A survey of physical therapists' clinical practice patterns and adherence to clinical guidelines in the management of patients with whiplash associated disorders (WAD)

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Objectives: To explore the clinical practice of physical therapists and examine adherence to clinical guidelines for treating patients with whiplash associated disorders (WAD).

Methods: A cross-sectional electronic survey was sent to 1484 licensed physical therapists from the Orthopedic Section of the American Physical Therapy Association and the American Academy of Orthopedic Manual Physical Therapists. The survey included demographic data and two clinical vignettes describing patients with acute and chronic WAD. The chi-square test was used to analyze responses.

Results: There were 291 (19.6%) responses to the survey. Of those, 237 (81.4%) provided data for vignette 1 and 204 (70.1%) for vignette 2. One hundred and eighty (76.6%) respondents reported familiarity with evidence-based or clinical practice guidelines for treating patients with WAD. Of those, 71.5% ($n=128$) indicated that they followed them more than 50% of the time. Therapists with an advanced certification were more likely to be familiar with clinical guidelines than those who were not certified ($P<0.01$). Responses indicated overall adherence to guidelines; however, there was a low utilization of quantitative sensory assessment, screening for psychological distress and some outcome measures. Significant differences in clinical practice ($P<0.01$) were found between therapists who were and were not familiar with guidelines and those with and without an advanced certification.

Discussion: Advanced certification and knowledge of guidelines appeared to play a role in the clinical practice of physical therapists treating patients with WAD. Further research is needed to explore factors affecting knowledge translation from research to clinical practice and to evaluate the outcomes of patients with WAD when clinical guidelines are applied in practice.

Keywords: Clinical guidelines, Whiplash associated disorder, Evidence-based practice

Introduction

Whiplash associated disorders (WAD) result in considerable social and economic cost as a result of the high rates of persisting pain and subsequent disability associated with this complex condition.¹ Physical therapy management of patients with WAD should incorporate an evidence-based approach to maximize patient outcomes and reduce unnecessary inefficiencies and variation in treatment. Evidence-based practice incorporates both clinical expertise and relevant research.² To promote best practice treatment and management of patients with neck pain, a number of reviews and clinical guidelines have been developed.^{3,4} A treatment-based classification approach for patients with neck pain has been recommended,⁵ and the

Orthopaedic Section of the American Physical Therapy Association (APTA) has published clinical practice guidelines on neck pain, linked to the International Classification of Functioning, Disability, and Health (ICF).³ The Quebec task force published a comprehensive report on whiplash in 1995 which included treatment guidelines and recommendations.⁶ More recently a number of clinical and literature reviews on whiplash have been published.⁷⁻¹⁰ Clinical guidelines on WAD have been developed in the United Kingdom, Canada, and Australia.¹¹⁻¹³ These guidelines provide recommendations and directions for evaluation, diagnosis, prognosis, and plan of care for adults with acute, subacute, and chronic WAD.

Effective management of patients with musculoskeletal disorders, which includes adherence to clinical guidelines, has been shown to improve outcomes and lower costs.^{14,15} However, clinical practice guidelines

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and relevant research findings are not always immediately implemented into clinical practice in physical therapy and other medical fields.^{16–18} Previous research on adherence to clinical guidelines has focused on the lumbar spine.^{17–20} A survey of physical therapy management of patients with WAD has been conducted in the UK,²¹ however, to the authors' knowledge no such investigation into clinical practice in this area has been conducted in the US. Previous work has identified barriers to physical therapists' implementation of clinical practice guidelines. Côté *et al.*²² identified the following barriers to implementation of clinical guidelines for low back pain: understanding of the guidelines, compatibility between therapist practice and guidelines, and perceived relevance and agreement with the guidelines. Iles *et al.*²³ identified the following variables: time to review guidelines, access to easily understandable summaries of guidelines, and lack of skill in searching and evaluating research findings.

Factors associated with the implementation of clinical guidelines have also been studied.

Therapists with higher levels of training have been found to be more likely to integrate research findings into clinical practice.²³ A study of implementation of rheumatoid arthritis guidelines among specialist and generalist physical therapists found that generalist physical therapists had more difficulty in interpreting guidelines and that specialist physical therapists had more knowledge and more positive attitudes regarding guidelines.²⁴ Rebbeck *et al.*²⁵ found that an implementation strategy including education successfully changed physiotherapists' knowledge and clinical practice to be more consistent with guidelines for management of patients with acute whiplash in Australia. The role of clinical specialization and training in adherence to clinical guidelines for WAD has not been well studied.

The purpose of this study was to explore the clinical practice of physical therapists and examine adherence to evidence-based and clinical practice guidelines when treating patients with WAD. It was hypothesized that differences would exist in the clinical practice of therapists and their adherence to clinical guidelines, on the basis of familiarity with guidelines and advanced certification. We expected clinical practice of physical therapists who reported familiarity with guidelines and who had an advanced certification, to be more consistent with current WAD practice guidelines, compared to therapists who were not familiar with guidelines or did not have a certification.

Methods

Sample and design

A descriptive, cross-sectional online survey was sent to 1484 licensed physical therapists in early 2010.

Physical therapists were randomly selected from the online databases of the Orthopaedic Section of the APTA and the American Academy of Orthopaedic Manual Physical Therapists (AAOMPT).

Survey development

A series of clinical management questions were created for the survey, based on a review of the literature and clinical practice guidelines for WAD.^{3,11–13} Following internal edits, the survey was sent to six clinical consultants with manual therapy and whiplash expertise, both within and outside of the US. All six therapists reviewed the survey and provided feedback, which was incorporated into the final draft. A copy of the survey can be found in Appendix A.

Demographic measures

The survey contained three sections. The first included a series of demographic questions, pertaining to qualifications, attendance at continuing education courses/conferences, years of experience, clinical practice setting, and frequency of treating patients with WAD. Respondents were also asked if they were familiar with any evidence-based or clinical practice guidelines for treating patients with WAD. Respondents who answered yes to this question were asked specifically if they were familiar with any of the following and to select all that applied: treatment-based classification, Quebec task force, bone and joint decade task force, reading current research on the topic, clinical practice guidelines linked to the International Classification of Functioning, Disability, and Health from the Orthopedic Section of the APTA, and other. Reading current research on the topic was included as an option because of the fact that research on WAD is continuously evolving and clinical guidelines are not frequently updated to reflect current research findings. Respondents were asked to quantify by percentage how frequently they adhered to the guidelines listed.

Clinical measures

The second and third parts of the survey comprised one patient vignette each. The patient vignettes were selected to reflect commonly encountered clinical presentations of a patient with an acute/subacute WAD and a patient with a chronic WAD. See Appendix A for complete descriptions of the two vignettes. The survey contained clinical management questions based on these vignettes.

