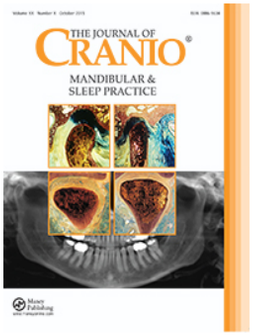

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Janey Prodoehl, Steven Kraus, Gary D. Klasser & Kathy D. Hall

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EDUCATION

Temporomandibular disorder content in the curricula of physical therapist professional programs in the United States

Janey Prodoehl, PT, PhD[a], Steven Kraus, PT, OCS[b,c], Gary D. Klasser, DMD[d] and Kathy D. Hall, PT, EdD [a]

[a]Physical Therapy Program, Midwestern University, Downers Grove, IL, USA; [b]Horizon Physical Therapy LLC, Atlanta, GA, USA; [c]Division of Physical Therapy Department of Rehabilitation Medicine, Emory University of Medicine, Atlanta, GA, USA; [d]School of Dentistry, Department of Diagnostic Sciences, Louisiana State University Health Sciences Center School of Dentistry, New Orleans, LA, USA

ABSTRACT

Objective: To describe the status of entry-level physical therapist (PT) education related to the diagnosis and management of temporomandibular disorders (TMD) in accredited, entry-level United States PT programs.

Methods: An electronic survey explored specific TMD diagnostic and management curricular content, including the use of evidence-based diagnostic criteria, opportunities for students to interact with individuals with TMD, and faculty qualifications.

Results: Eighty-four programs completed the survey. TMD content is covered in the entry-level PT curriculum of almost all (98.8%) responding programs. Content specifically related to TMD averaged 12 h across program respondents (range 1.5–50 h). The majority (68%) of respondents utilized established evidence-based diagnostic criteria.

Discussion: Consistent entry-level education guidelines related to TMD and additional post-professional education opportunities are necessary to ensure that patients with TMD are not underserved by the profession of PT by newly graduated PTs.

KEYWORDS
Curriculum; physical therapy; education; temporomandibular disorders; interprofessional education

Introduction

The prevalence of orofacial pain (OFP) in the general population has been estimated to be between 4% and 15% [1]. Sources of a headache and OFP are multifactorial and include, but are not limited to, sinusitis, allergies, otalgia, odontalgia, ophthalmic, neurological, neuropathic, cervical spine disorders, and temporomandibular disorders (TMD). TMD represents a constellation of signs and symptoms involving the temporomandibular joints and/or muscles of mastication. The prevalence of TMD can vary by subtype but has been estimated to be between 6% and 13.3% in the general population [2,3].

Management of TMD may require an interdisciplinary approach among physical therapy, dentistry, and medical professionals [4]. However, a recent survey of dentists in Florida indicated that 41% were not aware that PTs can treat TMD, suggesting TMD patients needing physical therapy may be underserved [5]. Today, the process by which a patient can consult and be treated by a PT is changing with a move toward a direct access model of physical therapy care. As of January 1, 2015, all 50 states, the District of Columbia, and the US Virgin Islands allow patients to seek some level of treatment from a licensed PT without a referral [6]. Therefore, it is important that PT receive appropriate training in the evaluation and management of TMD either during their attainment of a professional degree or with appropriate post-graduate continuing education.

The entry-level professional degree for a PT is the Doctor of Physical Therapy (DPT). The Commission on Accreditation in Physical Therapy Education (CAPTE) specifies that a PT professional curriculum should include, in part, content and learning experiences about the musculoskeletal and nervous systems, system interactions, differential diagnosis, and the medical and surgical conditions across the lifespan commonly seen in PT practice [7]. These accreditation guidelines do not specify what specific content should be covered for any region of the body, instead of relying on an expectation inclusion of conditions commonly seen in physical therapy practice. In 1997, the Guide to Physical Therapist Practice was first published, with a second edition in 2014 [8]. The Guide to Physical Therapist Practice mentions TMD as a musculoskeletal condition causing pain, although it does not provide any specific protocols for diagnosis or management of TMD or any other orofacial pain

CONTACT Janey Prodoehl jprodo@midwestern.edu Midwestern University, 555 31st St., Downers Grove, IL 60515, US

conditions. Since TMD is a musculoskeletal problem, it would seem appropriate that physical therapists be a primary health-care provider to diagnose and treat TMD. A recent survey of self-perceived adequacy of entry-level education on TMD among PTs in Florida, however, reported that 69% felt that they did not receive adequate information/education on TMD during their entry-level PT education [9].

There is no standardized curriculum to guide entry-level PT educational programs in teaching specific musculoskeletal content, including content pertaining to TMD. This problem is not limited to education in physical therapy. In a 2007 study of predoctoral teaching of TMD in dental education, only three dental schools described their TMD-related teaching situation as ideal [10]. Additionally, in 2013, the Commission on Dental Accreditation (CODA), which serves the public and profession by developing and implementing accreditation standards that promote and monitor the continuous quality and improvement of dental education programs, removed the need to educate predoctoral students regarding the diagnosis and management of TMD from their criteria. This decision may result in the possibility that some dental professionals may not receive any entry level training on diagnosing or managing TMD. Medical doctors also receive little to no musculoskeletal healthcare training in their predoctoral classes [11], and it is unclear whether they receive training on the classification of TMD to allow for comprehensive management of the patients experiencing TMD [12].

It is currently not known how comprehensive the predoctoral education of PTs is in the evaluation and management of TMD. The primary purpose of this study was to identify the extent to which TMD content is taught in entry-level DPT curricula in the US. The study aimed to identify the specific content being taught, to identify whether any evidence-based diagnostic criteria were being used to teach this content, to identify what opportunities existed for students to interact with individuals with TMD and/or other health-care professionals in management of TMD patients, and to delineate the specific qualifications of faculty teaching this content. Findings from this study will help to clarify the extent to which specific content related to diagnosis and management of individuals with TMD is presented within entry-level DPT curricula.

Materials and methods

Subjects

Accredited, entry-level United States DPT professional programs (n = 224 at the time of data collection) were identified via the website of the Commission on Accreditation in Physical Therapy Education (CAPTE), and an initial survey electronic mailing (email) was sent and addressed specifically to the program director of each program.

