



C-TMD IMPACT

Center for TMD IMproving PAtient-
Centered Translational Research

Center for TMD-IMPACT Patient and Clinician Needs Assessment Report

September 2024



USC University of
Southern California

About this Report

This report was prepared by the University of Southern California, Center for TMD-IMPACT. This project was conducted as part of the TMD Collaborative for IMproving PATient-Centered Translational Research during a one-year planning phase to develop a national, interdisciplinary, patient-centered research collaborative that will advance basic, translational, and clinical research to improve prevention, diagnosis, and treatment of temporomandibular disorders. This report details the results of two surveys administered to patients and clinicians to uncover unmet needs in the prevention, diagnosis, and treatment of temporomandibular disorders (TMD).

Authors and Center for TMD IMPACT Team

Report Authors

Nicole Tam
VyVy Nguyen, MPH

Grant Personnel and Collaborators

Yang Chai, DDS, PhD	Robert Schuler, PhD	Michael Jamieson, DRSc	Mariela Padilla, DDS, MEd
Jianfu Chen, PhD	Bridget Samuels, PhD	Nancy Lane, MD	Jason Pomerantz, MD
Glenn Clark, DDS, MS	Mohammad Abou-el- enein, MD, PhD, MSPH	Jeffrey Lotz, PhD	Mark Urata, MD, DDS
Carl Kesselman, PhD	Thomas Buchanan, MD	Eunjoo Pacifici, PharmD, PhD	

Acknowledgments

We gratefully acknowledge funding from NIDCR/NIH R34DE033572-01. The report contents are solely the responsibility of the authors and do not necessarily reflect the views of NIDCR/NIH. We gratefully acknowledge the contributions of Nicole Tam in collecting the data and writing this report. We would also like to acknowledge the clinic staff at the USC Orofacial Pain and Oral Medicine Clinic for the assistance during data collection.

Table of Contents

Executive Summary	1
Background/Introduction	2
Temporomandibular Disorders	2
Center for TMD IMPACT	2
Method	3
Survey Development	3
Survey Administration.....	3
Patient.....	3
Clinician.....	4
Analysis	4
Results	4
Patient Survey.....	4
Clinician Survey.....	8
Limitations.....	13
References	14

Executive Summary

During a one-year planning phase, the Center for TMD-IMPACT (C-TMD IMPACT) established at the University of Southern California conducted a needs assessment to uncover unmet clinical needs related to temporomandibular disorders (TMDs). Two surveys were administered to better understand the needs of patients who experience symptoms of TMD and clinicians who treat patients experiencing symptoms of TMD. Patients indicated priority areas for improved TMD treatment: 1) better coverage of treatment, 2) faster and more immediate access to care, 3) more frequent appointments, 4) better information about TMD, 5) more knowledgeable providers to enhance treatment quality, and 6) overall better bedside manners from clinicians. Clinicians indicated priority areas for TMD treatment: (1) addressing gaps in phenotyping and pain research related to TMDs, (2) improving patient accessibility to care, and (3) improving the quality of care through interdisciplinary care, improved educational curriculum and opportunities, and better technology and software.

Background

Temporomandibular Disorders

Temporomandibular disorders (TMD) are a group of over 30 conditions affecting the temporomandibular joints (TMJs) and surrounding muscles and ligaments. The joints, muscles, and ligaments allow for movements necessary for chewing, speaking, and facial expressions. TMD can manifest as pain in the jaw, face, or neck, difficulty or discomfort in chewing, a clicking or locking of the jaw, and headaches. The exact cause of TMDs is often multifactorial, including factors like jaw injury, arthritis, teeth grinding (bruxism), and stress, which can lead to muscle tension and inflammation around the TMJ.¹

TMD can affect people of all ages but is most seen in adults between the ages of 20 and 40, with a higher prevalence in women than men. The impact of TMD on individuals can be significant, leading to chronic pain, reduced quality of life, and limitations in daily activities such as eating and speaking. Current treatments for TMD range from conservative approaches like physical therapy, stress management, and oral splints to more invasive procedures like injections and surgery. Addressing TMD is crucial due to its potential to cause chronic pain and dysfunction, emphasizing the need for effective prevention, diagnostic, and treatment strategies and ongoing research to improve patient outcomes.¹

Center for TMD IMPACT

The Center for TMD IMPACT is a premier center for the development of innovative therapies for temporomandibular disorders. In a one-year planning phase, C-TMD IMPACT has been developing the necessary structure to support the development of preventative, diagnostic, and treatment solutions to address TMDs. C-TMD IMPACT will be organized in a “hub and spoke” architecture and integrated within the larger TMD IMPACT Collaborative. During this one-year planning phase, C-TMD IMPACT has had three objectives:

- To develop the multi-institutional infrastructure and operational procedures to complete the launch of C-TMD IMPACT.
- To establish strong working relationships with other funded teams that may comprise the Collaborative in the next phase and to work with NIDCR/NIH to define the Collaborative’s structure and the roles of each team within the framework.
- To enable this translational and “big data” infrastructure to be put in service of the TMD IMPACT Collaborative by applying our experiences and best practices gleaned from operating C-DOCTOR and FaceBase to C-TMD IMPACT. Clinical implementation is at the core of C-TMD IMPACT and the “hub-and-spoke” architecture is visible in Figure 1.