Procedure

Each participant was sent an email which contained an invitation to participate in the survey, an informed consent statement, and an electronic link to the survey. All aspects of this study were approved by the Northeastern University Institutional Review Board. After 1 week, a reminder email was sent to only those recipients who had yet to complete the survey. Two

weeks from the initial email, when no additional responses were forthcoming, the survey was closed.

Data analysis

Descriptive statistics were gathered for response rates and questions regarding demographics and clinical management, using the online survey tool. Researchers reviewed the open-ended results by hand to summarize the responses. Data analysis was performed using IBM SPSS V19 (SPSS Inc., Chicago, IL, USA). A Pearson chi-square analysis was used to compare group responses to dichotomous variables. Chi-square tests of independence were conducted on the responses to the survey questions to determine if differences existed between therapists with and without familiarity with clinical guidelines, and with/without advanced certification. In addition, because of multiple comparisons, the *P* value was set at 0.01 to reduce the likelihood of a Type I error.

Results

Response rate

The survey was successfully delivered to 1484 physical therapists, 291 (19.6%) of whom responded. Response rates to individual questions varied and of the 291 who responded, 237 (81.4% of returned surveys) provided usable data for clinical vignette 1 (V1) by answering all of the key questions. Respondents to both vignettes were largely the same, however, there was a slightly lower number who provided usable data, *n*=204 (70.1% of returned surveys) for clinical vignette 2 (V2). This was because of a drop off in the response rate between the first and second vignettes.

Physical therapist characteristics

Details of survey respondents' demographics are summarized in Table 1. The respondents were predominantly male (65.8%) equally representing the four geographic regions of the US, as per our survey. There were also three respondents from outside of the US. Eighty-four percent (*n*=199) of respondents worked predominantly in hospital-based or physical therapist operated outpatient settings, and 69.6% (*n*=165) of respondents had more than 10 years of experience. Respondent qualifications and training are listed in Table 2. Ninety-eight percent (*n*=231), attended conferences at least annually, and 75% (178) reported holding one or more advanced certifications. Of those, 55% (98) had more than one certification and 45% (80) had one certification.

Table 3 lists answers regarding evidence-based or clinical practice guidelines for WAD. About 76.6% (*n*=180) of respondents answered that they were familiar with evidence-based or clinical practice guidelines for WAD. The most frequently selected sources of information were: reading current research on the topic, 68.3% (*n*=123) and treatment-based classification, 59.4% (107); these were also the most followed

Table 1 Respondent demographics

Years of experience	Percent (n)
<1 year	1.3% (3)
1–5 years	9.3% (22)
6–10 years	19.8% (47)
11–20 years	31.6% (75)
20+ years	38.0% (90)
Current practice setting	
Hospital-based outpatient clinic	33.8% (80)
<i>PT operated private practice</i>	50.2% (119)
Physician owned private practice	6.3% (15)
Inpatient	0.0% (0)
Other (open-ended) included	14.3% (34)
academia and other outpatient PT	
Current region	
Northeast US	24.9% (59)
Midwest US	21.5% (51)
<i>South US</i>	28.3% (67)
West US	24.1% (57)
Outside the US	1.3% (3)
Gender	
<i>Male</i>	65.8% (154)
Female	34.2% (80)
Frequency of WAD patients	
Never	0.8% (2)
Fewer than one patient every 12 months	3.0% (7)
At least one patient every 12 months	8.0% (19)
<i>At least one patient every 6 months</i>	37.6% (89)
At least one patient a month	31.6% (75)
At least one patient a week	19.0% (45)

Italics indicate most frequently given answer.

guidelines at 44.3% (*n*=74) and 42.5% (*n*=71), respectively. Since respondents could select multiple options, 82% of respondents who selected reading current research also selected one or more of the other options provided as a source of information. When

Table 2 Respondent qualifications and training

Highest physical therapy degree	Percent (n)
Certificate	0.4% (1)
Bachelors	22.0% (52)
Masters	28.8% (68)
<i>Doctorate</i>	48.7% (115)
Other certifications/qualifications	178 (75%)
<i>APTA board certified orthopaedic specialist (OCS)</i>	63% (113)
Manual therapy certification (MTC)	53% (94)
Fellow of the American Academy of Orthopaedic	43% (76)
Manual Physical Therapists (FAAOMPT)	
Mechanical diagnosis and treatment (MDT)	2% (3)
More than one certification	55% (98)
OCS and manual therapy certification	27% (48)
OCS, manual therapy certification, and FAAOMPT	15% (26)
One certification	45% (80)
OCS	26% (47)
MTC	18% (32)
Mechanical diagnosis and treatment (MDT)	<1% (1)
Continuing education course attendance	
Never	0.0% (0)
Once every 6–10 years	0.0% (0)
Once every 3–5 years	0.0% (0)
Once every 1–3 years	2.5% (6)
Annually	22.8% (54)
<i>More than once per year</i>	74.7% (177)

Italics indicate most frequently given answer.

Table 3 Questions regarding evidence-based and clinical practice guidelines

Are you familiar with any evidence-based or clinical practice guidelines for treating patients with whiplash associated disorders?	Percent (n)
Yes	76.6% (180)
No	23.4% (55)
Which of the following guidelines are you familiar with?	
<i>Reading current research on the topic</i>	68.3% (123)
Treatment-based classification	59.4% (107)
Quebec task force	52.2% (94)
Clinical practice guidelines linked to ICF from the APTA	48.9% (88)
Bone and joint decade task force	9.4% (17)
Other	8.3% (15)
Which of these guidelines do you follow the most?	
<i>Reading current research on the topic</i>	44.3% (74)
Treatment-based classification	42.5% (71)
Clinical practice guidelines linked to ICF from APTA	19.8% (33)
Quebec task force	13.8% (23)
Bone and joint decade task force	1.8% (3)
How often do you follow these guidelines?	
Never	0.6% (1)
0–25% of the time	3.4% (6)
25–50% of the time	25.1% (45)
51–75% of the time	33.0% (59)
76–100% of the time	38.5% (69)

Italics indicate most frequently given answer.

asked how often they followed the guidelines, 71.5% ($n=128$) indicated that they followed them more than 50% of the time.

Respondents who reported one or more advanced certifications were more likely to be familiar with the evidence-based or clinical guidelines listed in the survey, than those who did not have an advanced certification ($\chi^2(1)=15.8$, $P<0.01$). Eighty-three percent of therapists with an advanced certification reported being familiar with evidence-based or clinical guidelines for WAD compared to 57.6% of respondents who did not have an advanced certification. Respondents who attended continuing education or professional conferences more than once a year were also more likely to be familiar with guidelines than those who did not attend as frequently, ($\chi^2(1)=4.4$, $P=0.035$). Eighty percent of respondents who attended continuing education or conferences more than once a year were familiar with clinical guidelines compared to 20% of those who attended less frequently. However, this difference did not reach our statistically significant threshold of 0.01. There was no significant difference in knowledge of guidelines between therapists with 5 years of experience or less, 6–10 years of experience, 11–20 and greater than 20 years of experience ($\chi^2(3)=5.6$, $P=4.69$), nor was there a difference in guideline familiarity when comparing those with a doctorate degree versus those with a masters, baccalaureate, or certificate ($\chi^2(1)=2.1$, $P=0.149$).

