



HHS Public Access

Author manuscript

J Am Dent Assoc. Author manuscript; available in PMC 2020 June 11.

Published in final edited form as:

J Am Dent Assoc. 2015 October ; 146(10): 721–8.e3. doi:10.1016/j.adaj.2015.04.001.

Prevalence of pain in the orofacial regions in patients visiting general dentists in the Northwest Practice-based REsearch Collaborative in Evidence-based DENTistry research network

Orapin V. Horst, DDS, MS, MSD, PhD [assistant clinical professor],

Department of Preventive and Restorative Dental Sciences, School of Dentistry, University of California, San Francisco, CA, when this article was written. She now is a principal investigator, AfaSci Research Laboratories, Redwood City, CA; and is in private practice limited to endodontics in the San Francisco Bay Area.

Joana Cunha-Cruz, DDS, PhD [research assistant professor],

Department of Oral Health Sciences, School of Dentistry, University of Washington, Seattle, WA.

Lingmei Zhou, PhD [research assistant],

Office of Research, School of Dentistry, University of Washington, Seattle, WA.

Walter Manning, DMD [general dentist and an investigator],

Northwest Practice-based REsearch Collaborative in Evidence-based DENTistry. He maintains a private dental practice in Albany, OR.

Lloyd Mancl, PhD [research associate professor],

Department of Oral Health Sciences, School of Dentistry, University of Washington, Seattle, WA.

Timothy A. DeRouen, PhD [professor emeritus]

Department of Oral Health Sciences, School of Dentistry, Department of Biostatistics, School of Public Health, University of Washington, Seattle, WA.

Abstract

Background—This study aimed to measure prevalence of pain in the orofacial regions and determine association with demographics, treatment history, and oral health conditions in dental patients visiting clinics in the Northwest Practice-based REsearch Collaborative in Evidence-based DENTistry (PRECEDENT) research network.

Methods—Data were recorded in a survey with systematic random sampling of patients (n = 1,668, 18 to 93 years old, 56% female) visiting 100 general dentists in the Northwest PRECEDENT research network. Prevalence ratios (PR) of orofacial pain by each variable were estimated by generalized estimating equations for Poisson regression.

Address correspondence to Dr. Horst at 1770 Post St. #226, San Francisco, CA 94115, orapinvy@gmail.com.

Submitted on behalf of the Northwest Practice-based REsearch Collaborative in Evidence-based DENTistry research network, with support from National Institute of Dental and Craniofacial Research grants DE016750, DE016752, T32 DE007132, and K08DE022377.

Disclosure. None of the authors reported any disclosures.

SUPPLEMENTAL DATA

Supplemental data related to this article can be found at: <http://dx.doi.org/10.1016/j.adaj.2015.04.001>.

Results—The prevalence of orofacial pain during the past year was 16.1% (95% confidence interval [CI], 13.4–18.9), of which the most prevalent pain locations were dentoalveolar (9.1%; 95% CI, 7.0–11.2) and musculoligamentous tissues (6.6%; 95% CI, 4.5–8.7). Other locations included soft tissues (0.5%; 95% CI, 0.2–0.8) and nonspecific areas (0.6%; 95% CI, 0.2–1.0). The prevalence of dentoalveolar but not musculoligamentous pain decreased with age. When comparing the 18- to 29-year-old patients, dentoalveolar pain decreased significantly in 45- to 64-year-old patients (PR, 0.59; 95% CI, 0.4–0.9) and in those 65 years or older (PR, 0.5; 95% CI, 0.3–0.9). Sex significantly affected the prevalence of musculoligamentous but not dentoalveolar pain. Women (PR, 3.2; 95% CI, 2.0–5.1) were more likely to have musculoligamentous pain. The prevalence of dentoalveolar and musculoligamentous pain did not vary significantly by ethnicity. Dentoalveolar pain was reported more frequently in patients who did not receive dental maintenance (PR, 2.9; 95% CI, 2.1–4.2) and those visiting community-based public health clinics (PR, 2.2; 95% CI, 1.2–3.7).

Conclusions—One in 6 patients visiting a general dentist had experienced orofacial pain during the past year. Dentoalveolar and musculoligamentous pains were the most prevalent types of pain.

Practical Implications—Pain in the muscles and temporomandibular joints was reported as frequently as that in the teeth and surrounding tissues in patients visiting general dentists. Although the dental curriculum is concentrated on the diagnosis and management of pain and related conditions from teeth and surrounding tissues, it is imperative to include the training for other types of orofacial pain, particularly those from temporomandibular joint and musculoligamentous tissues.

Keywords

Orofacial pain; prevalence; practice-based research network; Northwest PRECEDENT

Pain in the orofacial regions affects 21.7% of the population in the United States and costs over \$32 billion each year.¹ These pain conditions can be found in the population seeking care from dentists, but the prevalence and distribution of these conditions by sociodemographic and other variables in dental patients in the United States are unknown. A number of community-based surveys have been conducted over the past decades to measure the prevalence of orofacial pain in various populations (Table 1).^{1–19} Because the prevalence of orofacial pain from these studies varied greatly, from 5% to 57% depending on the study period, population, location, and possibly other unidentified factors, the estimation of orofacial pain prevalence in dental patients in the United States cannot be extrapolated from these data.