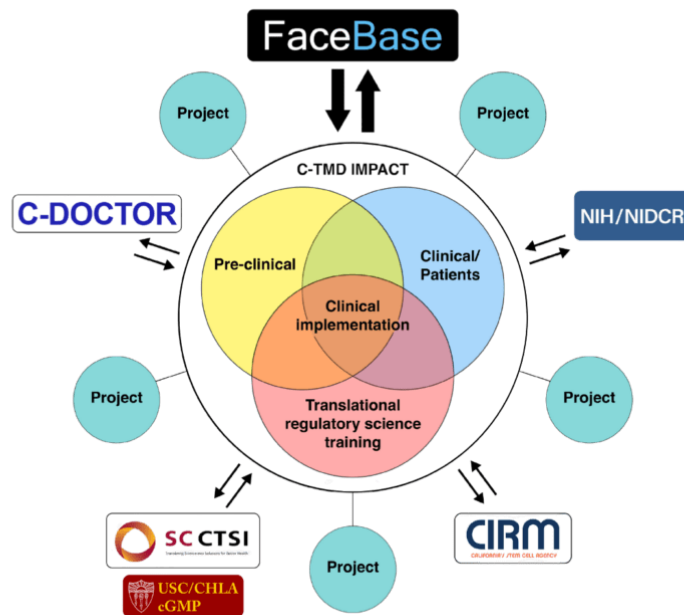


Figure 1. The hub-and-spoke architecture of C-TMD IMPACT demonstrates the projects which will be served by C-TMD IMPACT at the core and benefit from external resources.

Method

Survey Development

Two surveys were developed: one for patients and one for clinicians. The patient survey contained three main sections: 1) patient demographics, 2) patient description of symptoms, and 3) patient description of treatments. The patient survey was reviewed and refined by practicing clinicians and TMD patient advocates to improve the breadth of knowledge gained through the survey and align with current treatment definitions and classifications. The clinician survey contained three sections: 1) clinician demographics, 2) opinions on the current standard of treatment for TMD, and 3) opinions on how to improve the current standard of treatment for TMD. The clinician survey was reviewed and refined by practicing clinicians to improve the clarity of responses and align with current treatment definitions and classifications. Refer to Appendix A–B for the patient and clinician surveys.

Survey Administration

Patient

Between May 2024 and July 2024, a patient survey was administered at the USC Orofacial Pain and Oral Medicine Center in Los Angeles, California by C-TMD IMPACT project staff. The purpose of the survey was to uncover unmet clinical needs to support further research aimed at improving patient care and treatment for TMD by surveying patients with TMDs or patients who currently have or previously experienced TMD symptoms. The survey took approximately 10–20

minutes to complete and was administered electronically via REDCap, with patients having the option to complete it themselves or receive assistance from project staff. For Spanish-speaking patients, bilingual project staff read translated documents and translated patient responses, while another member of the project staff entered the responses into the electronic survey form.

Clinician

Between June 25 and August 14, 2024, data collection for the clinician survey took place. The survey was conducted electronically via REDCap, targeting practicing clinicians around the Los Angeles and San Francisco Bay areas who treat patients with TMDs. The contact information for potential participants was provided by C-TMD IMPACT clinician study team members, and the study team reached out via email to request their participation.

Analysis

Quantitative results were analyzed using IBM SPSS 29. Qualitative responses were reviewed to find common responses and recurring themes.

Results

Patient Survey

There were 103 survey participants. Demographic information describing the participants can be found in Appendix C. Tables 1–5 show descriptive information regarding the survey participants' temporomandibular disorders (e.g., length of symptoms, symptoms experienced, treatment providers, treatments received).

In summary, 85% of survey participants have experienced chronic symptoms of TMD (i.e., symptom duration 6 months or longer). Most participants (95%) reported experiencing symptoms at the time of the survey. For the TMD classification, 76% of participants reported disorder of the temporomandibular joint, 61% reported disorders of the masticatory muscles, and 65% reported headaches associated with TMD. Participants were able to select more than one answer. About 63% of the participants had received an official diagnosis of temporomandibular disorder. Participants reported that dentists and physicians were the providers that addressed their TMD symptoms at 83% and 35%, respectively.