Vignette 1 and 2 responses

Table 4 lists the responses to questions pertaining to V1 and V2 in order of the most frequently selected answers. The majority of respondents selected tests and measures recommended in clinical guidelines. A majority of respondents selected screening tests for ligamentous stability, an average of 83.6% selected alar ligament and 63.9% selected Sharp Purser tests, for both vignettes. An average of 99.1% of respondents for both vignettes selected range of motion assessment, and cervical (95.5%) and thoracic (94.9%) joint play assessment as part of their patient examination. A neurological examination including manual muscle testing for myotomal weakness (82.55%), deep tendon reflex assessment (75.8%), and sensory assessment of light touch (68.35%) was selected for both vignettes. Among the least commonly selected tests were: sensation assessment of mechanical pain pressure thresholds (5.1%) and thermal sensitivity (2.55%) for both vignettes. A multimodal approach to intervention was selected by a majority of respondents for both vignettes. Responses to V1 and V2 included: soft tissue mobilization (85.75%), cervical joint mobilization (88.35%), thoracic joint mobilization (78.15%) and thoracic thrust manipulation (65.9%), therapeutic exercise intervention for the scapular region (89.75%) and deep neck flexors (85.25%), home exercise program (98%), and posture advice (94.35%). The most commonly selected outcome measures for both vignettes were the numerical pain rating scale (NPRS) (82.35%) and neck disability index (NDI) (81.15%) and the least commonly selected from the list provided were the Tampa scale for kinesiophobia (TSK) (3.4%) and the impact of events scale (IES) (3.2%). A majority of respondents did not recommend additional diagnostic testing for either vignette. The Canadian C spine rules and findings from ligamentous stability tests were cited in the open-ended responses, as guiding this decision. Magnetic resonance imaging (MRI) or cervical radiographs were the most frequent recommendations for those who recommended additional diagnostic testing, 36.7% ($n=87$) for V1 and 21.6% ($n=44$) for V2.

Responses were analyzed to see if there was a difference between those who reported familiarity with guidelines and those who did not. Tables 5 and 6 highlight results determined to be significant using the chi-square test (χ^2), with a significance level of 1% ($P<0.01$). A statistically significance difference was found in the following categories: special tests, manual therapy interventions, therapeutic exercise interventions, therapeutic modalities, and outcome measures. Therapists who reported that they were familiar with clinical guidelines were more likely to use the following examination and intervention techniques for the patients in both vignettes: the Sharp Purser test, the deep neck flexor endurance test,

Table 4 Vignette 1 and 2 responses

	Vignette 1 (n=237)% (n=no. of respondents) Percent (n)	Vignette 2 (n=204)% (n=no. of respondents) Percent (n)
Which of the following screening tests would you perform on this patient? Please check all that apply		
Alar ligament test	84.4% (200)	82.8% (169)
Sharp Purser test	64.6% (153) [†]	63.2% (129) [†]
Other/additional sagittal/transverse ligament stress test	52.7% (125)	55.4% (113)
Vertebral artery test	48.9% (116)	57.8% (118) [†]
Other, please specify	25.3% (60)	17.2% (35)
Would you perform a range of motion assessment on this patient?		
Yes	98.7% (234)	99.5% (203)
Which of the following methods would you use to assess ROM?		
Visual assessment	62.4% (146)	64.7% (132)
Inclinometer	30.3% (71)	31.9% (65)
Goniometer	28.2% (66)	28.9% (59)
Other, please specify	10.2% (24)	8.3% (17)
Which of the following special tests would you perform?		
Cervical segmental mobility	94.9% (225)	96.1% (196)
Thoracic segmental mobility	93.7% (222)	96.1% (196)
Manual muscle testing for myotomal weakness	82.3% (195)	82.8% (169)
Deep tendon reflexes	78.1% (185)	73.5% (150)
Sensory assessment of light touch	70.5% (167)	66.2% (135)
Scapular muscle co-ordination, strength, and endurance	67.1% (159)	84.8% (173)
Deep neck flexor endurance test	60.3% (143) ^{†‡}	74.5% (152) [†]
Upper limb tension/brachial plexus provocation testing	57.0% (135)	58.8% (130)
Cranial cervical flexion test	54.4% (129)	57.4% (117) [†]
Upper quadrant muscle length assessment	48.1% (114)	63.7% (130)
Cervical flexion rotation test	N/A	51.5% (105)
Cervical extensor muscle performance	32.9% (78)	39.2% (80)
Tests of eye movement control	26.6% (63)	23.5% (48)
Cervical joint position error testing	21.1% (50)	28.4% (58)
Balance testing	16.5% (39)	15.2% (31)
Sensation assessment of mechanical pain pressure thresholds	4.6% (11)	5.4% (11)
Thermal sensitivity	1.7% (4)	3.4% (7)
Other, please specify	13.9% (33)	13.2% (27)
Which of the following interventions/therapeutic modalities would you be likely to use?		
Soft tissue mobilization techniques	85.7% (203) [†]	85.8% (175)
Hot pack	38.4% (91)	32.8% (67)
Electrical stimulation/TENS	35.4% (84)	30.9% (63) [‡]
Cold pack	30.0% (71)	20.6% (42)
Ultrasound	13.9% (33) ^{†‡}	11.8% (24) ^{†‡}
Soft collar	12.7% (30)	3.9% (8)
Other, please specify	40.1% (95)	31.4% (64)
If cervical and thoracic joint hypomobility is found during the initial exam, which of the following manual therapy interventions would you use?		
Cervical joint mobilization	89.9% (213)	86.8% (177)
Thoracic joint mobilization	76.4% (181)	79.9% (163)
Thoracic joint high velocity thrust manipulation	61.2% (145) ^{†‡}	70.6% (144) [†]
Cervical spine traction	30.4% (72)	33.8% (69)
Cervical high velocity thrust manipulation	21.1% (50)	33.8% (69) [‡]
Other, please specify	18.1% (43)	18.1% (37)
Which of the following therapeutic exercise interventions would you be likely to use with this patient?		
Scapular motor control/stabilization/strengthening exercises	86.9% (206)	92.6% (186)
Deep neck flexor muscle retraining exercises	85.7% (203) [†]	84.8% (173) [†]
Active range of motion exercises	81.4% (193)	71.6% (146)
Cervical and thoracic spine stretching exercises	62.9% (149)	71.1% (145)
Aerobic/cardiovascular exercise conditioning	50.6% (120)	59.8% (122)
General neck strengthening exercises such as isometrics	41.8% (99)	55.9% (114)
Cervical kinesthetic retraining	38.0% (90) [†]	41.2% (84)
Exercises for eye movement control	18.6% (44)	20.1% (41)
Balance exercises	15.2% (36)	13.2% (27)
McKenzie regimen	8.9% (21)	9.8% (20)
Other, please specify	17.3% (41)	12.7% (26)
Which of the following advice and counseling would you most likely give to this patient?		
Home exercise program	97.5% (231)	98.5% (201)
Posture advice and correction	94.1% (223)	94.6% (193)
Resume normal activity within patient's tolerance	92.0% (218)	80.4% (164)
Reassure the patient she will most likely make a good recovery	84.4% (200)	60.3% (123)
Ergonomic interventions	76.8% (182)	80.9% (165)
Encourage work breaks	66.2% (157)	63.7% (130)
Encourage rest and avoidance of painful movements and activities	21.9% (52)	20.6% (42)
Other, please specify	10.5% (25)	12.7% (26)
Which of the following outcome measures would you use with this patient for assessing progress?		
Numerical pain rating scale	81.9% (194)	82.8% (169)