Survey development

Three of the authors possess expertise in teaching TMD content to PT students or to dental students, based on their content expertise in orofacial pain. The fourth author has expertise in survey design and methodology. The survey (Appendix 1) contained four sections and used branching logic, so respondents saw answer options for an item based on responses to previous items. Section one requested background information related to the entry-level DPT program (5 items). The second section explored existing curricular content related to TMD evaluation and management (up to 22 items). Section three delved into the qualifications of the specific faculty responsible for teaching the content identified in section two. The fourth, and final, section included demographic questions about the survey respondent.

Five TMD content proficient individuals were identified to pilot the survey and provide feedback. Pilot respondents had no affiliation with an entry-level PT program and, therefore, were not potential respondents in the survey. This pilot testing served to ensure content validity and error checking in branching logic. The survey instrument was modified based on feedback received from this pilot testing.

Survey administration

The Institutional Review Board at Midwestern University reviewed the study protocol and declared it exempt from additional review. REDCap, a web-based application designed to support data capture for survey research and hosted by Vanderbilt University, was used to collect and manage the data for the survey. Initial emails were sent to the PT program directors requesting participation or asking them to forward the email to the faculty member or adjunct/guest lecturer who was most familiar with how content related to the examination and management of TMD is addressed within their curriculum. This proviso was included, as the authors recognized that content may be taught in anatomy, kinesiology, and/or musculoskeletal or orthopedic evaluation and treatment courses within the entry-level DPT program. Survey responses were anonymous and not identifiable to any program. As such, two follow-up emails were sent at 3-week intervals to all program directors thanking them if their program

had already participated or requesting program participation if they had not.

Data analysis

Survey responses were exported directly from REDCap into an Excel spreadsheet (Microsoft Corp, Redmond, WA, USA). Data were checked for export errors, and descriptive statistics were calculated for each of the variables.

Results

Responses were received representing 84 DPT programs. The average number of students in a graduating class was 46.5 (Standard deviation [SD] 16.1, range 20–104). All but one program response (98.8%) identified that content related to evaluation and/or management of TMD was currently included in the entry-level DPT program. The average number of years since the inaugural PT class graduated across program respondents was 28.2 years (SD 17.3, range 0.5–76), while the average number of years that TMD content had been integrated into the curriculum was 16.4 years (SD 9.2, range 3–50).

Curricular content

TMD content was taught by all program respondents as part of a required clinical science course rather than as a stand-alone course or elective. The average number of hours devoted to teaching TMJ structure and function, which included anatomy and kinesiology, was 5.6 h (SD 4.5, range 0.5–24). The average number of hours devoted to teaching the examination and evaluation of TMD was 3.5 h (SD 2.4, range 0.5–16), and 2.7 h (SD 1.6, range 0.5–10) for teaching TMD-specific management/intervention strategies or skills.

Diagnostic criteria

Related to the diagnosis of specific forms of TMD, the majority of program respondents (53.0–86.7%) taught classification of 10 TMD diagnoses (Table 1). Fifty-seven (68.7%) of the program respondents reported using either the Research Diagnostic Criteria for Temporomandibular Disorder (RDC/TMD) [2] or the updated 2014 revision, the Diagnostic Criteria for Temporomandibular Disorder (DC/TMD) [13] in teaching diagnostic classification of TMD in the entry-level DPT program. Of program respondents who identified that they used different TMD diagnostic criteria, five identified the use of textbooks (three specifically named books were "Olsen text," "Dutton textbook," "Hedgesus and Cook Special Test book"), two indicated the use of Rocabado [14] criteria, and two responded using the classification proposed by Harrison et al. [15]. The teaching of content related to the treatment/management of individuals with specific TMD diagnoses ranged from 42.2% to 88.0% across program respondents (Table 2). An analysis of TMD intervention/management skills showed that over 90% of program respondents taught joint mobilization/manipulation, soft tissue mobilization, therapeutic exercise and postural education content (Table 3). The next most common interventions taught across program respondents were biobehavioral strategies and pain science and education (Table 3). The least common intervention taught was oral appliance design (7.2% of program respondents), although indications for oral appliance use was taught across a greater num-

Table 1. Diagnosis of TMD diagnostic sub-categories covered in entry-level DPT curricula.

	# of program respondents	% of program respondents
Local myalgia	72	86.7
Myofascial pain with referral	73	88.0
Arthralgia	65	78.3
Headache attributed to TMD	76	91.6
Disc displacement with reduction	76	91.6
Disc displacement with reduction, with intermittent locking	65	78.3
Disc displacement without reduction, with limited opening	72	86.7
Disc displacement without reduction, without limited opening	59	71.1
Degenerative joint disease	64	77.1
Subluxation	44	53.0
Other*	5	6.0

*comments given: scarring, inflammation, muscle imbalance, posterior capsulitis, bruxism, biopsychosocial, retrodiscitis, hypermobility. TMD = temporomandibular disorder; DPT = Doctor of Physical Therapy.

Table 2. Intervention/management of TMD diagnostic sub-categories covered in entry-level DPT curricula.

	# of program respondents	% of program respondents
Local myalgia	73	88.0
Myofascial pain with referral	70	84.3
Arthralgia	61	73.5
Headache attributed to TMD	72	86.7
Disc displacement with reduction	65	78.3
Disc displacement with reduction, with intermittent locking	57	68.7
Disc displacement without reduction, with limited opening	60	72.3
Disc displacement without reduction, without limited opening	53	63.9
Degenerative joint disease	52	62.7
Subluxation	35	42.2
Other*	4	4.8

*comments given: posterior capsulitis, bruxism, all general orthopedic conditions, biopsychosocial, retrodiscitis. TMD = temporomandibular disorder; DPT = Doctor of Physical Therapy.

Table 3. Intervention/management strategies for individuals with TMD taught within the entry-level DPT curricula.