The most common symptoms experienced by the participants include pain in the teeth, gums, salivary gland, or jaw bone (69%); pain in the chewing muscles (75%); limited movement, locking, clicking, or grating of the jaw (78%); and headaches and migraines (69%). The most common treatments received by the participants include jaw stretching and strengthening exercises (83%), prescription medication (51%), and lifestyle changes (50%).

Table 1. Length of symptom duration

	Number of responses	Percent
Less than one month	1	1
Between 1 and 3 months	6	6
Between 3 month and 6 months	7	7
Between 6 and 12 months	12	12
1 to 3 years	29	28
3 to 5 years	13	13
5 to 7 years	4	4
7 to 10 years	6	6
Greater than 10 years	24	23
Prefer not to answer	1	1

Table 2. Description of survey participants' TMD

	Number of "Yes" responses	Percent
Do you currently have or have you had (in the past) symptoms of a temporomandibular disorder?	98	95
From the following three classifications, which best describes the temporomandibular disorder(s) you have/had?		
Disorder of the temporomandibular joint	78	76
Disorder of the muscles for chewing	63	61
Headaches related to temporomandibular disorder	67	65
Is your temporomandibular disorder a result of an injury?	11	11
Have you received an official diagnosis of temporomandibular disorder?	65	63

Table 3. Types of providers addressing survey participants' TMD

	Number of responses	Percent
Dentist	85	83
Physician	36	35
Physical therapist	7	7
Behavioral therapist	2	2
None	3	3
Other*	6	6

*Other: Chiropractor (1), Neurologist (2), TMJ specialist (1), first time here (1), have had past treatment (1)

Table 4. TMD Symptoms experienced by survey participants

	Number of responses	Percent
Pain in the teeth, gums, salivary gland, or jaw bone	71	69
Pain in the chewing muscles	77	75
Pain in the jaw joint without inflammation	39	38
Pain in the jaw joint due to inflammation	43	42
Limited movement, locking, clicking, or grating of the jaw	80	78
Nerve-related (trigeminal and/or glossopharyngeal nerve) pain	33	32
Pain that spreads to the face or neck	60	58
Ringing in the ears, hearing loss, or dizziness	44	43
Headaches, migraines	71	69
Other*	6	6

*Other: Constant contractures in neck due to grinding (1), cracked at least 2 but probably 4 molars as a result of intense clenching. cracked temp crowns placed twice while awaiting permanent crown (1 week), wore down natural teeth. changed bite alignment as a result of night clenching (1), cracking sounds and popping noise; earaches (1), difficulty to eat (1), numbness in gums (1), pain in temples (1)

Table 5. Treatment methods to address TMD in survey participants

	Number of responses	Percent
Jaw stretching and strengthening exercises	85	83
Over-the-counter medication	32	31
Lifestyle changes (e.g., reduce gum chewing, reduce nail biting)	51	50
Behavioral health therapy	9	9
Physical therapy	30	29
Prescription medication	53	51
Intraoral appliances (e.g., nightguards)	39	38
Muscle injections*	30	29
Temporomandibular Joint injections**	3	3
Arthrocentesis	0	0
Arthroscopy	1	1
Surgery	0	0
Prefer not to answer	2	2

*Yes to muscle injections: Anesthetic (1), Anesthetic (trigger point) (2), Botox (2), Botox (Masseter) (1), Botox/Dysport (1), Lidocaine 5% trigger point (4), Lidocaine injections (8), Muscle focused acupuncture in jaw (1), Trigger point injections (3), Unsure (7)

**Yes to TMJ injections: Lidocaine injections (3)

The symptoms that the participants reported as most impactful (detrimental) were headaches, migraines, jaw and muscle pain, difficulty sleeping and eating, limited mouth movement, face

and neck pain, and clicking sounds in the jaw. Participants reported that these symptoms severely impacted their quality of life resulting in difficulty sleeping, eating, and talking. One participant noted the significant financial burden that has resulted from TMD-related clenching, "The fact that I clench affects my life the most because it has result in high financial costs (~10,000) due to crowns needed as a result of cracks." Below are two other representative responses from the survey participants regarding the impact of symptoms on their lives. One participant described the impact of TMD symptoms on their lives saying, "I would say the constant pain would hurt the most and gives me a lot of frustration, often it is hard to sleep from the pain and eat and yawn." Another participant stated, "It's hard to focus when you're in too much pain. Having migraines almost every day really stopped me from having fun and enjoying the day."

Most participants (59%) reported that their treatment(s) had improved their symptoms, while 28% of participants reported the contrary. For those who reported improved symptoms, the effective treatments include jaw stretching/exercises, lidocaine/trigger point injections, medication, and nightguards. Survey participants noted that exercises were effective in relieving jaw and muscle pain, headaches, jaw locking, and inflammation, allowing participants to eat, sleep, and have an improved overall quality of life. One participant mentioned, "Jaw exercises and stretches helped the jaw muscle soreness slowly go away and helped me feel more relaxed." Participants also reported that injections, nightguards, and medication improved pain, jaw tightness, and inflammation. Another participant highlighted, "Temporary relief pain in muscles and nerves. In addition, the nightguard helps reduce pressure, chipping, and wearing down of teeth." These treatments collectively contributed to enhanced patient outcomes.