According to these community-based surveys, sociodemographic variables such as age, sex, ethnicity, economic status, and other traits including tobacco usage, parafunctional habits, trauma, tooth wear, tooth decay, malocclusion, missing teeth, clicking, and locking jaws were significantly associated with the prevalence of orofacial pain in dentoalveolar, temporomandibular joint, musculoligamentous, and soft tissues.^{1,3,5–7,10–14,16–24} The prevalence of these traits in dental patients might be different from those in the community-based surveys and those who do not visit dentists. Therefore, we hypothesized that the prevalence of orofacial pain in patients seeking care from dentists differs from those in the

previous reports of the community-based surveys and that the characteristics of patients, practices, or both contribute to these differences.

The objectives of this study were to measure prevalence of pain in the orofacial regions and determine association with demographics, treatment history, and oral health conditions in dental patients visiting clinics in the Northwest Practice-based REsearch Collaborative in Evidence-based DENTistry (PRECEDENT) research network in the United States.

METHODS

A cross-sectional study of orofacial pain, oral health conditions of the patients, and treatment performed by general dentists in their clinics was conducted from September 2006 to July 2009 in the Northwest PRECEDENT research network, a dental practice-based research network. Participating patients were selected using a systematic random sampling scheme for which the sampling interval was adjusted for each practice on the basis of patient volume, so that each dentist was expected to sample approximately 1, and no more than 2, patients per day. When the study was terminated, 93 of 100 dentists had enrolled 20 patients, 2 dentists had enrolled 19 patients, and 5 dentists had enrolled 5 to 12 patients during an average of 2.5 months (standard deviation, 2.9) per practice. Only 1 dentist from each clinic was registered. We enrolled dentists in the study in a sequential manner, so the last 7 had not reached their goal of 20 patients when the enrollment ended. The detailed study protocol, including study design, practice recruitment, practice, and patient selection, has been described previously.²⁵ The institutional review boards of the Oregon Health and Science University and University of Washington approved the study protocol and had a reciprocity agreement recognizing each other's reviews.

The purposes and procedures of the study were explained to each participating patient, and informed consent was obtained. For each patient, the dentist completed a clinical research form (Appendix, available online at the end of this article) for collecting data on diagnosis and treatment of oral conditions, and specifically the presence of pain in the orofacial tissues during the past 12 months, from oral examination, patient interview, and dental chart review. To be able to compare our data with those other studies, we adapted the widely used and validated classification of orofacial pain for population-based surveys from Macfarlane and colleagues¹⁴ and Aggarwal and colleagues.¹⁵ Data abstracted from charts on pain were classified as follows:

- dentoalveolar—pain in the tooth and surrounding tissues, including dental and periodontal abscesses, irreversible pulpitis, and other tooth-related pain;
- musculoligamentous—pain in the orofacial muscles, ligaments, and temporomandibular joints, including arthralgia, myalgia, or pain associated with temporomandibular disorders, capsulitis, and arthritis;
- soft tissue—pain in the orofacial soft tissues including aphthous ulcers, herpes, and burning mouth syndrome;
- nonspecific areas—diffuse pain, sinuslike pain, or pain due to orthodontic treatment and the like.

The number of missing permanent teeth was also collected during a chart review and was categorized as “no” for no missing tooth and “yes” for 1 or more missing tooth, excluding the third molars. The Angle malocclusion classification, open bite, and number of teeth with wear facets were collected through clinical examination. Participating patients were classified as follows: Angle class I if the permanent molar relationship on both sides was class I; Angle class II if the permanent molar relationship on at least 1 side was a class II; and Angle class III if the permanent molar relationship on at least 1 side was a class III and neither side was class II. Open bite was recorded as present when anterior (canine and anterior region) or posterior (molar and premolar region) open bite was observed. Participating patients were classified as having tooth wear if they had at least 1 tooth with moderate to severe wear facets (loss of 1 millimeter or more of tooth structure). The reason for the sampled visit was recorded and was classified as a maintenance visit if the main reason for the visit was an examination, prophylaxis, or preventive treatment. Participating patients were also asked about their age, sex, and race and ethnicity during the clinical examination. We restricted our study participants to adult patients, and the following age groups were defined: 18 to 29 years, 30 to 44 years, 45 to 64 years, and 65 years and older. Race and ethnicity were dichotomized as non-Hispanic white and other.

The distribution of orofacial pain categories and dentist and patient characteristics was examined using descriptive statistics. Chi-square tests adjusted for clustering by dental practice were used to test for differences between patients with and without the 2 most common groups of orofacial pain: dentoalveolar pain and musculoligamentous pain.²⁶ Prevalence ratios (PR) were estimated to relate dentoalveolar pain or musculoligamentous pain to dentist and patient characteristics using generalized estimating equations for Poisson regression, taking into account the clustering of participants within the same practice.²⁷

Multiple regression models were also used to estimate adjusted PR. To obtain the most parsimonious models,²⁸ variables were included in the multiple regression models if their P values were less than .2 in the bivariate analysis. Analyses were performed by SAS software version 9.2 for Windows (SAS Institute).

RESULTS

From 100 general dentists, the total number of patients enrolled was 1,668; age ranged from 18 to 93 years, 56% were women, and 83% were non-Hispanic white. Sixty percent of the patients had class I molar relationship, 12% had anterior or posterior open bite, and 53% had at least 1 missing permanent tooth.