	# of program respondents	% of program respondents
Joint mobilization/ manipulation	80	96.4
Therapeutic exercise	79	95.2
Soft tissue mobilization	80	96.4
Trigger point dry needling	16	19.3
Appliance indications	37	44.6
Appliance design	6	7.2
Biobehavioral strategies	57	68.7
Pain science and education	63	75.9
Postural education	77	92.8
Cranio mobilization	23	27.7
Post-operative TMJ surgical management	24	28.9
Other *	1	1.2

*no comments given. TMD = temporomandibular disorder; DPT = Doctor of Physical Therapy.

ber of program respondents (44.6%) (Table 3). Competency in TMD content was primarily assessed through written exam questions (91.6%), psychomotor skill assessment (61.4%), and practical examinations incorporating psychomotor skill performance and clinical decision-making (62.7%).

Access to patients with TMD

Within the didactic portion of the curriculum, the survey asked what opportunities were available for students to interact with an individual with TMD. Opportunities for students to interact with an individual with TMD were much lower than students having the opportunity to interact with an individual with a spinal or extremity problem (Table 4). When asked about the clinical or practical portion of the curriculum, no program respondent identified that every student had at least one opportunity to observe or work with a patient with TMD, whereas 91.5% responded that some students may have at least one opportunity to observe or work with an individual with TMD (Table 4).

Faculty qualifications and access to other health-care professionals

All program respondents indicated that a PT, either as a core or adjunct faculty member was responsible for teaching evaluation and management of TMD-related content in the entry-level DPT program curriculum. There was a wide variety of credentials held by these faculty (Figure 1). Within the entry-level DPT program respondents, there were limited opportunities for students to interact with other health-care professionals regarding the diagnosis or management of individuals with TMD. Ten-point-eight percent of program respondents reported that students had an opportunity to interact with physicians and 22.9% with dentists. No program response reported any opportunities for students to interact with neurologists, ear nose and throat specialists, or other health-care professionals regarding TMD diagnosis or management.

Table 4. Percentage of programs responding to opportunities for students to work with patients with TMD, spinal problems or extremity problems in the didactic portion of entry-level DPT curricula and with TMD patients in the clinical portion of the entry-level DPT curriculum.

	Didactic			Clinical
	Spine	Extremity	TMD	TMD
Every student has at least one opportunity to observe or work with an individual with this problem	59.0%	59.0%	10.8%	0.0%
The majority of students have at least one opportunity to observe or work with an individual with this problem	18.1%	21.7%	8.4%	8.4%
Some students may have at least one opportunity to observe or work with an individual with this problem	15.7%	10.8%	55.4%	90.4%
No opportunities exist to observe or work with an individual with this problem	7.2%	7.2%	25.3%	0.0%

TMD = temporomandibular disorder; DPT = Doctor of Physical Therapy.

Discussion

This study aimed to identify the specific TMD content being taught in entry-level DPT curricula in the US, whether any evidence-based diagnostic criteria were being used to teach this content, what opportunities existed for students to interact with individuals with TMD or other health-care professionals in the management of TMD patients, and to delineate the specific qualifications of faculty teaching this content. Results showed that TMD content is covered in the entry-level PT curriculum of almost all (98.8%) responding programs. No conclusions can be made about the 62.5% of program respondents who did not respond. Content specifically and uniquely related to the anatomy and kinesiology of the TMJ and the diagnosis and management of specific TMD conditions averaged 12 h across program respondents, although there was a wide range in the number of hours devoted to this content across program respondents (1.5–50 h). However, these hours do not account for other content important and relevant for the diagnosis and management of TMD problems that is otherwise included in DPT curricula, including pain science and neuroscience education, cranial nerve function and testing, cervical spine disorders,

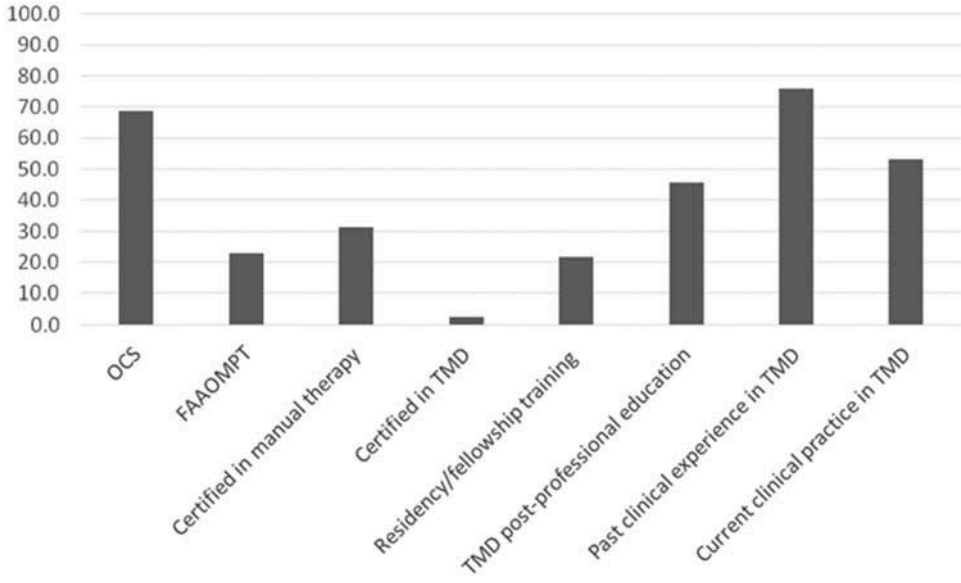

Figure 1. Percentage of programs responding regarding faculty credentials for teaching temporomandibular disorder (TMD) content in the entry-level Doctor of Physical Therapy (DPT) curriculum.

differential diagnosis, and medical screening, all of which are essential in the diagnosis, screening, and management of TMD. The majority (68%) of program respondents utilized the established evidence-based diagnostic criteria (RDC/TMD and DC/TMD) when teaching this content. The RDC/TMD and DC/TMD are the most widely used diagnostic criteria in clinical and research settings and are heavily cited in peer-reviewed publications for the diagnostic protocol for TMD. However, one third (32%) of program respondents did not incorporate either the RDC/TMD or DC/TMD. Instead, comments from survey respondents indicated that they used descriptions taken from textbooks or websites, diagnoses based on clinical reasoning, impairment-based assessment, clustered signs and symptoms, or the diagnostic criteria used had no name, or no standard diagnostic criteria were used. Two program respondents who referenced using the classification from Harrison et al. [15] may have been unaware that this classification is actually based on the DC/TMD.