For those that reported that treatments had not improved their symptoms, several were first-time patients and had not received treatment or had only just received a treatment plan from their provider. However, some participants reported that treatments, especially appliances/nightguards, did not improve or worsened their symptoms. One patient reported that the "last treatment was a mouth device that changed my bite and made my symptoms so much worse." Another participant stated, "I feel like by doing the stretches and strengthening exercises, my TMJ disorder got worse. Prior to doing them, I had little to no pain when opening my mouth, but since starting them, so has the pain." Many participants also reported that no prescribed treatments had made a significant difference. A participant stated, "I have not received real treatment for this medical issue. My previous doctor told me to take aspirin, which did not help at all. I tried jaw muscle exercises on my own at home, which did not make a difference."

Survey participants were asked to describe the top three ways to improve care for patients with TMD. The responses varied widely; however, most patients expressed a desire for improved care/payment coverage, faster and more immediate access to care, more frequent appointments, better information about TMD, more knowledgeable providers to enhance treatment quality, and overall better bedside manners from clinicians. As the survey collection site was in Los Angeles, the participant responses may highlight the difficulty in accessing TMD care in their region.

A common theme among responses was the significant financial and insurance barriers faced when seeking TMD treatment. One participant remarked, “Due to my insurance not being accepted by other places, I wasn't able to go to a TMJ specialist that was recommended by other dentists.” This sentiment reflects a broader issue where patients have noted a substantial lack of TMD treatment coverage with both dental and medical insurances. Another participant shared, “I was just diagnosed, so I do not know how these treatments will work. Treatment for TMD can be improved by better access to dentists and doctors who can treat. Currently, regular dental coverage does not [cover it], and neither does regular medical coverage, which leaves a huge gap.”

Participants expressed a need for TMD treatment that involved better education for patients and exploring other forms of treatment beyond traditional methods. They emphasized the importance of “continuous follow-up with primary care (PC) along with physical therapy (PT) and muscle relaxation techniques,” highlighting that ongoing support is crucial for effective management. Other participants also noted that lifestyle changes and improved educational resources could significantly enhance patient understanding of the condition, ultimately leading to better self-management and outcomes.

Several participants reported the need for clinicians to have better bedside manners and to adopt more supportive approaches. One participant expressed frustration, stating, “I also hope for other dentists/doctors to assume that because symptoms aren't improving, it doesn't mean the patient isn't doing the recommended exercises or treatments.” Another participant recounted a particularly disheartening experience: “While I was at USC dentistry, one of the dentists told me that the only way I was going to get better was to pray to God.” Such experiences underscore the need for sensitivity and professionalism in patient interactions.

There is a clear call for better guidance on treatment plans and comprehensive provider education to bridge the gaps in patient care and improve overall outcomes. Addressing these issues could lead to significant improvements in the management and treatment of TMD.

Clinician Survey

There were 17 clinicians that participated in the survey. Two clinicians did not complete the survey, but data from their partial responses are included in this report. Participants reported demographic information such as their provider type, clinical specialty, volume of patients treated, and practice type as seen in Tables 6–10. In response to many of these questions, the participants were able to select more than one answer choice. See Appendix B for the full survey. In summary, most participants were dentists (88%). The most common clinical specialty was orofacial pain/oral medicine (88%), with few specialists in oral and maxillofacial pathology (6%), prosthodontics (6%) and rheumatology (6%). Most participants reported working in a private practice or teaching clinic setting; others reported working in a faculty practice or hospital as seen in Table 8. As shown in Table 9, the most reported volumes of patients ranged from 51-100 (24%) and 151-200 (24%) patients seen monthly. The most common treatment strategies used by the participants were patient education and self-management (94%),

pharmacological management (94%), physical therapy (88%), orthopedic appliances (88%), and interventions (including injections) (82%).

Most participants reported having adequate professional education (71%) while others reported not having adequate professional education (24%) to treat patients with TMDs. Participants who reported having adequate professional education reported participating in orofacial pain residencies in which they were able to gain hands-on experience with TMD patients. Those who reported having an inadequate professional education stated that there needs to be more education on the specifics of TMD in their professional school curriculum.