Prevalence of orofacial pain

In the 1,668 patients, the prevalence of orofacial pain during the past 12 months was 16.1% (95% confidence interval [CI], 13.4–18.9), of which the most frequently reported pain locations were dentoalveolar region (9.1%; 95% CI, 7.0–11.2) and musculoligamentous tissues (6.6%; 95% CI, 4.5–8.7). Other locations included soft tissue (0.5%; 95% CI, 0.2–0.8) and nonspecific area (0.6%; 95% CI, 0.2–1.0). The data for orofacial pain were not recorded in 40 patients (2.4%).

The report of pain in each category included: dentoalveolar pain—dentin hypersensitivity (n = 1), irreversible pulpitis (n = 142), dental abscess (n = 4), periodontal abscess (n = 1), pericoronitis (n = 1), gingivitis (n = 1), cracked teeth (n = 1), and dental trauma (n = 2); musculoligamentous pain—pain in the muscles or in the jaws after prolonged opening, clenching, grinding, or bruxism (n = 24), pain in the temporomandibular joint area (n = 36), and pain associated with previously diagnosed temporomandibular disorder, capsulitis, and arthritis (n = 50); soft-tissue pain—recurrent herpes simplex (n = 3), burning mouth syndrome (n = 3), pain on the tongue (n = 1), and aphthous ulcer (n = 1); and nonspecific pain—diffuse pain with unidentified location (n = 5), pain from orthodontic braces (n = 1), and sinusitis-like pain or diffuse pain in the sinus area (n = 4).

Association of pain in dentoalveolar and musculoligamentous tissues, and patient demographics, treatment history, and oral health conditions

The prevalence of pain in the dentoalveolar tissues but not the musculoligamentous tissues varied significantly by age (Tables 2, 3, and 4). Compared with patients 18 to 29 years old, the prevalence of dentoalveolar pain was significantly lower in patients 45 to 64 years old (PR, 0.59; 95% CI, 0.4–0.9) and those 65 years or older (PR, 0.5; 95% CI, 0.3–0.9) (Table 4).

Pain in the musculoligamentous tissues was reported 3 times more frequently by women (9.5%; 95% CI, 6.2–12.8) than men (2.9%; 95% CI, 1.7–4.0) (Tables 2 and 3). In contrast, the prevalence of dentoalveolar pain did not differ significantly between women (8.3%; 95% CI, 6.0–10.3) and men (10.1%; 95% CI, 7.1–13.2) (Tables 2 and 4). Ethnicity (non-Hispanic white versus others) was not related to the prevalence of dentoalveolar and musculoligamentous pain (Tables 2, 3, and 4).

Patients who were not scheduled for a dental maintenance visit were more likely to report dentoalveolar pain (PR, 2.9; 95% CI, 2.1–4.2). The prevalence of dentoalveolar pain was 14.1% (95% CI, 11.0–17.3) for nonmaintenance visits versus 4.1% (95% CI, 2.6–5.6) for maintenance visits. Type of visits was not associated with the prevalence of musculoligamentous pain: 7.5% (95% CI, 3.9–11.2) for nonmaintenance visits versus 5.6% (95% CI, 3.9–7.7) for maintenance visits. Tooth loss was associated with increased report of dentoalveolar pain (PR, 1.7; 95% CI, 1.2–2.3)—10.9% (95% CI, 8.2–13.7) with tooth loss versus 6.9% (95% CI, 4.8–9.0) without tooth loss. The presence of orthodontic treatment or record was associated with decreased report of dentoalveolar pain (PR, 0.6; 95% CI, 0.4–0.9)—6.9% (95% CI, 4.4–9.4) with orthodontic treatment versus 10.2% (95% CI, 7.7–12.6) without orthodontic treatment. Furthermore, tooth wear was associated with increased prevalence of musculoligamentous pain (PR, 1.78; 95% CI, 1.1–3.0)—7.7% (95% CI, 5.0–10.4) with tooth wear versus 4.5% (95% CI, 2.5–6.7) without tooth wear. Malocclusion and open bite were not associated with the prevalence of both dentoalveolar or musculoligamentous pain.

Association of pain in dentoalveolar and musculoligamentous tissues, and dentist demographics and practice characteristics

Dentist demographics and practice characteristics were associated with the prevalence of dentoalveolar pain but not musculoligamentous pain (eTables 1, 2, and 3, available online at the end of this article). Dentists younger than 31 years saw more patients experiencing dentoalveolar pain than older dentists (eTable 1, available online at the end of this article). Dentoalveolar pain was more prevalent among patients in community-based practices (PR, 2.2; 95% CI, 1.2–3.7) and in clinics in Idaho (PR, 1.7; 95% CI, 1.0–3.0) but less prevalent in clinics with more than 51 patients per week (PR, 0.7; 95% CI, 0.4–1.0) (eTables 1 and 3, available online at the end of this article).