DPT curricular content

The *Guide to Physical Therapist Practice* defines PTs as "health care professionals who help individuals maintain, restore, and improve movement, activity, and functioning, thereby enabling optimal performance and enhancing health, well-being, and quality of life" [8]. Physical therapists utilize movement analysis in the diagnosis and treatment of musculoskeletal disorders and strive to practice in an evidence-based manner. The minimum requirement for a professional DPT curriculum is at least 90 semester credit hours (or the equivalent) plus a clinical education component that includes a minimum of 30 weeks of full-time clinical education experiences [7]. An average of 12 contact hours of TMD content (range 1.5–50 h) found in this study would translate to approximately 0.32 semester hours (range 0.04–1.33), or about 0.4% (range 0.04–1.33%) of a 90-semester hour didactic professional program. While this average seems quite low, it likely underrepresents the didactic preparation of the entry-level PT to evaluate and manage a patient with TMD. Content related to TMD is only one component of the evaluation and intervention content covered in an entry-level DPT curriculum. In addition to teaching TMD specific content, entry-level DPT education is expected to include physiology, genetics, exercise science, biomechanics, neuroscience, pathology, pharmacology, diagnostic imaging, histology, nutrition, and psychosocial aspects of health and disability [7], as well as medical screening, systems review, differential diagnosis, recognition of scope of limitations, and

establishing a diagnosis and patient prognosis to guide PT intervention [16]. All of these areas are relevant to understanding TMD but are typically taught as applying to more than one condition or body region, and thus would not typically be counted as TMD-specific content. In addition, the reported time spent on TMD content does not account for any curricular time spent examining the cervical spine, an area frequently involved when treating TMD patients, or other conditions that may be related, such as a headache [17–22]. In addition to content related to TMD, PT programs must appropriately cover content for all body regions, including the spine, upper and lower extremities, as well as content outside of musculoskeletal PT, including neuromuscular, cardiovascular, pulmonary, and integumentary systems. There is limited evidence to inform how different PT programs weight teaching areas across different aspects of PT or across regions of the body to allow for a comparison of the findings in this study. A 2004 study examined weighting of content across different regions of the body in the context of teaching manipulation skills and showed that the average percent of the time in the entry-level PT curriculum devoted to the cervical spine was 8.9% [23]. However, that study did not identify if TMD or other forms of OFP were included in that number.

In regards to specific skills taught by respondent programs, the most consistent intervention tools taught across programs were skills that are foundational to PT practice and transcend body regions, such as joint mobilization/manipulation, therapeutic exercise, soft tissue mobilization, biobehavioral strategies, pain science and education, and postural education, all of which are important and evidence-supported, in the management of TMD problems [24–29]. Of the interventions identified that have limited universal support or evidence of effectiveness is cranio mobilization [30–32], and a lower percentage of program respondents reported teaching this (27.7%). The content with the lowest percentage of program respondents covering it, however, was oral appliance design (7%).

Interprofessional issues

Entry-level DPT programs are also expected to provide content in interprofessional education and teamwork [7], which is a professional responsibility of PTs in clinical practice. When working with an individual with TMD, PTs will routinely refer the patient to a dentist for an oral appliance when indicated. Indeed, approximately 45% of program respondents reported that oral appliance indications were taught in entry DPT curricula, thereby facilitating referral to and communication with dentists. What is not known from this study, however, is if the content is communicated related to different oral appliance designs based on TMD diagnostic subset. An oral appliance is a commonly used management strategy by dentists in the treatment of TMD [33–35]. If adequate content is not taught regarding evidence-based oral appliance recommendations in entry-level DPT programs as the results of this study suggest, upon graduation, a PT will have to rely on dental colleagues to choose an appropriate evidence-based design and the specific diagnostic subset the oral appliance is used for. Given the changing shape of dental education in relation to teaching TMD content at the predoctoral level, general dentists or dentists without specific OFP training may not be prepared to implement evidence-based oral appliance design for patients with TMD. In regards to interprofessional collaboration, the results of this survey identified that only a very small number of respondent programs provided opportunities for students to interact with other health-care professionals, including dentists. Physical therapy programs, and potentially dental education programs, should consider interprofessional opportunities to facilitate enhanced interprofessional communication to ensure patients are receiving optimal evidence-based care.

Opportunities for PT students to interact with individuals with TMD

In the didactic portion of the program, some programs have control of the types of patients seen through embedded clinical activities. However, this may be dependent on access to patients by faculty teaching this content or connections to dental schools. Overall, the opportunity to interact with an individual with TMD in the didactic portion of the program was low (Table 4). Opportunity to interact with patients with TMD was higher in the clinical portion of the curriculum (Table 4). No program could guarantee that every student would interact with a patient with TMD, since programs have little control over what type of patients their students work with while on clinical rotations. The results of this study do show, however, that not every PT student had the opportunity to work with an individual with TMD prior to graduation. Anecdotally, clinical opportunities to observe or work with TMD patients may mirror the percentage of patients seeking PT services for TMD. As patients and dental and medical professionals become more aware of the role of PT in evaluating and managing TMD, clinical opportunities for students to observe or work with TMD may increase. As continued evidence supports

the role of PT as a cost-effective and conservative approach for the management of individuals with TMD [24,36–38], more patients may be seen during a student's clinical rotations, giving a greater number of students real-time experience with a TMD patient. If the number of patients with TMD seen in clinical practice increases, the challenge to PT educators will be to increase entry-level TMD content in existing DPT curricula. However, it is also important that PT educators become proactive by staying current with the evidence and clinical practice patterns of TMD, so as to provide the necessary didactic and clinical experience for their students to both manage this underserved population of patients and educate the dental and medical professions on the role of the PT in management of TMD.

Post-professional educational opportunities for physical therapists in TMD

Beyond entry-level doctoral education, PTs have limited formal options to enhance their diagnostic and management skills in TMD or OFP. The American Board of Physical Therapy Specialties provides formal recognition for PTs with advanced clinical knowledge, experience, and skills in nine specialty areas of practice [39]. Evaluation and management of TMD and other forms of OFP is a small subset of the Orthopedic Clinical Specialist (OCS) certification [39]. The survey results showed that entry-level content related to TMD was taught exclusively by PTs in all responding programs, with the most common credential to teach TMD being "past clinical experience with TMD;" the second most common credential was having OCS certification. This specialist certification, however, is achieved by examination in a multiple-choice format with no oral or practical testing and includes only 3% of content dedicated to head, maxillofacial, or craniomandibular content [40]. Thus, it cannot be inferred that having past clinical experience with TMD or having an OCS indicates the faculty teaching this content has expert knowledge and/or clinical experience with TMD.