Table 6. Provider type of survey participants

	Number of responses	Percent
Dentist	15	88%
Physician	1	6%
Physical Therapist	1	6%
Behavioral Therapist	0	0
Other	1	6%

Table 7. Clinical specialty of survey participants

	Number of responses	Percent
Orofacial Pain/Oral Medicine	15	88%
Oral and Maxillofacial Pathology	1	6%
Prosthodontics	1	6%
Rheumatology	1	6%

Table 8. Practice setting of survey participants

	Number of responses	Percent
Faculty practice	3	18%
Hospital	2	12%
Mobile clinic	0	0%
Private Practice	9	53%
Teaching Clinic	7	41%

Table 9. Volume of patients seen per month by survey participants

	Number of responses	Percent
1-20	2	12%
21-50	3	18%
51-100	4	24%
101-150	2	12%
151-200	4	24%
201-250	0	0%
251-300	0	0%
Over 300	0	0%

Table 10. Proportion of monthly patients with a chief complaint related to TMD

	Number of responses	Percent
Less than 25%	6	35%
Between 25% and 50%	1	6%
Between 50% and 75%	3	18%
Over 75%	5	29%

Table 11. Treatment strategies used by survey participants

	Number of responses	Percent
Patient education and self-management	16	94%
Physical therapy	15	88%
Behavioral therapy	13	77%
Pharmacological management	16	94%
Orthopedic Appliances	15	88%
Interventions (including injections)	14	82%
Surgical management	1	6%
Referral	9	53%
Other	1	6%

Table 12. Survey participant assessment of educational adequacy for treating TMD

	Number of responses	Percent
Yes	12	71%
No	4	24%

The survey sought to understand clinician opinions on the current limitations of TMD treatment and thoughts on the barriers that healthcare providers face in delivering effective care for TMDs. Clinicians were also asked to recommend priority areas of improvement for TMDs. With this information from clinicians that treat TMDs, we can better understand and identify gaps in the current treatment standard of TMDs and propose methods to improve patient outcomes.

Barriers and limitations to providing effective TMD treatment are numerous and often interrelated, affecting both patient access to care and providers' ability to deliver comprehensive treatment. Participants reported that there is a significant financial barrier as TMD treatments can be costly and this barrier is further exacerbated when many insurance plans do not cover TMD treatments. Patients must bear the costly expenses on their own or forego treatment altogether. Some participants reported that they did not accept insurance at all due to the burden of dealing with reimbursement and billing, which further compounds the problem for patients. Participants offered more insight on their desires of better insurance coverage of TMD treatment. One participant stated, "Medicare should also support those patients better, and dental insurances can also support better the reimbursement." Another participant reported, "Medical insurances should be supporting this care beyond just the fee for service; Medicare should also support those patients better."

Participants also reported challenges in providing comprehensive and coordinated care. TMD treatments often require coordination with other healthcare providers (e.g., behavioral therapists, physical therapists), yet participants reported a lack of proper referrals, which prevents patients from receiving necessary, specialized care. One participant stated, “Family medicine, PCPs, and general dentists need to acquire better understanding in order to be able to properly refer and/or manage TMD cases.” Access to holistic, comprehensive care is often lacking, with patients needing coordinated services that include psychological support and social work to empower lifestyle changes. Another participant noted, “It has taken time to develop a “team” for comprehensive treatment - i.e., Functional Medicine practitioners, hands-on therapists, acupuncturists, etc. These people are very busy - more auxiliary training is needed.” Furthermore, even when there are attempts to provide comprehensive, coordinated care, participants reported feeling that there is not enough direction and leadership (i.e., a designated point person or care manager), which creates inefficiencies in the delivery of care.

Issues with the quality of treatment due to patient compliance, education, and resistance to innovative treatment methods are also significant. Participants reported that one major challenge is patient compliance, particularly among individuals with cognitive impairments who may struggle to adhere to treatment protocols. One participant said, “Compliance is always a problem, and patients with mental health conditions are more resistant to behavioral modifications.” Some patients often require special communication strategies to ensure they fully understand and follow their care plans. Participant responses indicated that education regarding TMD treatment is not standardized for clinicians. As such, general doctors and dentists, who could play a crucial role in this coordination, frequently lack the necessary education and guidance, resulting in fragmented care and suboptimal outcomes for patients. Additionally, there is a problem of misinformation among providers about best practices, as some participants reported that some approved courses perpetuate incorrect information about TMD treatment, further complicating the delivery of effective care. One participant stated, “There is a lot of misinformation in the marketplace that is confusing to dental and healthcare providers. There are a lot of CE courses available that are approved by PACE teaching this misinformation.” Some participants reported that their workplaces and their supervisors lack the willingness to explore new approaches, as well as a lack of experience among providers, which further limits the ability to provide care. This underscores the need for better education among clinicians and general dentists to properly diagnose and manage TMD. These barriers highlight the urgent need for improvements in patient education, accessibility, and clinician training to enhance the overall treatment of TMD.