DISCUSSION

The prevalence of orofacial pain during the past 12 months in patients visiting general dentists in the Northwest PRECEDENT research network was 16.1%. Pain related to the teeth and surrounding tissues (dentoalveolar) and pain related to the temporomandibular joints and muscles (musculoligamentous) were the most prevalent. Patients 45 years or older were less likely to have dentoalveolar pain. This type of pain was reported more frequently in patients who did not receive dental maintenance and those visiting community-based public health clinics. Women were more likely to have pain in the musculoligamentous tissues. To our knowledge, this is the first study to quantify the prevalence of orofacial pain in dental patients in the United States and to describe this population with orofacial pain by age, sex, ethnicity, geographic region, treatment history, and oral health conditions.

The 12-month prevalence of orofacial pain in dental patients aged 18 to 93 years shown in this study (16.1%) is similar to the previous report in general population aged 6 to 79 years in Canada (12%)³ and those 65 years or older in the United States (17%).⁴ In general, the prevalence of orofacial pain in the elderly is lower than that in the younger population.^{7,6,8,18,21,29–34} To make a direct comparison, we estimated a 12-month prevalence of orofacial pain from 2 United Kingdom community-based surveys with similar orofacial pain classification, population age, and sex distribution to our study but with a 1-month recall period.^{14,15} The estimated 12-month prevalence of dentoalveolar pain in the United Kingdom community-based surveys is 14%, which is slightly higher than our finding from the dental patients (9.1%).

Similarly, the estimated 12-month prevalence of musculoligamentous or soft tissue pain is 13%, which is also higher than our finding from the dental patients (7.1%). These data are supported by the results from the 1989 United States National Health Interview Survey⁶ and other community-based surveys in Hong Kong,¹³ China,⁵ Spain,¹⁷ southeast Iran,⁷ and Korea,¹¹ and suggest that the prevalence of orofacial pain in dental patients is lower than those in the general population and community-based surveys (Table 1). The orofacial pain prevalence in patients of the US dental clinics (16.1%) is higher than the previous report in patients of the German university hospitals (5.2%).¹² However, we cannot directly compare our data with those in that study as a result of differences in pain classification, inclusion and exclusion criteria, data collection method, study population, and study period. The German

study was limited to chronic orofacial pain that manifested longer than 6 months and was reported during the past 3 months.

The prevalences of orofacial pain in the temporomandibular joints and muscles in our study (2.9% in men and 9.5% in women) are lower than those in the general population-based surveys (3% to 10% in men and 9% to 15% in women). Multiple factors could lower the prevalence of musculoligamentous and other pain and are limitations of our study. One such factor is the exclusion of a population seeking care from physicians instead of dentists. Approximately 50% to 75% of the patients with musculoligamentous pain will visit a dentist, whereas the other 25% to 50% are seen by physicians.³⁴ According to the records from the university-based facial pain clinics, 30% of these patients were identified and referred by nondental personnel including physicians, attorneys, insurance companies, self-referral, friends, and family.³⁵ Another factor is the retrospective nature of this study.

If the pain was not recently presented, the patient may not report the pain condition. A third factor is the lack of standardization and special training for the diagnosis of nondental orofacial pain for participating dentists. A final factor is the data collection method (questionnaire-based oral health survey), for which we relied on reports from patients and general dentists for existing diagnoses or pain reports; we thus may have missed undiagnosed or unrecognized conditions. Regardless of these limitations, we believe that this report shows the prevalence of orofacial pain as it is diagnosed in real-life circumstances.

Age and sex were shown to be major factors affecting the prevalence of orofacial pain. Temporomandibular pain, toothache, oral sores, and facial pain were shown to decrease with age and were the lowest in patients 65 years or older.^{6,8,18,21,29-34} We observed a similar trend for dentoalveolar pain but not for musculoligamentous pain. In contrast, musculoligamentous pain but not dentoalveolar pain varied by sex. Similar to previous studies,^{10,12,18,21,22,29,34,36-39} women have a higher prevalence of musculoligamentous pain than men. Although the female-to-male PR of musculoligamentous pain in this study (3.3) is greater than in previous reports (1.2 to 2.6),³⁴ we did not observe significant difference in the sex of participating patients; of 1,668 patients, 56% were female and 44% were male.

In this study, we found that patients having teeth with wear facets were more likely to have musculoligamentous or temporomandibular pain than those without tooth wear. Wear facets found in patients with temporomandibular pain may result from occlusal adjustment and may not be directly caused by the temporomandibular pain-related defects. Conflicting results have been reported previously. Pergamalian and colleagues⁴⁰ reported no significant association between tooth wear (including anterior and posterior teeth) and musculoligamentous pain. Furthermore, no significant association between anterior tooth wear and musculoligamentous pain has been reported by others.⁴¹⁻⁴⁴ However, Oginni and colleagues⁴⁵ reported a significant association between posterior tooth wear and musculoligamentous pain. The correlation found in our study might change if we separate the anterior tooth wear from the posterior tooth wear. Our group also reported that tooth wear is associated with older age, male sex, occlusal splint usage, and periodontal disease.⁴⁶ The association found in our study is weak, and the cross-sectional nature of these data hampers our ability to infer causality. Further studies are needed to verify this correlation.