Orthopedic residency and fellowship programs are available for the PT at the post-graduate level. However, such programs provide limited educational experiences for TMD. A recent study investigated the didactic and clinical education exposure to TMD content by PTs enrolled in fellowship programs credentialed by the American Physical Therapy Association (APTA) and recognized by the American Academy of Orthopedic Manual Physical Therapists (AAOMPT) [41]. Fifteen out of 19 eligible fellowship programs in the US responded to an online survey, and the study concluded that despite a high level of clinical specialization, fellows-in-training receive minimal TMD education. A 2018 study investigated international PTs' education on TMD during post-professional Orthopedic Manual Physical Therapy education [42]. This comparison was done to account for the differences in health-care systems between the US and international programs through the International Federation of Orthopaedic Manual Physical Therapists (IFOMPT) jurisdictions. A total of 38 programs (62%) from 13 of 21 different nations/jurisdictions participated in the study, which concluded that, at the post-professional education level, little importance is placed on the temporomandibular region in many international programs. Given the limited US and international fellowship educational opportunities related to TMD, this places more importance on the entry-level PT professional education programs to teach defined and specific content related to TMD to prepare PT graduates for working with patients with TMD upon graduation.

If an orthopedic residency and fellowship program is not an option for practicing PTs interested in pursuing advanced knowledge on TMD or OFP, PTs must rely on unregulated continuing education courses for increasing their exposure to TMD content. Continuing education courses offered for credit may be required to get approval by a state's professional physical therapy association, although not all states require such approval. Educational experiences obtained from continuing education weekend courses can be mixed with some courses given online without any practical component or assessment of competency. Other opportunities available for the PT to gain educational opportunities in TMD can lead towards specialization in TMD, such as those offered by the Physical Therapy Board of Craniofacial & Cervical Therapeutics (www.ptbcct.org).

Limitations

No conclusions can be drawn about the content covered by non-responding programs. While there is no specific minimally acceptable survey response rate, 60% has been used to suggest an excellent response rate [43]. However, other recent studies surveying DPT educational programs regarding DPT content have response rates ranging from 31% [44] to 58.3% [23]. One recent study that examined self-perceived adequacy of entry-level education in PTs from Florida had a survey response rate of 0.04% [9]. The response rate in the current study was well above that, and while not in an excellent range, was within an acceptable

range at 37.5%. Possible reasons for the lower than desired response rate include the multiple requests for survey responses received by PT Programs, the use of electronic survey versus mailed survey, and the lack of incentive for completion. A 2004 study found a lower response rate for email survey of 20.7% compared to a postal survey [45]. Beyond several emails to encourage program participation, no follow-up was completed to assess non-response bias. The sample also was limited to US PT programs, without geographical data to show response distribution. Given differences in PT practice outside of the US, another study examining similar issues internationally would provide external validity. Additional limitations of this study include the use of survey methodology, which relies on self-report without any means to verify the accuracy of reported information, which is an inherent concern in survey methodology.

Conclusion

Physical therapists work as part of a multidisciplinary team in the diagnosis and management of patients with TMD, and a clear understanding of the predoctoral education of PTs will help to further foster this collaboration. Results of this study show that specific TMD content is covered as part of the entry-level curriculum in 98.8% of responding programs. However, the hours dedicated specifically to TMD in entry-level curricular content only reflect a small part of the preparation of a PT to screen, diagnose, and manage complex musculoskeletal problems. This survey identified several barriers with implications suggesting not all entry-level PTs are ready to work with patients with TMD. Barriers included PTs who may graduate without ever having worked with a patient with TMD, limited real-time patient experience, credentials and patient experience of faculty teaching TMD, and limited opportunities for students to interact with other health-care professionals involved in treating TMD. However, these barriers may be seen as minor obstacles when compared to the current dental and medical entry-level education of TMD. Clearer and consistent entry-level education guidelines related to TMD will improve the preparation of newly-graduated PTs. Additional post-professional education may be necessary to fill educational gaps to ensure that patients with TMD are not underserved by the profession of PT.

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Disclosure of interest

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ORCID

Kathy D. Hall PT, EdD http://orcid.org/0000-0002-5639-7700

References

[1] Macfarlane TV, Glenny AM, Worthington HV. Systematic review of population-based epidemiological studies of oro-facial pain. J Dent. 2001 September;29(7):451–467.

[2] Dworkin SF, LeResche L. Research diagnostic criteria for temporomandibular disorders: review, criteria, examinations and specifications, critique. J Craniomandib Disord. 1992 Fall;6(4):301–355.

[3] Manfredini D, Guarda-Nardini L, Winocur E, et al. Research diagnostic criteria for temporomandibular disorders: a systematic review of axis I epidemiologic findings. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2011 October;112(4):453–462.

[4] American Academy of Orofacial Pain, de Leeuw R, Klasser GD, editors. Orofacial pain guidelines for assessment, diagnosis, and management. 6th ed. Hanover Park, (IL): Quintessence Publishing Co, Inc; 2018.

[5] Gadotti IC, Hulse C, Vlassov J, et al. Dentists' awareness of physical therapy in the treatment of temporomandibular disorders: a preliminary study. Pain Res Manag. February 2018;1–8.

[6] American Physical Therapy Association. Direct access utilization survey report. Alexandria, VA: American Physical Therapy Association; 2017.

[7] Commission on Accreditation in Physical Therapy Education. Standards and required elements for accreditation of physical therapist education programs. American Physical Therapy Association. Online: 1–34; section 7c. http://www.capteonline.org/uploadedFiles/CAPTEorg/About_CAPTE/Resources/Accreditation_Handbook/CAPTE_PTStandardsEvidence.pdf. Accessed 2018, December 31.

[8] American Physical Therapy Association. Guide to physical therapist practice 3.0. Alexandria, VA: APTA; 2014. http://guidetoptpractice.apta.org/.