Participants were asked to suggest their top three priorities for improving TMD treatment. The top priorities for improving TMD treatment were (1) addressing gaps in research related to TMDs, (2) improving patient accessibility to care, and (3) improving the quality of care through interdisciplinary care and better education. First, there is a critical need for more research on TMDs, particularly in improving phenotyping strategies and understanding the pathophysiology of the disorders. Participants also reported that understanding the underlying pain mechanisms of TMDs is important. Advancing this knowledge is essential for developing more effective

preventative, diagnostic, and treatment methods. Accessibility is another key priority, as financial barriers, health insurance limitations, language differences, and issues can all impede patient access to care. One participant stated that the following are most important: “Integration with medical EHR would be invaluable, improved access to mental health treatment, and fee for service being covered.” Enhancing accessibility ensures that more patients can receive the treatment they need in a timely manner. Additionally, integrating interprofessional resources, such as behavioral therapists, psychologists, and mental health professionals, is crucial for providing comprehensive care that addresses the multifaceted nature of TMDs. Another participant stated that there needs to be better “education for professional and patients and to develop a good referral base of specialists trained to treat TMJ (therapists, MD, dentists).” Better education for both professionals and patients is essential to improve diagnosis, treatment, and self-management, ensuring that everyone involved is well-informed and prepared to treat TMD effectively.

To improve TMD treatment reimbursement, participants suggested that medical and dental insurances should extend coverage beyond fee-for-service models. Medical insurance needs to support comprehensive care. One participant stated, “It is essential to get reasonable compensation for the treatment of TMD patients. To achieve that, we need to establish a reasonable fee schedule for TMD treatment procedures, establish new procedure codes for any procedure that is not listed or for new procedures, and get credentialed with medical health insurance using the Orofacial Pain taxonomy code and bill procedures under medical, not dental codes.” Participants suggested that these practices will ensure fair compensation for providers and better access to care for patients.

Participants reported that improving education and training in TMD treatment requires incorporating comprehensive TMD education into the dental school curriculum. Early and effective education on TMDs ensures that future dentists/clinicians are well prepared to recognize and treat these complex disorders and avoid costly, invasive, and unnecessary treatment practices (i.e., surgical procedures). Additionally, there is a need for more hands-on training in orofacial pain facilities where both specialists and general dentists can gain practical experience in evaluating and treating TMDs. A participant reported, “Not every patient requires surgical treatment. Yet, this requires more time to be invested in exposing predoctoral students to more details and case-based scenarios as well as hands-on work or longer observing clinical exposure during OFP clinic rotations.” Another crucial aspect of education involves training in psychology and chronic pain management, emphasizing that many TMD patients benefit more from education and support than from surgical interventions. Another participant stated that it is important to “make sure that these professionals know that most of these patients getting better over time need education and support not surgery. Being clear about that is very important so that less patients are talked into surgery and instead have a strong advocate against surgery.” A holistic approach ensures that both healthcare professionals and patients are better equipped to manage TMD through evidence-based, patient-centered care.

Participants were asked to provide their thoughts on what advancements in technology and software would be pivotal for improving TMD treatment. Participants reported that a robust,

interoperable electronic health record system is essential for better patient data collection as well as improved coordination among healthcare providers and would facilitate more integrated care. A participant stated, “Electronic records vary throughout the industry. If we were to have a more common software, we could follow diagnostic and treatment outcomes.” Participants also reported that enhanced imaging technologies like CBCT and MRI could be used as precise diagnostic tools. Furthermore, participants reported that patient-centered applications can enable easy access to medical records, facilitate telemedicine follow-ups, and improve compliance through symptom tracking. One participant proposed desired features of patient-facing applications: “Patient compliance enhancing mobile app can be tailored and can be instrumental in tracking pain patterns and setting reminders for patients. Adding on synchronous follow up communication ability on those apps would be a plus.” Lastly, participants reported that an AI-driven diagnostic approach can enhance the accuracy and personalization of TMD care, making treatments more effective and accessible. By improving treatment through better electronic health records and innovative technologies, the current standard of treatment progresses toward precision medicine.

Limitations

Several limitations may have affected the accuracy and reliability of the study’s findings from the patient survey. Inconsistent survey administration is a limitation as some patients completed the survey independently, while others required assistance from project staff or relied on translations for Spanish-speaking participants. The variations in survey administration could have led to inconsistencies in the thoroughness of responses, especially among those with limited English proficiency or technological challenges. Additionally, some patients may not have fully understood certain questions, which may have affected the quality and thoroughness of the data collected.

Additionally, all survey participants were patients at one clinic site in Los Angeles, which therefore limits the generalizability of the results. Similarly, the diversity of the participant pool may have also been affected by potential participants who opted out of participating. Additionally, there is potential data duplication from individuals who may have completed the survey more than once. The study team addressed duplicate responses by combining answers where possible or omitting if they were not able to make a definitive decision based on the duplicate responses. Furthermore, as patients were asked to self-identify as patients experiencing or having had TMD symptoms, there is a variation in what treatments they have had (e.g., some participants were receiving their first consultation and had not yet undergone treatment) or those who realized they may not have/had symptoms of TMD at all. Problems with the survey design, such as insufficient answer options for race and ethnicity, and limited access to Spanish-speaking staff, further impacted the representativeness of the data. These limitations underscore the need for a more standardized and inclusive approach in future studies.

