to take part in a cross-sectional assessment study procedure. Those with mechanical neck pain aged 20 to 60 years referred to the physiotherapy outpatient unit of a tertiary care hospital in India, were screened and recruited for the study between the period August 2016 to March 2017. To be eligible for inclusion, the neck pain should be provoked with cervical spine movement. Participants with cervical radiculopathy (evaluated by dermatome and myotome testing), pain in other regions of the spine, neurological conditions affecting postural control, a recent history of trauma, whiplash disorders were excluded from the study. The Institutional research committee approved the study protocol, and ethical clearance was obtained from the Institutional ethics committee, Kasturba Hospital, Manipal, India. On recruitment, the participants were provided with a detailed description of the procedure and signed written informed consent. Demographic characteristics and brief pain history were recorded. 72 patients with mechanical neck pain (24 in each group) participated in the study.

Postural control assessment

Postural control assessments were performed on a static posturography platform (Metitur, GB02, Finland) (8, 9) Signals were recorded at 100 Hz and converted to digital].

Participants were asked to stand on a platform barefoot, with their arms by the side and eyes closed. All postural control measurements were taken with the eyes closed to eliminate any influence from the visual system. A foam surface of (10- cm thick high-density rubber) was placed under the feet. Following this, they were instructed to stand on the foam with their feet together and maintain their balance for 30 seconds. COP excursion (cm) in the anteroposterior (AP) and mediolateral (ML) directions was recorded for data analysis as in previous studies on spinal pain (8).

Inconclusive recommendation exists, considering the ideal parameter of postural sway to be read in the patient population. The present study measured COP excursion in cm because of its affluent understandability and clinical inference.

Statistical analysis

Statistical analysis was performed with SPSS version 16. The demographic details and baseline characteristics of the participants were summarized using descriptive statistics. Comparison of postural control parameters across the three groups was made by analysis of variance (ANOVA), and post hoc (Tukey) tests if the groups are statistically different. The level of significance was set at $p<.05$.

RESULTS

Seventy-two mechanical neck pain individuals (24 in each group) with a mean age of 29.9 ± 11.7 years and symptom duration of ranging from 4.8 ± 9.4 months participated in the study. **Table I** depicts the demographic details and the mean ROM, pain, and COP values.

Table I. Demographic characteristics of the participants (n=72)

Group	Acute (n=24)	Subacute (n=24)	Chronic (n=24)
Mean Age (in years)	24.3 ± 7.2	33.3±11.1	31.8±11.9
Mean duration of symptoms (in days)	3.5±1.9	43.08±26.2	410.3±391.7
Male: Female	5:19	10:14	11:13
Mean intensity of pain (NPRS)	4.0 ± 1.9	5.5±1.8	5.1±2.1
Sagittal plane ROM in degrees	107.2 ± 20.6	99.3±18.3	99.7±17.0
Frontal Plane ROM in degrees	83.3 ±15.2	84.5±12.1	82.3±15.2
Horizontal plane ROM in degrees	122.9± 27.0	130.2±23.7	123.2±23.1
Mean COP excursion(cm) AP (EC, Foam S, FT)	0.64± 0.15	0.58±0.15	0.61±0.23
Mean COP excursion ML(cm) (EC, Foam S, FT)	0.62± 0.14	0.55±0.18	0.65±0.31

NPRS: Numeric pain rating scale; ROM: Range of motion; COP: Centre of Pressure; AP: Anteroposterior; ML: Mediolateral; EC: Eyes closed; S: Surface; FT: Feet together

Table II. Comparison of postural sway (in cm) in different duration of symptoms

	Acute (n=24) (mean, SD)	Subacute (n=24) (mean, SD)	Chronic (n=24) (mean, SD)	P value
COP excursion AP (EC, Foam S, FT)	0.64, 0.15	0.58, 0.15	0.61, 0.23	0.5
COP excursion ML (EC, Foam S, FT)	0.62, 0.14	0.55, 0.18	0.65, 0.31	0.2

COP: Centre of Pressure; AP: Anteroposterior; ML: Mediolateral; EC: Eyes closed; S: Surface; FT: Feet together

Postural sway:
About differences of postural sway, no significant interactions were noted for duration and any of the COP measurements ($p>0.05$). During quiet standing with the eyes closed, the chronic group exhibited slightly higher medio- lateral excursion values compared to the acute and the sub-acute groups, however, this was not statistically significant (**table II**).

DISCUSSION

The purpose of the present study was to identify the difference in postural sway parameters in patients with acute, subacute, and chronic neck pain. Overall, no statistically significant differences were noticed in both the sway directions between the three groups. However, we observed that patients with chronic neck pain of symptoms for more than two years, had a visible increase in sway parameters during testing.

The time ranges considered for chronicity (> 3 months to 3 years) in the present study would have been very broad to elicit greater mean COP in the chronic group. Furthermore, the number of participants with more than two-year symptom duration was too less to perform subgroup analysis. Previous study on nonspecific neck pain participants showed no effect of pain duration on postural sway (6). Increased postural sway was documented in experimentally induced acute neck pain (10), but no studies attempted to compare the postural sway in acute, subacute acute and chronic neck pain.

The mean AP and ML sway distances in our cohort of younger population (mean age=29.9; **table I**) are larger than the values reported by Quek et al., (AP=0.45 cm and ML=0.20), indicating that our sample had greater postural instability. However, this study does not explain the possible mechanisms for the aforementioned findings. Multiple confounding contributors can affect the postural sway in neck pain (11). Patients with neck pain exhibit a stiffer movement pattern with a reduction in neck ROM (12,13.14,15). This stiffening pattern may alter the length-tension relationships of the muscles, thus leading to insignificant results. However, the present findings may infer that altered sensory input due to pain from the cervical spine alone may not have a considerable influence on the postural sway in neck pain. Consequently, the complexity of the relationship between reduced neck flexibility and increased muscle fatigue to postural sway qualifies for further research.

Clinical implications

To our knowledge, this is the first study that analyzed the relationship between pain duration and postural sway in patients with mechanical neck pain. With existing research evidence suggesting that patients with neck pain demonstrated increased postural sway compared to healthy controls, these results cast a new light that postural sway may alter irrespective of the duration of neck pain. Hence therapists should consider assessment and treatment of proprioceptive impairments across all durations of neck pain.

Limitations

The inclusion of pain-free control group could have established whether the postural sway was abnormal in our cohort sample however control group was not included based on the current literature that suggested abnormal postural control in neck pain (16,17,18). Further, the mean postural sway in our study population was larger than the normative values in some of the studies in healthy population as described in the previous review. Postural sway is much increased in neck pain cases with trauma (e.g., whiplash associated disorder) than those of non-traumatic neck pain (18). Future studies may attempt to investigate postural sway measurements while performing neck movements and examine the relationship between these clinical characteristics.

CONCLUSION

There is no significant difference in postural sway between acute, subacute, and chronic mechanical neck pain. Future studies may seek investigation of other factors that might be responsible for increased postural sway in neck pain population.

ETHICAL APPROVAL

Institutional Ethics Committee, Kasturba Hospital, Manipal, India

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