Table 4 Continued

	Vignette 1 (n=237)% (n=no. of respondents) Percent (n)	Vignette 2 (n=204)% (n=no. of respondents) Percent (n)
Neck disability index	81.4% (193) [†]	80.9% (165) [†]
Fear avoidance beliefs questionnaire	34.2% (81) [†]	39.7% (81) [†]
Headache disability index	N/A	37.7% (77)
Patient specific functional scale	22.4% (53)	21.1% (43)
Global rating of change scale	19.4% (46) [†]	22.1% (45)
Short form 36 health survey questionnaire (SF-36)	3.8% (9)	4.4% (9)
Tampa scale for kinesiophobia	3.4% (8)	3.4% (7)
Impact of event scale	2.5% (6)	3.9% (8)
Other, please specify	11.0% (26)	10.3% (21)
Would you recommend additional diagnostic testing for this patient?		
Yes	36.7% (87)	21.6% (44)
No	63.7% (151)	78.9% (161)

[†] Significant difference in use of this test between therapists with and without familiarity with evidence-based or clinical guidelines for WAD ($P<0.01$).

[‡] Significant difference in use of this test between therapists with and without an advanced certification ($P<0.01$).

Italics indicate most frequently given answer.

high velocity thrust joint manipulation (TJM) for the thoracic spine, and deep neck flexor training. They were more likely to use the NDI and the fear avoidance beliefs questionnaire (FABQ) as outcome measures for both vignettes. Therapists who were familiar with clinical guidelines were less likely to use ultrasound as a therapeutic modality for both vignettes.

Only a few differences were found between V1 and V2. Therapists familiar with clinical guidelines were more likely to select cervical kinesthetic retraining and the Global rating of change scale (GROC) for V1 and more likely to select the craniocervical flexion test for V2. They were less likely to select soft tissue mobilization, as an intervention for the patient in V1 and less likely to select the vertebral artery test for the patient in V2.

There were some statistically significant differences ($P<0.01$) in responses to the vignettes found between those who had a specialist certification and those who did not. These differences are highlighted in Tables 7 and 8. Respondents who had an advanced certification were more likely to use the deep neck flexor

endurance test and thoracic TJM for V1 and more likely to use cervical TJM for V2. They were less likely to use therapeutic ultrasound for both vignettes and less likely to use electrical stimulation/TENS as an intervention for V2.

Discussion

It is important for physical therapists treating patients with whiplash to be familiar with clinical practice guidelines and stay current with the latest evidence as it continually evolves. However, our study showed that there are statistically significant differences in adherence to the guidelines between the 77% of therapists reporting familiarity with guidelines and the remaining therapists. Significant differences were also found between the 75% of therapists who had advanced certification and those who did not.

Interestingly, there was no statistically significant difference in the knowledge of evidence-based practice guidelines between therapists with a doctoral degree and those who did not have one, whereas respondents who had an advanced certification

Table 5 Tests/interventions more likely to be used for V1 and V2 by therapists familiar with evidence-based or clinical practice guidelines for WAD, compared to those not familiar with guidelines. Percentages given are for V1 unless specified as V2

Tests/interventions	% Familiar with guidelines who selected intervention	% Not familiar with guidelines who selected intervention	Statistically significant value differences for V1	Statistically significant value differences for V2
Sharp Purser test	70.0%	47.3%	**	**
Deep neck flexor endurance test	68.3%	34.5%	***	***
Joint position error test	24.4%	10.9%	\$	\$
Thoracic spine high velocity thrust manipulation	68.9%	36.4%	***	***
Cervical kinesthetic retraining	43.3%	20.0%	**	\$
Deep neck flexor training	90.5%	69.1%	***	**
Craniocervical flexion test (V2)	63.2% (for V2)	40.4% (for V2)	NA	**
The neck disability index	88.3%	60.0%	***	***
Global rating of change scale	23.3%	7.2%	**	\$
Fear avoidance beliefs questionnaire	41.1%	12.7%	***	**

** $P<0.01$, *** $P<0.001$, and \$ $P<0.05$ (approaching significance).

Table 6 Tests/interventions less likely to be used by therapists familiar with evidence-based or clinical practice guidelines for WAD compared to those not familiar with guidelines. Percentages given are for V1 unless specified as V2

Tests/interventions	% Familiar with guidelines who selected intervention	% Not familiar with guidelines who selected intervention	Statistically significant value differences for V1	Statistically significant value differences for V2
Therapeutic ultrasound	10.0%	27.2%	**	**
Soft tissue mobilization	82.2%	96.4%	**	\$
Electrical stimulation	32.2%	47.2%	\$	NA
Cervical thoracic stretching	58.4%	74.5%	\$	NA
Vertebral artery insufficiency test	52.2% (for V2)	76.6% (for V2)	NA	**
Hot pack	28.4% (for V2)	44.7% (for V2)	NA	\$

** $P < 0.01$, *** $P < 0.001$, and \$ $P < 0.05$ (approaching significance)

reported greater familiarity with clinical guidelines. This could be reflective of the fact that the most commonly obtained doctoral degree is an entry level DPT which may not prepare graduates to focus on specialized populations such as patients with WAD. It may also indicate that therapists who do not have a doctoral degree are keeping up to date with clinical guidelines via post graduate training, continuing education, and professional development.

The results related to the clinical management questions will be discussed based on answers related to examination, outcomes measures, and interventions.