A greater prevalence of dentoalveolar pain in patients visiting community public health clinics than those visiting private clinics may suggest an association of dentoalveolar pain and patient socioeconomic status because community health clinics are key resources for underserved populations. Other data, including the presence of treatment records for restorative treatment but not dental maintenance and the loss of permanent teeth, may imply past or present poor oral health. An increased prevalence of dentoalveolar pain in this population suggests an association of dentoalveolar pain and the patient's oral health and socioeconomic status, as has been described previously.^{2,3,6-9,19,47}

The strength of our study includes the study population and location. We studied patients visiting general dentists in non-dental school clinics. This population represents patients seen by most dentists after graduation. We showed here that approximately 1 in every 6 patients visiting the dentists had experienced pain in the orofacial tissues during the past year. Furthermore, pain in the muscles and temporomandibular joints was reported as frequently as that in the teeth and surrounding tissues. Therefore, it is important to include training in the diagnosis and management of various types of orofacial pain in the dental curriculum and continuing education. Multiple aspects of orofacial pain were incorporated into the current dental school curriculums, but mostly at the postgraduate level, such as the Advanced General Dentistry Education Programs in Orofacial Pain.⁴⁸⁻⁵⁰ Incorporation and standardization of the orofacial pain education should also be required at the predoctoral level. Results from this study can be used to implement the design of the dental school curriculum, continuing education, and future prospective studies to verify the causal relationship of orofacial pain or other oral health conditions and sociodemographic traits.

CONCLUSION

Orofacial pain is a relatively common condition in the patients seeking care from general dentists; pain in the muscles and temporomandibular joints was found as frequently as that in the teeth and surrounding tissues. Dental records of orofacial pain during the past 12 months estimated that 1 in every 6 patients experienced pain in the orofacial tissues.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

The authors are thankful for the invaluable contributions of the Northwest Practice-based REsearch Collaborative in Evidence-based DENTistry research dentist investigators and their staff.

ABBREVIATION KEY

NA	Not available
PRECEDENT	Practice-based REsearch Collaborative in Evidence-based DENTistry

References

1. Centers for Disease Control and Prevention. National Center for Health Statistics. National Health and Nutrition Examination Survey Data. 2002 Available at: <http://www.cdc.gov/nchs/nhanes.htm> Accessed May 18, 2015.
2. Cohen LA, Bonito AJ, Akin DR, et al. Toothache pain: behavioral impact and self-care strategies. *Spec Care Dentist*. 2009;9(2):5–95.
3. Ravaghi V, Quinonez C, Allison PJ. Oral pain and its covariates: findings of a Canadian population-based study. *J Can Dent Assoc*. 2013;79:d3. [PubMed: 23522141]
4. Riley JL 3rd, Gilbert GH, Heft MW. Orofacial pain symptom prevalence: selective sex differences in the elderly? *Pain*. 1998;76(1–2):97–104. [PubMed: 9696462]
5. Leung WS, McMillan AS, Wong MC. Chronic orofacial pain in southern Chinese people: experience, associated disability, and help-seeking response. *J Orofac Pain*. 2008;22(4):323–330. [PubMed: 19090405]
6. Lipton JA, Ship JA, Larach-Robinson D. Estimated prevalence and distribution of reported orofacial pain in the United States. *JADA*. 1993; 124(10):115–121.
7. Kakoei S, Parirokh M, Nakhaee N, et al. Prevalence of toothache and associated factors: a population-based study in Southeast Iran. *Iran Endod J*. 2013;8(3):123–128. [PubMed: 23922574]
8. Bastos JL, Gigante DP, Peres KG. Toothache prevalence and associated factors: a population based study in southern Brazil. *Oral Dis*. 2008;14(4): 320–326. [PubMed: 18449961]
9. de Pinho AM, Campos AC, Ferreira EF, Vargas AM. Toothaches in the daily lives of Brazilian adults. *IntJ Environ Res Public Health*. 2012;9(8): 2587–2600. [PubMed: 23066384]
10. Riley JL 3rd, Gilbert GH. Orofacial pain symptoms: an interaction between age and sex. *Pain*. 2001;09(3)245–256.
11. Chung JW, Kim JH, Kim HD, et al. Chronic orofacial pain among Korean elders: prevalence, and impact using the graded chronic pain scale. *Pain*. 2004;112(1–2):164–170. [PubMed: 15494197]
12. Wirz S, Ellerkmann RK, Buecheler M, et al. Management of chronic orofacial pain: a survey of general dentists in German university hospitals. *Pain Med*. 2010;11(3):416–424. [PubMed: 20447309]
13. McMillan AS, Wong MC, Zheng J, Lam CL. Prevalence of orofacial pain and treatment seeking in Hong Kong Chinese. *J Orofac Pain*. 2006;20(3):218–225. [PubMed: 16913431]
14. Macfarlane TV, Blinkhorn AS, Craven R, et al. Can one predict the likely specific orofacial pain syndrome from a self-completed questionnaire? *Pain*. 2004;111(3):270–277. [PubMed: 15363870]
15. Aggarwal VR, McBeth J, Lunt M, Zakrzewska JM, Macfarlane GJ. Development and validation of classification criteria for idiopathic orofacial pain for use in population-based studies. *J Orofac Pain*. 2007;21(3): 203–215. [PubMed: 17717959]
16. Sanders AE, Slade GD. Gender modifies effect of perceived stress on orofacial pain symptoms: National Survey of Adult Oral Health. *J Orofac Pain*. 2011;25(4):317–326. [PubMed: 22247927]
17. Montero J, Bravo M, Vicente MP, et al. Oral pain and eating problems in Spanish adults and elderly in the Spanish National Survey performed in 2005. *J Orofac Pain*. 2011;25(2):141–152. [PubMed: 21528121]
18. Visscher CM, Ligthart L, Schuller AA, et al. Comorbid disorders and sociodemographic variables in temporomandibular pain in the general Dutch population. *J Oral Facial Pain Headache*. 2015;29(1):51–59. [PubMed: 25635960]
19. Constante HM, Bastos JL, Peres KG, Peres MA. Socio-demographic and behavioural inequalities in the impact of dental pain among adults: a population-based study. *Community Dent Oral Epidemiol*. 2012;40(6):498–506. [PubMed: 22607027]
20. Macfarlane TV, Blinkhorn AS, Davies RM, Kincey J, Worthington HV. Association between female hormonal factors and orofacial pain: study in the community. *Pain*. 2002;97(1–2):5–10. [PubMed: 12031774]
21. Drangsholt M, LeResche L, eds. *Epidemiology of Orofacial Pain*. New York, NY: Oxford University Press; 2009.