References

1. MedlinePlus. Temporomandibular Disorders [Internet]. Temporomandibular Disorders. National Library of Medicine; [cited 2024 Sep 23]. Available from: <https://medlineplus.gov/temporomandibulardisorders.html>

C-TMD IMPACT Patient Survey

Dr. Yang Chai and Dr. Jianfu Chen of USC's Center for Craniofacial Molecular Biology are leading a newly funded Center for Temporomandibular Disorder Improving Patient-Centered Translational Research (C-TMD IMPACT). We are surveying patients to uncover unmet clinical needs in the treatment of temporomandibular disorders.

C-TMD IMPACT will prioritize these unmet needs and identify strategies that can address these needs. C-TMD IMPACT will leverage an extensive array of resources to support all stages of product development from pre-clinical FDA-approved clinical trials. Your participation is completely voluntary and your responses will be de-identified. We thank you for your time and cooperation. If you do not wish to answer a question, please select "Prefer not to answer" or write "Skip".

For more information about C-TMD IMPACT, please visit: <https://c-tmd-impact.org/> or contact VyVy Nguyen at vyvyn@usc.edu.

What is your name?

1 What is your age?

2 What was your biological sex assigned at birth?

- Female
- Male
- Intersex
- None of these
- Prefer not to answer

Are you Hispanic, Latino/a, or Spanish origin? (Select all that apply)

- No, not of Hispanic, Latino/a, or Spanish origin
- Yes, Mexican, Mexican America, Chicano/a
- Yes, Puerto Rican
- Yes, Cuban
- Yes, Another Hispanic, Latino, or Spanish origin
- Prefer not to answer

3 What is your race? (select all that apply)

- White
- Black or African American
- Asian
- American Indian Alaska Native
- Native Hawaiian/Pacific Islander
- Other (Describe)
- Unsure
- Prefer not to answer

You selected "Other" in response to "What is your race?" Please describe.

4 Do you currently have or have you had (in the past) symptoms of a temporomandibular disorder? (like pain in your jaw, pain in your chewing muscles, or headaches related to pain in your jaw or chewing muscles?)

- Yes
- No
- Prefer not to answer

5 How long have you had symptoms of temporomandibular disorder?

- Less than one month
- Between 1 and 3 months
- Between 3 month and 6 months
- Between 6 and 12 months
- 1 to 3 years
- 3 to 5 years
- 5 to 7 years
- 7 to 10 years
- Greater than 10 years
- Prefer not to answer

6 From the following three classifications, which best describes the temporomandibular disorder(s) you have/had? (Select all that apply)

- Disorder of the temporomandibular joint
- Disorder of the muscles for chewing
- Headaches related to temporomandibular disorder
- Prefer not to answer

7 Is your temporomandibular disorder a result of an injury?

- Yes
- No
- Unsure
- Prefer not to answer

8 Have you received an official diagnosis of temporomandibular disorder?

- Yes
- No
- Unsure
- Prefer not to answer

9 Which healthcare professional provides treatment for your temporomandibular disorder? (Select all that apply)

- Dentist
- Physician (medical doctor; oral surgeon)
- Physical therapist
- Behavioral therapist
- Other (please specify)
- None
- Prefer not to answer

If you selected "Other", please describe which healthcare professional provides treatment for your TMD.

What symptoms have you experienced because of your temporomandibular disorder? (Select all that apply)

- Pain in the teeth, gums, salivary gland, or jaw bone
- Pain in the chewing muscles
- Pain in the jaw joint without inflammation
- Pain in the jaw joint due to inflammation
- Limited movement, locking, clicking, or grating of the jaw
- Nerve-related (tri-geminal) pain
- Pain that spreads to the face, neck, or other region
- Ringing in the ears, hearing loss, or dizziness
- Headaches, migraines
- Other (Describe)
- Prefer not to answer

If you selected "Other", please describe the other symptoms you have experienced because of your temporomandibular disorder.

11 Describe which of the symptoms of temporomandibular disorder you selected above impacted your life the most.

12 Select the following treatments you have received for your temporomandibular disorder: (Select all that apply)

- Jaw stretching and strengthening exercises
- Over-the-counter medication
- Lifestyle changes (e.g., reduce gum chewing, reduce nail biting)
- Behavioral health therapy
- Physical therapy
- Prescription medication
- Intraoral appliances (e.g., nightguards)
- Muscle injections
- Temporomandibular Joint injections
- Arthrocentesis (injection of solution into the temporomandibular joint to remove scar tissue)
- Arthroscopy (procedure where a doctor views your temporomandibular joint with a camera and may remove scar tissue or reposition the discs in the joint)
- Surgery
- Prefer not to answer

If you selected "muscle injections", please describe the type.