Examination

A majority of respondents (83.6% for both vignettes) indicated they would test the alar ligament while the Sharp Purser test was more likely to be performed by respondents familiar with clinical guidelines. Magnetic imaging analysis has shown that whiplash trauma can result in injury to the craniovertebral ligaments especially the alar ligament.^{26,27} As a result, therapists should perform a clinical assessment of the integrity of these ligaments. The Sharp Purser test has been shown to be reliable and valid for patients with rheumatoid arthritis but has not been studied in patients with whiplash.^{28,29} There is little research available on clinical testing of the alar ligament. However, MRI analysis has shown that both side-bending and rotation stress testing result in a measurable increase

in length of the contralateral alar ligament.³⁰ The use of the cranial cervical flexion test (CCFT) and deep neck flexor endurance test has been recommended for patients with neck pain with movement coordination impairments or with sprain or strain of the cervical spine.³ These tests were performed by an average of 55.9% and 67.4%, respectively, for V1 and V2. However, the deep neck flexor endurance test was performed by significantly more therapists familiar with guidelines for V1 and V2, and by more respondents holding an advanced certification in the case of V1. It is possible that many therapists obtain information regarding the Sharp Purser and deep neck flexor endurance tests through advanced certification and reading clinical guidelines rather than entry level education programs. The CCFT was also performed by more therapists familiar with guidelines for V2 indicating a greater awareness of the research in this area.³ The cervical extensor muscles have been shown to be affected in whiplash,^{10,31} however, a lower number of respondents (average of 36% for both vignettes) selected testing of these muscles. There was also a low utilization of tests for sensorimotor impairments such as eye movement control (25%), cervical joint position error testing (24.7%), and balance testing (15.8%) for both vignettes, all of which have been documented as being impaired in patients with chronic WAD.¹⁰ The presence of cold and mechanical hyperalgesia has been found to be

Table 7 Tests/interventions more likely to be used for V1 and V2, by therapists, with advanced certification compared to those without. Percentages given are for V1 unless specified as V2

Tests/interventions	% with certification who selected intervention	% Not certified who selected intervention	Statistically significant value differences for V1	Statistically significant value differences for V2
Fear avoidance beliefs questionnaire	38.2%	22%	\$	NA
Sharp Purser test	69.1%	50.8%	\$	NA
Deep neck flexor endurance test	66.3%	42.4%	**	\$
Joint position error test	24.7%	10.2%	\$	NA
Cervical segmental mobility testing	96.6%	90.0%	\$	NA
Thoracic segmental mobility testing	95.5%	88.0%	\$	NA
Cervical high velocity thrust manipulation	39.2% (for V2)	15.2% (for V2)	NA	**
Thoracic high velocity thrust manipulation	66.9%	44.1%	**	\$
Deep neck flexor training	88.8%	76.3%	\$	\$
Aerobic/cardiovascular exercise and conditioning	55.1%	37.3%	\$	\$
Resume activity as normal	84.2% (for V2)	67.4% (for V2)	NA	\$

** $P < 0.01$, *** $P < 0.001$, and \$ $P < 0.05$ (approaching significance).

Table 8 Tests/interventions less likely to be used for V1 and V2, by therapists with advanced certification compared to those without. Percentages given are for V1 unless specified as V2

Tests/interventions	% with certification who selected intervention	% Not certified who selected intervention.	Statistically significant value differences for V1	Statistically significant value differences for V2
Therapeutic ultrasound	10%	25.4%	**	**
Cervical and thoracic stretching	58.9%	74%	\$	NA
Cervical traction	26.9%	40.6%	\$	\$
Electrical stimulation	26.0% (for V2)	47.8% (for V2)	NA	**
SF36	2.5% (for V2)	10.9% (for V2)	NA	\$
Diagnostic tests	17.7% (for V2)	34.8% (for V2)	NA	\$

** $P < 0.01$, *** $P < 0.001$, and \$ $P < 0.05$ (approaching significance).

predictive of a poor prognosis following whiplash.^{10,32,33} This survey indicated that quantitative sensory assessment methods such as mechanical pain pressure thresholds (5% for both vignettes) and thermal sensitivity (2.5% for both vignettes) are not being widely assessed in clinical practice. This may be because of a lack of awareness of these tests among therapists or may reflect the lack of clinical usefulness of these tests for directing patient treatment and improving outcomes.³⁴ In the open-ended responses, a lack of tools for performing these tests was provided as a reason for not doing them. The utilization rate of these tests was slightly higher for V2 possibly because the chronicity of symptoms in the patient in that case.

Outcome measures

The FABQ was more likely to be used by therapists who were familiar with clinical guidelines for both V1 and V2. This tool has been shown to be a valid and reliable test and the modified version can be useful in predicting patients who will develop chronic neck pain.^{35,36} This test was selected by 41.1% of therapists who were familiar with clinical guidelines for V1 compared to 12.7% of therapists who were not familiar with guidelines. It was selected by 38.2% of therapists with an advanced certification compared to 22% who were not certified, however, this difference was not statistically significant ($P = 0.02$). Our findings of a low utilization of the FABQ are similar to those of Abrams *et al.*³⁷ who reported that a high percentage of outpatient physical therapists in Australia were not familiar with this test. The TSK, which measures fear of reinjury as a result of movement³⁸ and has been recommended as a useful clinical tool to use with patients with WAD,¹¹ had an overall low utilization rate of 3.4%.

The *Neck Pain: Clinical Practice Guidelines*³ published by the APTA acknowledge the role of psychological factors in recovery from whiplash, however, specific screening measures are not recommended. Other clinical guidelines for whiplash recommend screening for psychological distress when appropriate and include recommendations of specific tools for this purpose.^{11,13} In our study, the IES,³⁹ which assesses stress related to a specific event, had a

low utilization rate of 3.2%. There are other useful scales that have been used for assessing post-traumatic stress such as the post traumatic stress diagnostic scale⁴⁰ and the self rating scale for post-traumatic stress disorders.^{41,42} However, none of these were selected in the open-ended responses to that question for either vignette. This indicates that therapists are not widely screening patients for post-traumatic stress, which has been shown to be associated with a poor prognosis after whiplash. While a majority may not have thought it necessary to use this instrument for the patient in the first vignette, it may have been indicated for the patient in the second vignette as a result of the chronicity of symptoms.

The NDI and Patient-Specific Functional Scale (PSFS) are recommended outcome measures for patients with neck pain.³ The visual analog scale (VAS) or verbal rating scale (VRS) for pain, the NDI,⁴³ and the PSFS⁴⁴ have all been recommended for measuring baseline pain, function, and outcomes in patients with WAD.^{3,11,12} The NPRS was selected by an average of 82.3% of respondents, the NDI, by 81.15% and the PSFS, by 21.75% for V1 and V2. Several guidelines agree on the importance of using of at least two outcome measures to establish a solid baseline by which to gauge improvement in patients with whiplash associated disorders.^{11–13} Our findings are similar to those of Abrams *et al.*³⁷ who reported a high utilization rate of the NDI and much lower utilization of the PSFS.