22. Koopman JS, Dieleman JP, Huygen FJ, et al. Incidence of facial pain in the general population. *Pain*. 2009;147(1–3):122–127. [PubMed: 19783099]
23. Riley JL, Robinson ME, Wade JB, Myers CD, Price DD. Sex differences in negative emotional responses to chronic pain. *J Pain*. 2001;2(6):354–359. [PubMed: 14622815]
24. Aggarwal VR, Lunt M, Zakrzewska JM, Macfarlane GJ, Macfarlane TV. Development and validation of the Manchester orofacial pain disability scale. *Community Dent Oral Epidemiol*. 2005;33(2):141–149. [PubMed: 15725177]
25. DeRouen TA, Cunha-Cruz J, Hilton TJ, et al. What's in a dental practice-based research network? Characteristics of Northwest PRECEDENT dentists, their patients and office visits. *JADA*. 2010;141(7) :889–899. [PubMed: 20592411]
26. Rao JN, Scott AJ. A simple method for the analysis of clustered binary data. *Biometrics*. 1992;48(2):577–585. [PubMed: 1637980]
27. Zeger SL, Liang KY. Longitudinal data analysis for discrete and continuous outcomes. *Biometrics*. 1986;42(1):121–130. [PubMed: 3719049]
28. Kutner MHN, Nachtsheim CJ, Neter J. Regression variable selection In: Kutner MHN, Nachtsheim CJ, Neter J, eds. *Applied Linear Regression Models* [e-book]. New York, NY: McGraw-Hill/Irwin; 2004:chap 9.
29. Isong U, Gansky SA, Plesh O. Temporomandibular joint and muscle disorder-type pain in US adults: the National Health Interview Survey. *J Orofac Pain*. 2008;22(4):317–322. [PubMed: 19090404]
30. Agerberg G, Carlsson GE. Functional disorders of the masticatory system. I. Distribution of symptoms according to age and sex as judged from investigation by questionnaire. *Acta Odontol Scand*. 1972;30(6): 597–613. [PubMed: 15303265]
31. Locker D, Grushka M. Prevalence of oral and facial pain and discomfort: preliminary results of a mail survey. *Community Dent Oral Epidemiol*. 1987;5(3):69–172.
32. Sternbach RA. Pain and “hassles” in the United States: findings of the Nuprin pain report. *Pain*. 1986;27(1):69–80. [PubMed: 3785965]
33. Macfarlane TV, Blinkhorn AS, Davies RM, et al. Orofacial pain: just another chronic pain? Results from a population-based survey. *Pain*. 2002; 99(3):453–458. [PubMed: 12406520]
34. Drangsholt M, LeResche L, eds. *Temporomandibular Disorder Pain*. Seattle, WA: IASP Press; 1999.
35. Glaros AG, Glass EG, Hayden WJ. History of treatment received by patients with TMD: a preliminary investigation. *J Orofac Pain*. 1995;(2):147–151. [PubMed: 7488984]
36. Stewart WF, Lipton RB, Celentano DD, Reed ML. Prevalence of migraine headache in the United States. Relation to age, income, race, and other sociodemographic factors. *JAMA*. 1992;267(1):64–69. [PubMed: 1727198]
37. LeResche L, ed. *Epidemiologic Perspectives on Sex Differences in Pain*. Seattle, WA: IASP Press; 2000.
38. Riley JL 3rd, Gilbert GH, Heft MW. Socioeconomic and demographic disparities in symptoms of orofacial pain. *J Public Health Dent*. 2003;3(3):166–173.
39. Siqueira SR, Teixeira MJ, Siqueira JT. Clinical characteristics of patients with trigeminal neuralgia referred to neurosurgery. *Eur J Dent*. 2009;3(3):207–212. [PubMed: 19756195]
40. Pergamalian A, Rudy TE, Zaki HS, Greco CM. The association between wear facets, bruxism, and severity of facial pain in patients with temporomandibular disorders. *J Prosthet Dent*. 2003;90(2): 194–200. [PubMed: 12886214]
41. Manfredini D, Lobbezoo F. Relationship between bruxism and temporomandibular disorders: a systematic review of literature from 1998 to 2008. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*. 2010;109(6): e26–e50.
42. Schierz O, John MT, Schroeder E, Lobbezoo F. Association between anterior tooth wear and temporomandibular disorder pain in a German population. *J Prosthet Dent*. 2007;97(5):305–309. [PubMed: 17547950]
43. Hirsch C, John MT, Lobbezoo F, Setz JM, Schaller HG. Incisal tooth wear and self-reported TMD pain in children and adolescents. *Int J Prosthodont*. 2004;17(2):205–210. [PubMed: 15119873]