[9] Gadotti IC, Lakow A, Cheung J, et al. Physical therapists' self-perceived adequacy of entry-level education and their current confidence levels with respect to temporomandibular disorders: a pilot study. CRANIO®. September 28, 2018;1–8.

[10] Klasser GD, Greene CS. Predoctoral teaching of temporomandibular disorders: a survey of U.S. and Canadian dental schools. J Am Dent Assoc. 2007 February;138(2):231–237.

[11] DiCaprio MR, Covey A, Bernstein J. Curricular requirements for musculoskeletal medicine in American

medical schools. J Bone Joint Surg Am. 2003 March;85-A(3):565–567.
[12] Hampton T. Improvements needed in management of temporomandibular joint disorders. JAMA. 2008 March 12;299(10):1119–1121.
[13] Schiffman E, Ohrbach R, Truelove E, et al. Diagnostic criteria for temporomandibular disorders (DC/TMD) for clinical and research applications: recommendations of the international RDC/TMD consortium network and orofacial pain special interest group. J Oral Facial Pain Headache. 2014 Winter;28(1):6–27.
[14] Rocabado M. Diagnosis and treatment of abnormal craniocervical and craniomandibular mechanics. Knoxville, TN: Rocobado Institute; 1981.
[15] Harrison AL, Thorp JN, Ritzline PD. A proposed diagnostic classification of patients with temporomandibular disorders: implications for physical therapists. J Orthop Sports Phys Ther. 2014 March;44(3):182–197.
[16] American Physical Therapy association. Minimum required skills of physical therapist graduates at entry-level. Alexandria, VA: American Physical Therapy Association. 2019.
[17] Ciancaglini R, Testa M, Radaelli G. Association of neck pain with symptoms of temporomandibular dysfunction in the general adult population. Scand J Rehabil Med. 1999 March;31(1):17–22.
[18] Olivo SA, Fuentes J, Major PW, et al. The association between neck disability and jaw disability. J Oral Rehabil. 2010 September;37(9):670–679.
[19] Funakoshi M, Fujita N, Takehana S. Relations between occlusal interference and jaw muscle activities in response to changes in head position. J Dent Res. 1976 July-August;55(4):684–690.
[20] Boyd CH, Slagle WF, Boyd CM, et al. The effect of head position on electromyographic evaluations of representative mandibular positioning muscle groups. CRANIO®. 1987 January;5(1):50–54.
[21] Yotsuya M, Sato T, Kawamura S, et al. Electromyographic response in inferior head of human lateral pterygoid muscle to anteroposterior postural change during opening and closing of mouth. Bull Tokyo Dent Coll. 2009;50(4):191–198.
[22] VisscherCM, De Boer W, Lobbezoo F, et al. Is there a relationship between head posture and craniomandibular pain? J Oral Rehabil. 2002 November;29(11):1030–1036.
[23] Boissonnault W, Bryan JM, Fox KJ. Joint manipulation curricula in physical therapist professional degree programs. J Orthop Sports Phys Ther. April 2004;34 (4):171–178. discussion 179–181.
[24] McNeely ML, Armijo Olivo S, Magee DJ. A systematic review of the effectiveness of physical therapy interventions for temporomandibular disorders. Phys Ther. 2006 May;86(5):710–725.
[25] Medlicott MS, Harris SR. A systematic review of the effectiveness of exercise, manual therapy, electrotherapy, relaxation training, and biofeedback in the management of temporomandibular disorder. Phys Ther. 2006 July;86(7):955–973.
[26] Armijo-Olivo S, Pitance L, Singh V, et al. Effectiveness of manual therapy and therapeutic exercise for temporomandibular disorders: systematic review and meta-analysis. Phys Ther. 2016 January;96(1):9–25.
[27] Calixtre LB, Moreira RF, Franchini GH, et al. Manual therapy for the management of pain and limited range of motion in subjects with signs and symptoms of temporomandibular disorder: a systematic review of randomised controlled trials. J Oral Rehabil. 2015 November;42(11):847–861.
[28] Martins WR, Blasczyk JC, Aparecida Furlan de Oliveira M, et al. Efficacy of musculoskeletal manual approach in the treatment of temporomandibular joint disorder: a systematic review with meta-analysis. Man Ther. 2016;21:10–17.
[29] De Laat A, Stappaerts K, Papy S. Counseling and physical therapy as treatment for myofascial pain of the masticatory system. J Orofac Pain. 2003 Winter;17 (1):42–49.
[30] Green C, Martin CW, Bassett K, et al. A systematic review of craniosacral therapy: biological plausibility, assessment reliability and clinical effectiveness. Complement Ther Med. 1999 December;7 (4):201–207.
[31] Rogers JS, Witt PL, Gross MT, et al. Simultaneous palpation of the craniosacral rate at the head and feet: intrarater and interrater reliability and rate comparisons. Phys Ther. 1998 November;78(11):1175–1185.
[32] Rogers JS, Witt PL. The controversy of cranial bone motion. J Orthop Sports Phys Ther. 1997 August;26(2):95–103.
[33] Adibi SS, Ogbureke EI, Minavi BB, et al. Why use oral splints for temporomandibular disorders (TMDs)? Tex Dent J. 2014 June;131(6):450–455.
[34] Le Resche L, Truelove EL, Dworkin SF. Temporomandibular disorders: a survey of dentists' knowledge and beliefs. J Am Dent Assoc. 1993 May;124(5):90–94, 97–106.
[35] Von Korff MR, Howard JA, Truelove EL, et al. Temporomandibular disorders. Variation in clinical practice. Med Care. 1988 March;26(3):307–314.
[36] Sturdivant J, Fricton JR. Physical therapy for temporomandibular disorders and orofacial pain. Curr Opin Dent. 1991 August;1(4):485–496.
[37] Kraus SL. Physical therapy management of temporomandibular disorders. In: Fonseca RJ, editor. Oral and maxillofacial surgery: temporomandibular disorders. Vol. 4. St. Louis MO: WB Saunders Company; 2000. p. 161–193.
[38] Kraus S, Prodoehl J. Outcomes and patient satisfaction following individualized physical therapy treatment for patients diagnosed with temporomandibular disc displacement without reduction with limited opening: a cross-sectional study. CRANIO®. October 4, 2017: 37 (1):1–8.
[39] American Board of Physical Therapy Specialties. Alexandria, VA: American Physical Therapy Association. http://www.abpts.org. 2018 Accessed 2018 Oct 18.
[40] American Board of Physical Therapy Specialties. 2019 Orthopedic specialist certification candidate guide. Alexandria, VA: American Physical Therapy Association; 2018: 1–13. Section 11. http://www.abpts.org/uploadedFiles/ABPTSorg/Specialist_Certification/Orthopaedics/SpecCert_Orthopaedic_Application.pdf.
[41] Shaffer SM, Brismee J, Courtney CA, et al. The status of temporomandibular and cervical spine education in credentialed orthopedic manual physical therapy fellowship programs: a comparison of