The NDI (for V1 and V2) and the GROC⁴⁵ (for V1) were chosen significantly more often by therapists familiar with clinical guidelines than those who were not. For V1, 88.3% of therapists who were familiar with guidelines selected the NDI compared to 60% of therapists who were not and 23.3% of therapists familiar with guidelines selected the GROC compared to 7.2% of those who were not.

This study did not explore barriers to using standardized outcome measure in physical therapy, however Jette *et al.*⁴⁶ previously reported that the length of time taken to complete and analyze outcome data and the patient's difficulty in completing the

outcome tools, are reasons for their lack of implementation in physical therapy practice.

Interventions

The most commonly selected interventions of joint mobilization, exercise, and posture advice are consistent with clinical guidelines.^{3,11–13} These are similar to the most commonly reported treatments in a whiplash snapshot survey of private physiotherapy practitioners in the UK.²¹ In that survey, the most commonly selected initial and subsequent treatments for patients with whiplash were: exercise and training, e.g., active mobilizing exercises, manual techniques, education, and advice. The utilization of active treatment has been emphasized in the literature on treating patients with acute and chronic whiplash.^{11–13} A high number of respondents in our study selected scapular motor control/stabilization/strengthening exercises (89.75%), and deep neck flexor retraining exercises (85.25%) for both vignettes. However, therapists who were familiar with clinical guidelines were more likely to select the use of deep neck flexor training as an intervention, possibly reflecting their familiarity with relatively recent evidence in the literature investigating this area.^{47,48} This intervention was selected by 90.5% of therapists familiar with guidelines, for V1 compared to 69.1% who were not familiar with guidelines. There is evidence that an exercise program targeting the craniocervical flexor muscles in patients with chronic neck pain can enhance the pattern of deep and superficial muscle activity in these muscles⁴⁷ and result in improved ability to maintain a neutral cervical posture during prolonged sitting.⁴⁸

A high number of respondents selected an active physical therapy approach that included a home exercise program and encouraging the patient to resume normal activity within tolerance. There was also a low utilization rate of soft collar and ultrasound which is consistent with current guidelines and research.^{3,8,11–13,49} Clinical guidelines state that electrical modalities may be used in the sub acute phases of WAD, in conjunction with other active interventions, but that they are not recommended as the primary treatment for patients with chronic WAD.^{11–13} However, specifically with regard to therapeutic ultrasound, it has generally been found to not be effective for patients with acute or chronic WAD.^{11,49} Therapists with knowledge of clinical guidelines or an advanced certification, in this study were, in general, less likely to use therapeutic ultrasound than therapists who were not certified or not familiar with guidelines. Ten percent of therapists who were familiar with guidelines selected ultrasound as an intervention for the patient in V1. It was selected by 27.2% of therapists who were not familiar

with guidelines. Likewise 10% of therapists with an advanced certification selected ultrasound for V1, compared to 25.4% of therapists who did not have an advanced certification.

Therapists who were familiar with guidelines and had an advanced certification, selected evidence-based treatment interventions that required higher levels of skill. For example, therapists who were familiar with guidelines were more likely to select thoracic TJM for both V1 and V2. Thoracic TJM was selected by 68.9% of therapists familiar with guidelines and 36.4% of therapists who were not familiar with guidelines. Therapists with an advanced certification were more likely to select thoracic TJM for V1 and V2, and, in the case of the patient in V2, cervical TJM.

Our study found an overall adherence to clinical guidelines. However, some areas were identified where clinical practice did not reflect clinical guidelines or research findings such as variable use of existing valid and reliable outcome measures and low utilization rates of certain tests that may provide useful prognostic information for patients with WAD. These included: quantitative sensory testing, sensorimotor deficits in eye movement control, cervical joint position error and balance testing, and screening for psychological distress using validated screening tools.

There is a need for more research into patient outcomes following implementation of clinical practice guidelines for WAD. Rebbeck *et al.*,²⁵ in their previously cited study, showed that while an active implementation program increased adherence to clinical practice guidelines for WAD, there was no difference in patient outcomes. They hypothesized that this may have been because of the fact that many therapists in the study were already following recommended guidelines or that some of the guidelines may not have been essential to improving patient outcomes.²⁵ Additionally, patient outcomes are complex and are related to additional factors such as the relationship or alliance between the therapist and patient.⁵⁰ Research has shown a positive correlation between this alliance, and treatment outcomes of pain, disability, physical, and mental health, and satisfaction with treatment in the rehabilitation setting.⁵¹ There is some evidence that ongoing regular continuing education in the management of neck pain can result in improved patient outcomes.⁵² However, for continuing education to have a meaningful impact on clinical outcomes it needs to be interactive and ongoing.^{52,53}

Limitations of the study

Our survey had a good sample size ($n=237$) and geographical diversity. However, it targeted a select

group of physical therapists who were members of AAOMPT or the Orthopedic Section of the APTA. Respondents had a great deal of clinical experience and training. Seventy-five percent of respondents held an advanced certification which is higher than the certification rate among practicing physical therapists as a whole. There was a low response rate to the survey which may have been partly because of the short duration of time that the survey was open. However, previous surveys have also reported low response rates. An electronic survey by Jette and Jewell⁵⁴ of members of the orthopedic and private sections of the APTA regarding use of examinations and interventions yielded a response rate of 17% and Hendrick *et al.*⁵⁵ reported an overall response rate of 17% for their online survey. The low response rate may also be a source of selection bias as responders may differ in demographic characteristics and qualifications from non-responders. Therefore, our results may not be representative of all physical therapists. Additionally, the measure of physical therapists' current clinical practice was based on two vignettes with multiple choice follow-up questions. While vignettes have been shown to reliably assess clinical behavior,^{56,57} the options provided may have caused the therapists to feel limited, or may have guided their responses. A multiple-choice format may also overestimate performance by providing options that may influence the practitioners thought process compared to an open-ended format.⁵⁸ Lastly, some practitioners may have needed more information on which to base their clinical decisions, than provided in the vignettes. Therefore, actual clinical practice may vary from the responses collected.

Conclusion

This study has demonstrated that, in this surveyed population, a majority of physical therapists were familiar with evidence-based guidelines for the treatment of WAD and believed that they adhered to them a majority of the time. Based on answers to the clinical vignettes, a majority of therapists performed screening for upper cervical ligament injury, assessed cervical spine range of motion, cervical and thoracic spine joint play, performed a neurological assessment and used a multimodal treatment approach consisting of manual therapy, exercise, and posture advice. All of these are consistent with clinical guidelines and current evidence. In general, therapists reported a variable use of existing valid and reliable outcome measures and a low utilization rate of some tests that may provide useful prognostic information for patients with WAD. This study revealed differences in clinical practice, on the basis of knowledge of evidence-based clinical guidelines, and advanced certification. These

differences existed in examination, intervention, and use of outcome measures for patients with WAD.