44. John MT, Frank H, Lobbezoo F, Drangsholt M, Dette KE. No association between incisal tooth wear and temporomandibular disorders. *J Prosthet Dent.* 2002;87(2):197–203. [PubMed: 11854677]
45. Oginni AO, Oginni FO, Adekoya-Sofowora CA. Signs and symptoms of temporomandibular disorders in Nigerian adult patients with and without occlusal tooth wear. *Community Dent Health.* 2007;24(3): 156–160. [PubMed: 17958076]
46. Cunha-Cruz J, Pashova H, Packard JD, Zhou L, Hilton TJ. Tooth wear: prevalence and associated factors in general practice patients. *Community Dent Oral Epidemiol.* 2010;38(3):228–234.
47. Vargas CM, Macek MD, Marcus SE. Sociodemographic correlates of tooth pain among adults: United States, 1989. *Pain.* 2000;85(1–2):87–92. [PubMed: 10692606]
48. Commission on Dental Accreditation. Accreditation standards for dental education programs. 2013 Available at: <http://www.ada.org/~media/CODA/Files/predoc.ashx> Accessed April 16, 2015.
49. Klasser GD, Gremillion HA. Past, present, and future of predoctoral dental education in orofacial pain and TMDs: a call for interprofessional education. *J Dent Educ.* 2013;77(4):395–400. [PubMed: 23576585]
50. Watt-Watson J, McGillion M, Hunter J, et al. A survey of prelicensure pain curricula in health science faculties in Canadian universities. *Pain Res Manage.* 2009;14(6):439–444.

TABLE 1

Point and period prevalences of orofacial pain in various populations.

PERIOD, MO	STUDY POPULATION	AGE, Y	STUDY LOCATION	N	OROFACIAL PAIN, %	DENTOALVEOLAR, %	MUSCULOLIGAMENTOUS AND SOFT TISSUES, %	REFERENCE
12	Dental patients	18–93	United States of America	1,668	16	9	7	PRECEDENT
12	Community	≥21	United States of America	903	NA*	44 [†]	NA	2
12	Community	6–79	Canada	5,284	12 [‡]	NA	NA	3
12	Community	≥65	United States of America	1,636	1	12 [‡]	8 [§]	4
12	Community	25–74	Netherlands	975	NA	NA	8	18
12	Community	18–75+	Netherlands	11,648	NA	NA	7	18
6	Community	≥18	Hong Kong	1,352	57	28 [‡]	14 [§]	5
6	Community	18–65+	United States of America	116,929	22	14 [‡]	16 [¶]	6
6	Community	≥18	Southeast Iran	1,800	NA	55	NA	7
6	Community	≥20	Brazil	3,353	NA	18 [‡]	NA	8
6	Community	35–44	Brazil	744	NA	24 [‡]	NA	9
6	Community	≥45	United States of America	724	43	12 [‡]	8 [§]	10
6	Community	≥55	Korea	1,032	42	27 [‡]	16 [§]	11
5	Community	20–59	Brazil	1,720	NA	14.8 [‡]	NA	19
3	Hospital patients	12–70+	Germany	34,242	5	NA	2	12
3	Community	18–75+	United States of America	30,978	NA	NA	5	1
1	Community	≥18	Hong Kong	1,222	4	28 [‡]	NA	13
1	Community	18–65	United Kingdom	1,510	19	7	7	14
1	Community	18–75	United Kingdom	2,505	12	2	2	15
X [#]	Community	18–91	Australia	3,954	NA	NA	10	16
X	Community	35–44	Spain	540	32 [‡]	NA	NA	17

PERIOD, MO	STUDY POPULATION	AGE, Y	STUDY LOCATION	N	OROFACIAL PAIN, %	DENTOALVEOLAR, %	MUSCULOLIGAMENTOUS AND SOFT TISSUES, %	REFERENCE
X	Community	65-74	Spain	540	36 [‡]	NA	NA	17

* NA: not available.

[†]Tooth pain or tooth hypersensitivity.

[‡]Oral pain.

[§]Jaw joint pain.

[¶]Jaw joint pain, mouth sore, burning mouth, and dull facial pain.

[#]X indicates point prevalence.

TABLE 2
Prevalence of musculoligamentous and dentoalveolar pain according to patient characteristics.