If you selected "Temporomandibular Joint injections", please describe the type.

If you selected "Surgery", did you have TMJ implants?

13 Have your treatments improved your symptoms of temporomandibular disorder?

- Yes
- No
- Prefer not to answer

If you selected "Yes", which treatment has improved your quality of life the most and describe how.

If you selected "No", which treatment has negatively impacted your quality of life the most and describe how.

14 What are the top 3 ways in which the current standard of treatment (the treatment you received) for temporomandibular disorders can be improved. (What other care or what aspects of the care you received could have been improved?)

C-TMD IMPACT Clinician Survey

Dr. Yang Chai and Dr. Jianfu Chen of USC's Center for Craniofacial Molecular Biology are leading a newly funded Center for Temporomandibular Disorder Improving Patient-Centered Translational Research (C-TMD IMPACT). We are surveying clinicians to uncover unmet clinical needs in the treatment of temporomandibular disorders.

C-TMD IMPACT will prioritize these unmet needs and identify strategies that can fulfill these needs. C-TMD IMPACT will leverage an extensive array of resources to support all stages of product development from pre-clinical to IND/IDE filing with the FDA and clinical trial design. Your participation is completely voluntary and your responses will be de-identified. We thank you for your time and cooperation.

For more information about C-TMD IMPACT, please visit <https://c-tmd-impact.org/> or contact VyVy Nguyen at vyvyn@usc.edu.

What is your name? _____

- 1 Select which type of healthcare provider you are. (Select all that apply)
- Dentist
 - Physician
 - Physical Therapist
 - Behavioral Therapist
 - Other (Describe)

If you selected "Other", please describe which type of healthcare provider you are. _____

2 What is your clinical specialty? _____

- 3 What setting best describes your practice?
- Faculty practice
 - Hospital
 - Mobile clinic
 - Private practice
 - Teaching clinic
 - Other (Describe)

If you selected "Other", please describe which setting best describes your practice. _____

- 4 Approximately how many patients do you see per month?
- 1-20
 - 21-50
 - 51-100
 - 101-150
 - 151-200
 - 201-250
 - 251-300
 - Over 300

Table 1. Common types of temporomandibular disorders/conditions

Disorders of the temporomandibular joint	Disorder of the masticatory muscles for chewing	Headaches attributed to temporomandibular disorders
--	---	---

5 Of these patients, approximately how many patients present with a chief complaint related to temporomandibular disorder(s) (Listed in the table above)?

Less than 25%
 Between 25% and 50%
 Between 50% and 75%
 Over 75%

6 What are your treatment strategies for a patient presenting with any one of the temporomandibular disorder(s) listed above. (See table above)

Patient education and self- management
 Physical therapy
 Behavioral therapy
 Pharmacological management
 Orthopedic Appliances
 Interventions (including injections)
 Surgical management
 Referral
 Other (Please describe)

If you selected "Other", please describe which other treatment strategies you have used to treat patients presenting with temporomandibular disorders.

7 What are the limitations and complications associated with the treatment strategies for patients with temporomandibular disorder(s)?

8 Was your professional education adequate in preparing you for the treatment of patients with temporomandibular disorder(s).

Yes
 No

If you selected "Yes", please describe how your education prepared you for treatment.

If you selected "No", please describe in what ways your education could have been improved.

8 What barriers prevent you from providing treatment to patients with temporomandibular disorder(s)?

10 Are you able to provide care to patients in coordination with other medical providers (e.g., dentists, physicians, physical therapists, behavioral therapists, orofacial pain specialists)?

What should be the top three priorities of the proposed Center to improve treatment strategies for temporomandibular disorder(s)?

What would improve the education and training of the future workforce regarding treating temporomandibular disorder(s)?

What technologies/software would improve your treatment of patients with temporomandibular disorder(s)?

Describe what reimbursement/billing strategies would improve your treatment of patients with temporomandibular disorder(s)?

Appendix C

Table 1. Biological sex of survey participants

	Number of responses	Percent
Female	84	82
Male	19	18
Total	103	100

Table 2. Age groups of survey participants

	Number of responses	Percent
18 to 24	19	18
25 to 34	22	21
35 to 44	22	21
45 to 54	14	14
55 to 64	15	15
65 to 74	8	8
75+	2	2

Table 3. Race of survey participants

	Number of responses	Percent
American Indian/Alaska Native	1	1
Asian	16	16
Black or African American	7	7
Native Hawaiian/Pacific Islander	2	2
White	42	41
Other	19	18
Unsure	10	10
Prefer not to answer	6	6

Table 4. Classification of survey participants identifying as Hispanic

	Number of responses	Percent
Mexican	34	33
Puerto Rican	1	1
Cuban	1	1
Another	23	22
Prefer not	2	2