This study highlights the importance of advanced specialization and professional development for physical therapists. Further research is needed to explore clinical practice of physical therapists treating patients with WAD, factors affecting implementation of clinical practice guidelines for patients with WAD, and recommendations or additional guidelines pertaining to the use of quantitative sensory testing and psychological screening tools for patients with WAD. Research is needed to evaluate the clinical outcomes of physical therapists based on the application of evidence-based clinical guidelines and clinical specialization.

Appendix 1: Survey

Background information

1. How many years of experience do you have as a licensed Physical Therapist?
 - a. Less than 1 year
 - b. 1–5 years
 - c. 6–10 years
 - d. 11–20 years
 - e. Greater than 20 years
2. In what setting are you currently working?
 - a. Hospital-based outpatient clinic
 - b. Physical therapist operated private practice
 - c. Physician owned private practice
 - d. Inpatient
 - e. Other, please specify: _____
3. In what region are you currently practicing?
 - a. Northeast US
 - b. Midwest US
 - c. South US
 - d. West US
 - e. Outside the US
4. Please indicate your gender?
 - a. Male
 - b. Female
5. Which of the following is your highest level Physical Therapy Degree?
 - a. Certificate
 - b. Bachelors
 - c. Masters
 - d. Doctorate
6. Do you have any of the following certifications or qualifications? Please check all that apply.
 - a. APTA board certified orthopaedic specialist
 - b. Manual therapy certification
 - c. FAAOMPT
 - d. Other, please specify: _____
7. On average, how often do you attend continuing education courses or professional conferences?
 - a. Never
 - b. Once every 6–10 years
 - c. Once every 3–5 years
 - d. Once every 1–3 years
 - e. Annually

- f. More than once per year
- 8. On average, how often do you see patients with whiplash associated disorders (WADs)?
 - a. Have never treated a patient with WAD
 - b. Fewer than one patient every 12 months
 - c. At least one patient every 12 months
 - d. At least one patient every 6 months
 - e. At least one patient a month
 - f. At least one patient a week
- 9. Are you familiar with any evidence-based or clinical practice guidelines for treating patients with whiplash associated disorders?
 - a. Yes
 - b. No (please skip Q10–12)
- 10. If yes, which guidelines are you familiar with? Please check all that apply.
 - a. Treatment-based classification
 - b. Quebec task force
 - c. Bone and joint decade task force
 - d. Reading current research on the topic
 - e. Clinical practice guidelines linked to International Classification of Functioning, Disability, and Health from the Orthopedic Section of the APTA
 - f. Other, please specify: ____
- 11. Which one of these guidelines do you follow the most?
 - a. Treatment-based classification
 - b. Quebec task force
 - c. Bone and joint decade task force
 - d. Reading current research on the topic
 - e. Clinical practice guidelines linked to international classification of functioning, disability, and health from the Orthopedic Section of the APTA
 - f. Other, please specify: _____
- 12. How often do you follow these guidelines?
 - a. Never
 - b. 0–25% of the time
 - c. 26–50% of the time
 - d. 51–75% of the time
 - e. 76–100% of the time

Clinical Vignette 1

Based on the following case, please answer questions 13–23:

Patient A is a 44-year-old female who presents to PT 4 weeks following a motor vehicle collision. The patient reports diffuse neck and thoracic spine pain with some referral to the right upper trapezius region. She reports limited range of motion of the cervical spine especially when rotating her head to the right and feels that her neck is stiff. She is referred to physical therapy by her primary care physician. She has not had any radiographs or other diagnostic imaging tests.

The collision occurred when she was sitting in her car, stopped at a red light and was hit from behind by another vehicle, which was traveling at approximately 35 mph. She was wearing her seatbelt at the time, looking straight ahead and did not have immediate onset of symptoms.

Current pain is 2/10. Worst pain levels are 5/10 and best 0/10. Exacerbating factors include prolonged computer and phone use, greater than 1 hour and prolonged driving. Patient reports that her neck feels better after a warm shower.

PMHx is non-contributory. She is not taking any medications except for Tylenol PRN. She is employed full time as an administrative assistant and has two young children.

The patient is not seeking litigation relating to this injury.

13. Which of the following screening tests would you perform on this patient? Please check all that apply.

- A. Sharp Purser
- B. Other/additional sagittal/transverse ligament stress test
- C. Alar ligament test
- D. Vertebral artery test
- E. Other, please specify

14. Would you perform range of motion (ROM) assessment on this patient?

- A. Yes
- B. No (if you answer is no, please skip Q15 and go to Q16)

15. If you answered yes to Q 14, which of the following methods would you use to assess ROM?

- A. Visual assessment
- B. Goniometer
- C. Inclinator
- D. Other, please specify

16. Which of the following special tests would you perform as part of your examination either on the initial or subsequent visits? Please check all that apply.

- A. Cranial cervical flexion test
- B. Deep neck flexor endurance test
- C. Manual muscle testing for myotomal weakness
- D. Deep tendon reflexes
- E. Sensory assessment of light touch
- F. Sensation assessment of mechanical pain pressure thresholds with algometer
- G. Thermal sensitivity
- H. Cervical joint position error testing
- I. Upper limb tension/brachial plexus provocation testing
- J. Cervical segmental mobility
- K. Thoracic segmental mobility
- L. Balance testing
- M. Tests of eye movement control
- N. Cervical extensor muscle performance
- O. Scapular muscle co-ordination, strength and endurance
- P. Upper quadrant muscle length assessment
- Q. Other, please specify: _____

17. Which of the following interventions/therapeutic modalities would you be likely to use with this patient? Please check all that apply.

- A. Soft collar
- B. Ultrasound
- C. Hot pack
- D. Cold pack
- E. Electrical stimulation/TENS
- F. Soft tissue mobilization techniques

G. Other, please specify: _____

18. If cervical and thoracic joint play hypomobility is found during the initial exam, which of the following manual therapy interventions would you most likely use with this patient? Please check all that apply.

- A. Cervical joint mobilization
- B. Cervical high velocity thrust manipulation
- C. Thoracic joint mobilization
- D. Thoracic joint high velocity thrust manipulation
- E. Cervical spine traction
- F. Other, please specify: _____

19. Which of the following therapeutic exercise interventions would you be likely to use with this patient during the course of treatment? Please check all that apply.