CHARACTERISTIC	N = 1,639	MUSCULOLIGAMENTOUS PAIN			DENTOALVEOLAR PAIN		
		%	95% CI*	P	%	95% CI	P
Age Group, y							
18–29	254	8.2	4.6–11.8		10.5	6.5–14.6	
30–44	397	7.2	4.3–10.2	.078	11.2	7.4–15.0	.166
45–64	695	7.0	4.4–9.6		8.1	6.0–10.3	
65+	293	3.4	0.7–6.0		7.4	4.3–10.6	
Sex							
Male	716	2.9	1.7–4.0	< .0001	10.1	7.1–13.2	.243
Female	923	9.5	6.2–12.8		8.3	6.0–10.7	
Race or Ethnicity							
Non-Hispanic white	1,357	6.3	4.2–8.4	.156	9.0	6.9–11.1	.541
Other	211	8.9	4.5–13.3		10.3	5.8–14.8	
Unreported	71	5.6	0.1–11.1		7.0	0.0–14.4	
Maintenance Visit							
No	813	7.5	3.9–7.4	.263	14.1	11.0–17.3	< .0001
Yes	826	5.6	3.9–11.2		4.1	2.6–5.6	
Orthodontic Treatment							
No	1,119	5.9	3.5–8.2	.070	10.2	7.7–12.6	.018
Yes	504	8.3	5.7–10.8		6.9	4.4–9.4	
Unreported	16	5.9	0.0–17.9		5.9	0.0–17.9	
Angle Malocclusion Classification							
Class I	991	6.5	4.1–9.0	.747	8.1	6.0–10.3	.056
Class II	332	7.7	4.3–11.0		8.0	4.4–11.5	
Class III	145	6.9	2.7–11.1		14.5	8.3–20.7	
Unreported	171	4.5	1.6–7.5		12.5	6.3–18.7	

CHARACTERISTIC	N = 1,639	MUSCULOLIGMENTOUS PAIN			DENTOALEAR PAIN		
		%	95% CI*	P	%	95% CI	P
Anterior or Posterior Open Bite							
No	1,412	6.8	4.7–8.9	.719	8.9	6.8–11.0	.632
Yes	197	6.1	2.0–10.2		10.2	5.6–14.7	
Unreported	30	0	NA [†]		12.5	0.0–26.7	
Tooth Wear (1 + Teeth)							
No	547	4.5	2.5–6.5	.024	8.3	5.7–10.9	.403
Yes	1,087	7.7	5.0–10.4		9.5	7.0–11.9	
Unreported	5	0	NA		16.7	0.0–49.9	
Tooth Loss (1 + Teeth)							
No	774	6.6	3.7–9.6	.990	6.9	4.8–9.0	.001
Yes	861	6.6	4.6–8.6		10.9	8.2–13.7	
Unreported	4	0	NA		33.3	6.2–60.5	

* CI: Confidence interval.

[†]NA: Not available.

TABLE 3

Prevalence ratios of musculoligamentous pain with patient characteristics.

PATIENT CHARACTERISTIC	CRUDE ANALYSIS		ADJUSTED ANALYSIS	
	PR [*]	95% CI [†]	PR [‡]	95% CI
Age (Reference, 18–29 y), y				
30–44	0.88	0.6–1.4	0.98	0.6–1.7
45–64	0.87	0.6–1.4	1.18	0.7–1.9
65+	0.41 [§]	0.2–0.9	0.66	0.3–1.6
Sex				
Female	3.29 [§]	2.1–5.1	3.19 [§]	2.0–5.1
Ethnicity				
Non-Hispanic white	0.71 [§]	0.5–1.1	0.80	0.5–1.3
Treatment				
No maintenance visit	1.36	0.8–2.3		
Occlusal splints	3.82 [§]	2.2–6.5		
Orthodontic treatment	1.39 [§]	1.0–2.0	1.15	0.8–1.7
Malocclusion (Reference, Class I)				
Class II	1.18	0.8–1.8		
Class III	1.04	0.6–1.9		
Posterior or anterior open bite	0.90	0.5–1.6		
Tooth Wear (1 + Teeth)				
	1.71 [§]	1.1–2.8	1.78 [§]	1.1–3.0
Missing Teeth (1 + Teeth)				
	1.00	0.7–1.5		

* PR: Prevalence ratio.

† CI: Confidence interval.

‡ Variables included in multiple regression model if $P < .2$ in bivariate analysis.§ $P < .05$.

TABLE 4

Prevalence ratios of dentoalveolar pain with patient characteristics.

PATIENT CHARACTERISTIC	CRUDE ANALYSIS		ADJUSTED ANALYSIS	
	PR [*]	95% CI [†]	PR [‡]	95% CI
Age, y				
30–44	1.07	0.7–1.6	0.92	0.6–1.4
45–64	0.79	0.5–1.2	0.59 [§]	0.4–0.9
65+	0.71 [§]	0.4–1.2	0.50 [§]	0.3–0.9
Sex				
Female	0.82	0.6–1.2		
Ethnicity				
Non-Hispanic white	0.88	0.6–1.3		
Treatment				
No maintenance visit	3.53 [§]	2.6–4.9	2.94 [§]	2.1–4.2
Occlusal splints (ever)	0.75	0.4–1.4		
Orthodontic treatment (ever)	0.67 [§]	0.5–0.9	0.63 [§]	0.4–0.9
Malocclusion				
Class II	0.98	0.6–1.5		
Class III	1.75 [§]	1.1–2.8		
Posterior or anterior open bite	1.11	0.7–1.7		
Tooth Wear (1 + Teeth)	1.15	0.8–1.6		
Missing Teeth (1 + Teeth)	1.60 [§]	1.2–2.1	1.67 [§]	1.2–2.3

* PR: Prevalence ratio.

† CI: Confidence interval.

‡ Variables included in multiple regression model if $P < .2$ in bivariate analysis.§ $P < .05$.