didactic and clinical education exposure. J Man Manip Ther. 2015;23(1):51–56.
[42] Shaffer SM, Stuhr SH, Sizer PS, et al. The status of temporomandibular and cervical spine education in post-professional physical therapy training programs recognized by Member Organizations of IFOMPT: an investigation of didactic and clinical education. J Man Manip Ther. 2018;26(2):102–108.
[43] Johnson TP, Wislar JS. Response rates and nonresponse errors in surveys. JAMA. 2012 May 2;307 (17):1805–1806.
[44] Pullen SD, Bruns EL, Dawkins NG, et al. HIV-related content in physical therapist education programs: a curricular needs assessment. J Phys Ther Ed. 2017;31 (1):80–85.
[45] Kaplowitz MD, Hadlock TD, Levine R. A comparison of web and mail survey response rates. Public Opin Q. 2004;68(1):94–101.

Appendix 1

SURVEY

Section I: Program Demographics

1. How many years since your inaugural physical therapy (PT) class graduated? (if in candidacy, mark 0)
   _____ years since inaugural class graduated

2. What is the total length of your entry-level PT program?
   _____ Didactic program
   _____Full time clinical experiences

3. How many students were enrolled in the most recent graduating entry-level PT class?
   _____ students

4. Which of the following applies to the entry-level PT program at your institution (check all that apply)?
   - ☐It is within an institution that has a primary focus on health science education
   - ☐It is within an institution that has a primary focus on liberal arts education
   - ☐It is within an institution that has a primary research focus
   - ☐It is within an institution that has a medical education program
   - ☐It is within an institution that has a dental education program
   - ☐The program has an orthopedic/manual therapy residency program associated with it
   - ☐It is within a public institution
   - ☐It is within a private institution
   - ☐The program is offered, at least partly, remotely
   - ☐Other (define):

Section II: Curricular content

5. Is content related to evaluation and/or management of temporomandibular disorders (TMD) currently included in your entry-level PT program? Branching logic. ***If yes, go to Question 6, if no go to Question 20***
   - ☐Yes
   - ☐No

6. How long has TMD content been integrated into your entry-level PT program's curriculum? (enter in years)

7. Identify how TMD content is currently being taught within your entry-level PT curriculum (check only one)?
   - ☐Part of a required clinical science course (e.g. part of musculoskeletal or orthopedic course)
   - ☐As a required separate course focused on orofacial pain and/or a headache
   - ☐Content only offered as an elective
   - ☐Other (comments to specify)

8. How many total hours does the curriculum spend teaching TMD specific content in each of the following areas?
   - ☐Number of hours for lecture/discussion hours for temporomandibular joint (TMJ) structure/function including anatomy and/or kinesiology
   - Number of hours for lecture/discussion for examination/evaluation
   - Number of hours for lecture/discussion for treatment/intervention

9. Considering only the **didactic** portion of the entry-level PT curriculum, which of the following describes the opportunities for students to interact with individuals with **TMD** (check the one answer that best describes your program):
   - ☐Every student has at least one opportunity to observe or work with an individual with TMD
   - ☐The majority of students have at least one opportunity to observe or work with an individual with TMD
   - ☐Some students may have at least one opportunity to observe or work with an individual with TMD
   - ☐No opportunities exist to observe or work with individuals with TMD
   - Comments:

The next two questions will ask how similarly/differently TMD content is taught in the curriculum compared to other body regions:

10. This question now asks you to consider individuals with spinal problems (i.e. movement problems associated with the cervical, lumbar or thoracic spine). Considering only the **didactic** portion of the entry-level PT curriculum, which of the following describes the opportunities for students to interact with individuals who have **spinal conditions** (check the one answer that best describes your program):

□Every student has at least one opportunity to observe or work with individuals with spinal problems
□The majority of students have at least one opportunity to observe or work with individuals with spinal problems
□Some students may have at least one opportunity to observe or work with individuals with spinal problems
□No opportunities exist to observe or work with individuals with spinal problems
Comments:

11. This question now asks you to consider individuals with extremity problems (i.e. movement problems associated with upper or lower limb structures). Considering only the **didactic** portion of the entry-level PT curriculum, which of the following describes the opportunities for students to interact with individuals with **extremity problems** (check the one answer that best describes your program):
□Every student has at least one opportunity to observe or work with individuals with extremity problems
□The majority of students have at least one opportunity to observe or work with individuals with extremity problems
□Some students may have at least one opportunity to observe or work with individuals with extremity problems
□No opportunities exist to observe or work with individuals with extremity problems
Comments:

12. Returning now to a consideration of TMD in the **clinical/practicum** component of the entry-level PT curriculum, have your students reported any opportunities to see individuals with TMD during their clinical placements or practica? (check the one answer that best describes your program)
□Every student has at least one opportunity to observe or work with individuals with TMD
□The majority of students have at least one opportunity to observe or work with individuals with TMD
□Some students may have at least one opportunity to observe or work with individuals with TMD
□No opportunities exist to observe or work with individuals with TMD
Comments:

13. Which of the following TMD diagnostic sub-categories do you feel that your curriculum prepares the entry-level PT to diagnose (check all that apply):
□Local myalgia
□Myofascial pain with referral
□Arthralgia
□Headache attributed to TMD
□Disc displacement with reduction
□Disc displacement with reduction, with intermittent locking
□Disc displacement without reduction, with limited opening
□Disc displacement without reduction, without limited opening
□Degenerative joint disease
□Subluxation
□Other