- A Active range of motion exercises
- B McKenzie regimen
- C Deep neck flexor muscle retraining exercises
- D General neck strengthening exercises such as isometrics of rotators/flexors and extensors
- F Scapular motor control/stabilization/strengthening exercises
- G Cervical kinesthetic retraining
- H Exercises for eye movement control
- I Balance exercises
- J Cervical and thoracic spine stretching exercises
- K Aerobic/cardiovascular exercise conditioning
- L Other, please specify: _____

20. Which of the following advice and counseling would you most likely give to this patient? Please check all that apply.

- A. Resume normal activity within patient's tolerance
- B. Encourage rest and avoidance of painful movements and activities
- C. Reassure the patient they will most likely make a good recovery from this injury
- D. Ergonomic interventions
- E. Posture advice and correction
- F. Encourage work breaks
- G. Home exercise program
- H. Other, please specify: _____

21. Which of the following outcome measures would you use with this patient for assessing progress? Please check all that apply.

- A. Numerical pain rating scale
- B. Neck disability index
- C. Patient specific functional scale
- D. Short form 36 health survey questionnaire (SF-36)
- E. Impact of event scale
- F. Global rating of change scale
- G. Fear avoidance beliefs questionnaire
- H. Tampa scale for kinesiophobia
- I. Other, please specify: _____

22. Would you recommend any additional diagnostic testing for this patient?

- A. Yes
- B. No (if you answer no, please skip Q23)

23. If you answered yes, please explain your rationale or reasoning?

Clinical Vignette 2

Based on the following case, please answer questions 24–34:

Patient B is a 33-year-old female who presents to PT with a chief complaint of neck pain and headaches. The patient reports intermittent neck pain and headaches since a motor vehicle collision (MVC) 1 year ago, which have worsened over the past 2 months. This exacerbation was provoked by weight lifting in the gym. The neck pain radiates to the left upper trapezius/levator scapulae and medial scapular region. She has no reports of distal arm pain or paresthesia. Pain is worse at the end of the day and after prolonged computer use, for more than 3 hours. Stress also exacerbates symptoms which are relieved by lying down. Pain is rated 6/10 at worst, currently 2/10 and 0/10 at best. The headaches occur approximately five times a week, are felt in the left occipital region and have a pain intensity of 3–5/10. They last on average 2–3 hours. She also reports occasional retro-orbital pain with headaches. She has not returned to her routine exercise regimen since the injury and is concerned that doing so will exacerbate her symptoms.

Meds: Aleve PRN, Singulair, Ortho Tri-Cyclen

Diagnostic imaging: Cervical spine radiographs taken 1 year ago after MVC, including AP, lateral, oblique, and open mouth views were WNL.

PmHx: Involved in a MVC 1 year ago with resultant neck pain. Treatment included 5 weeks of PT which helped resolve most of her symptoms but she has had intermittent episodes of neck pain and headaches since then. She has seasonal allergies and is otherwise in good health.

Soc Hx: She works as a high school teacher and also attends night school. She was a former competitive gymnast.

The patient is not seeking litigation relating to this injury.

Posture: Elevated left scapula with moderate anterior tipping and abduction. Both shoulders are internally rotated and forward. There is a decreased cervical lordosis and decreased thoracic kyphosis.

24. Which of the following screening tests would you perform on this patient? Please check all that apply.

- A. Sharp Purser
- B. Other/additional sagittal/transverse ligament stress test
- C. Alar ligament test
- D. Vertebral artery test
- E. Other

25. Would you perform range of motion (ROM) assessment on this patient?

- A. Yes
- B. No (please skip Q 26)

26. If you answered yes to Q 25, which of the following methods would you use to assess ROM?

- A. Visual assessment

- B. Goniometer
 - C. Inclinator
 - D. Other, please specify
27. Which of the following special tests would you perform as part of your examination either on the initial or subsequent visits? Please check all that apply.
- A. Cranial cervical flexion test
 - B. Deep neck flexor endurance test
 - C. Cervical flexion rotation test
 - D. Manual muscle testing for myotomal weakness
 - E. Deep tendon reflexes
 - F. Sensory assessment of light touch
 - G. Sensation assessment of mechanical pain pressure thresholds with algometer
 - H. Thermal sensitivity
 - I. Cervical joint position error testing
 - J. Upper limb tension/brachial plexus provocation testing
 - K. Cervical segmental mobility
 - L. Thoracic segmental mobility
 - M. Balance testing
 - N. Tests of eye movement control
 - O. Cervical extensor muscle performance
 - P. Scapular muscle co-ordination, strength and endurance
 - Q. Upper quadrant muscle length assessment
 - R. Other, please specify: _____
28. Which of the following interventions/therapeutic modalities would you be likely to use with this patient? Please check all that apply.
- A. Soft collar
 - B. Ultrasound
 - C. Hot pack
 - D. Cold pack
 - E. Electrical stimulation/TENS
 - F. Soft tissue mobilization techniques
 - G. Other, please specify: _____
29. If upper cervical and upper thoracic joint play hypomobility and mid cervical increased mobility are found during the initial exam which of the following manual therapy interventions would you most likely use with this patient? Please check all that apply.
- A. Cervical joint mobilization
 - B. Cervical high velocity thrust manipulation
 - C. Thoracic joint mobilization
 - D. Thoracic joint high velocity thrust manipulation
 - E. Cervical spine traction
 - F. Other, please specify: _____
30. Which of the following therapeutic exercise interventions would you be likely to use with this patient? Please check all that apply.
- A. Active range of motion exercises
 - B. McKenzie regimen
 - C. Deep neck flexor muscle retraining exercises
 - D. General neck strengthening exercises such as isometrics of rotators/flexors and extensors
 - E. Scapular motor control/stabilization/strengthening exercises
 - F. Cervical kinesthetic retraining
 - G. Exercises for eye movement control
 - H. Balance exercises

- I. Cervical and thoracic spine stretching exercises
 - J. Aerobic/cardiovascular exercise conditioning
 - K. Other, please specify: _____
31. Which of the following advice and counseling would you most likely give to this patient? Please check all that apply.
- A. Resume normal activity within patient's tolerance
 - B. Encourage rest and avoidance of painful movements and activities
 - C. Reassure the patient they will most likely make a full recovery from this injury
 - D. Ergonomic interventions
 - E. Posture advice and correction
 - F. Encourage work breaks
 - G. Home exercise program
 - H. Other, please specify: _____
32. Which of the following outcome measures would you use with this patient for assessing progress? Please check all that apply.
- A. Numerical pain rating scale
 - B. Neck disability index
 - C. Headache disability index
 - D. Patient specific functional scale
 - E. Short form 36 health survey questionnaire (SF-36)
 - F. Impact of event scale
 - G. Global rating of change scale
 - H. Fear avoidance beliefs questionnaire
 - I. Tampa scale for kinesiophobia
 - J. Other, please specify: _____
33. Would you recommend any additional diagnostic testing for this patient?
- A. Yes
 - B. No
34. If you answered yes, please explain your rationale or reasoning?

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