14. Are either the Diagnostic Criteria for Temporomandibular Disorder (DC/TMD) or the Research Diagnostic Criteria for Temporomandibular Disorder (RDC/TMD) used in teaching diagnostic classification of TMD in the entry-level PT curriculum?
□Yes
□No
If no, what diagnostic criteria is used?_____

15. Which of the following TMD diagnostic sub-categories do you feel that your curriculum prepares the entry-level PT to appropriately treat/manage? (check all that apply):
□Local myalgia
□Myofascial pain with referral
□Arthralgia
□Headache attributed to TMD
□Disc displacement with reduction
□Disc displacement with reduction, with intermittent locking
□Disc displacement without reduction, with limited opening
□Disc displacement without reduction, without limited opening
□Degenerative joint disease
□Subluxation
□Other
□Comments:

16. Which of the following specific treatment/intervention strategies are taught within the context of TMD management in the entry-level PT program? Check all that apply:
Joint mobilization/manipulation
□Therapeutic exercise
□Soft tissue mobilization
□Trigger point dry needling
□Appliance indications
□Appliance design
□Biobehavioral strategies
□Pain science and education
□Postural education
□Cranio mobilization
□Post-operative TMJ surgical management
□Other

17. Which of the following best describes how physical agents and/or electrotherapy is covered specific to the management of TMD: (check only one)
□General course on physical agents and/or electrotherapy with the intention to apply to all clinical conditions that may include TMD
□Specific application of physical agents and/or electrotherapy to TMD problems

18. How would you define the evidence to support the effectiveness of PT for the management of TMD?
□Weak
□Moderate

□Strong
□Do not know

19. What options are available for assessing student competency in TMD content in the entry-level PT program? (Check all that apply)
□Written exam questions
□Psychomotor skill assessment
□Practical examinations which incorporate psychomotor skill performance and clinical decision-making

Show Questions 20–25 only if no to Question 5:

20. In your opinion, what is the priority to include TMD specific content into the musculoskeletal content of an entry-level PT curriculum considering the scope of expectations of an entry-level PT?

10 cm visual analogue slider:
From lowest priority of all body regions to the highest priority of all body regions

21. Do you believe that content related to the evaluation and treatment of TMD is included in the current edition of the Guide to PT Practice?
□Yes
□No

22. Do you believe that content related to the evaluation and treatment of TMD is included in the current national licensing examination for PTs?
□Yes
□No
□Don't know

23. Are there any plans to add specific TMD content (evaluation and/or intervention) to your entry-level PT curriculum? ***(If no, REDcap forced a jump to Question 26)***
□Yes
□No

24. Considering only existing plans for including TMD content in the entry-level PT curriculum, identify how TMD content will be taught within the entry-level curriculum (check all that apply):
□As part of a required clinical science course (e.g. part of musculoskeletal or orthopedic course)
□As a required separate course focused on orofacial pain and/or headache
□As an elective
□Other (comments to specify)

25. How many total hours would you plan to allocate in the entry-level PT program curriculum to teach TMD content in each of the following areas?
____Number of hours for lecture/discussion hours for TMJ structure/function including anatomy and/or kinesiology
____Number of hours for lecture/discussion for examination/evaluation

____Number of hours for lecture/discussion for treatment/intervention

Section III: Faculty

26. Who currently teaches evaluation and treatment of TMD related content in the entry-level PT program curriculum? (check all that apply)
□Physical therapist who is a core full-time or part-time PT program faculty member
□Physical therapist who is an adjunct or guest faculty member
□Non-physical therapist who is a core full-time or part-time PT program faculty member

Define profession

□Non-physical therapist who is an adjunct or guest faculty member

Define profession

□Other

27. What credentials does the physical therapist teaching TMD content in the entry-level program either currently holds or has held in their career (check all that apply):
□OCS
□FAAOMPT
□Certified in manual therapy – Identify the certification
□Certified in TMD – Identify the certification
□Define
□Orthopedic residency/fellowship training
□Continuing education certificate in TMD content
□Past clinical experience with TMD
□Current clinical practice involving patients with TMD

28. How many total years of clinical experience, regardless of content area, does the person primarily responsible for teaching evaluation and treatment of TMD content in the entry-level PT program have? (answer in years)

29. How many years of clinical experience, specifically related to the evaluation and treatment of individuals with TMD, does the person responsible for teaching TMD content in the entry-level PT program have? (answer in years)

30. What credentials do you feel is the minimum that an individual must have to teach TMD evaluation and intervention content to PT students at the entry level? (check all that apply)
□Is a physical therapist
□OCS
□FAAOMPT
□Certified in manual therapy
□Certified in TMD
□Orthopedic residency/fellowship training
□Continuing education certificate in TMD content
□Past clinical experience with TMD
□Current clinical practice involving patients with TMD

31. Do your students interact with any of the following professionals specifically related to the diagnosis and/or management of individuals with TMD within the entry-level PT program? (check all that apply)
□physical therapists

- □physicians
- □dental professionals
- □neurologists
- □ENTs
- □Chiropractors
- □others
  Define

Finally, a few demographic questions about you:

32. What is your gender?
    - □Male
    - □Female

33. What is your age? (answer in years)

34. Are you the person primarily responsible for coordinating or teaching TMD content somewhere in the PT curriculum?
    - □Yes
    - □No

35. What is your specific role within the entry-level PT program?
    - □PT Program director/chair
    - □Core PT faculty member
    - □Adjunct faculty

36. What is your **entry-level** physical therapy degree? Check only 1
    - □Certificate
    - □Diploma
    - □Bachelor's degree or equivalent
    - □Master's degree
    - □DPT
    - □Other

37. What is your **highest earned** academic degree? Check only 1
    - □Certificate
    - □Diploma
    - □Bachelor's degree or equivalent
    - □Master's degree
    - □DPT
    - □PhD
    - □EdD
    - □Other advanced post-professional doctoral degree
    - □Other

38. Have you ever held any of the following certifications? (check all that apply)
    - □American Board of Physical Therapist Specialties certification, Orthopedic Clinical Specialist (OCS)
    - □American Board of Physical Therapist Specialties certification, non-OCS (i.e. other)
    - □Other certifications