Influences of adult-onset diabetes on orofacial pain and related health behaviors

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Abstract

Objectives: This study tested the hypothesis that persons with orofacial pain and comorbid adult-onset diabetes will experience greater functional and emotional impact than persons experiencing orofacial pain without diabetes.
Methods: A random-digit dialing sampling procedure was used for a disproportionate probability sample of 10,341 persons who were screened for orofacial pain in the past 6 months and diabetes. This paper reports on 1,767 individuals reporting toothache pain and 877 reporting painful oral sores. A structured telephone interview assessed diabetes history, orofacial pain characteristics, oral health-care behaviors, and emotional and functional impacts of orofacial pain.
Results: The 6-month point prevalence was 16.8 percent for toothache pain, 8.9 percent for painful oral sores, and 9.6 percent for adult-onset diabetes. Individuals with comorbid orofacial pain and adult-onset diabetes differed significantly on many of the pain characteristics and health behaviors compared with nondiabetic sufferers of orofacial pain. Diabetics were more likely than nondiabetics to have pain every day, to suffer negative emotions associated with pain, to experience disruption of daily activities and sleep, to make an emergency room visit for orofacial pain, and to report the current need for a pain-related health-care visit.
Conclusions: Although diabetes is well known to be associated with neuropathic pain, these results indicate that the experience of nociceptive pain is exacerbated by diabetes. Findings have significance for the subjective experience of oral pain, dental-care outcomes, and health-related quality of life associated with oral-health outcomes among individuals with diabetes.

Introduction

Approximately 5 percent of all patients seen in dental offices have diabetes (1). Diabetes manifests itself in the oral cavity and can affect the mouth and teeth. Specifically, diabetes is associated with periodontal infections, poor wound healing after dental surgery or trauma, oral ulcers, changes in taste, and nerve disorders (2). Moreover, some people with diabetes develop dry mouth that increases their risk of developing dental caries and greater need for caries prevention (3).

Although the clinical signs of oral disease (e.g., decayed teeth, loss of periodontal attachment, and oral lesion) are an important outcome of a clinical examination, the subjective symptoms are often of primary importance to patients (4). These impacts on oral health-related quality of life include functional limitations, physical pain, psychological discomfort, physical and psychological disability, handicap, and social disability (5). In addition to a subjective marker for oral disease, pain is the most commonly reported impact of oral disease and is reported as a primary reason that patients seek dental care, and individuals often do so in the absence of knowing the reason of their symptoms (6). There are a few studies that have reported on the subjective impacts of diabetes on the oral cavity, and none have reported on a range of variables associated with orofacial pain (7,8).

The aim of this study was to test the hypothesis that persons with orofacial pain and comorbid adult-onset diabetes will experience greater functional and emotional impact

of toothache and painful oral sores, and exhibit more health behaviors than persons experiencing only orofacial pain.

Research design and methods

A disproportionate stratified probability sample of households in Broward and Miami Dade counties was recruited using list-assisted random-digit dialing methodology. Telephone numbers were generated using the GENESYS telephone bank database system. Connection was made with 25,548 telephone numbers of which 5,847 were answering machines, fax lines, or businesses, and 770 were households without an eligible person. The response rate was 53 percent, calculated as the total number of completed screenings (10,385) over the total completed + refusals (7,941) + incomplete screenings (445) + those that were unable to participate because of language, health, or other issues (930). The households were contacted by trained interviewers employed by the University of Florida Bureau of Economic and Business Survey Research Center. Respondents were provided with the choice of an English or Spanish version of the survey instrument. Once respondents provided informed consent, they were screened for diabetes and orofacial pain symptoms using a series of consecutive questions. Those eligible then completed the structured interview.

The parent project was a longitudinal study that examined race- and ethnic-related mechanisms underlying decisions to seek health care or self-manage orofacial pain. This project was approved by the Institutional Review Board at the University of Florida, and all human subjects who participated provided informed consent. Inclusion criteria included: a) residing in a household in either Miami-Dade or Broward county in the state of Florida; b) speaking English or Spanish as the first language; c) capable of engaging in a telephone conversation; d) meeting race and ethnicity criteria; e) being 18 years of age or older; and f) reported experiencing toothache pain or painful oral sores twice or more in the past 6 months.

Measures

Diabetes status

Participants were asked, "Have you ever been told by a doctor that you have diabetes?" Those answering in the affirmative were asked, "How old were you when you were told you have diabetes?" Persons who were diagnosed with diabetes at 18 years of age or younger were excluded from the analysis. Based on a diagnosis occurring at 18 years of age and older, type 2 diabetes mellitus was inferred. Wording for the diabetes items was taken from the National Health Interview Survey (9). It is acknowledged that there is some overlap in age of diagnosis between juvenile diabetes and adult-onset diabetes (1). Consequently, our use of an arbitrary cutoff of 25 years of age has limitations. Using the age of 19 years increases specificity, whereas 25 years of age as a cut point would increase sensitivity. The data were analyzed using both ages 19 and 25 years as cutoffs, with no substantive differences in results or interpretations.

Orofacial pain and pain impact variables

Participants were asked, "In the past 6 months, did you have a toothache pain more than once? In the past 6 months, did you have painful sores or irritations around the lips or in your mouth more than once?" The orofacial pain symptoms were worded as used by the National Health Interview Survey (9).

Orofacial pain questions

Orofacial pain intensity was assessed by asking participants: "On a scale of 1-10, where 1 is very mild and 10 is severe, how would you rate the intensity of this pain at its worst?" They were then asked how long they had experienced the symptoms, its continuity, and its impact on daily activities and responsibilities. These variables were taken from the Medical College of Virginia Pain Questionnaire (10).

A range of health behaviors were assessed as outcomes of orofacial pain, including visits to health-care providers, visits to hospital emergency rooms, use of prescription or nonprescription medications, alcohol consumption, use of folk or home remedies, application of heat or cold, and rest or relax to reduce the pain.

Socioeconomic variables

Participants responded to questions about economic variables taken from the Florida Dental Care Study (11). Questions included the following: a) whether they had dental insurance and b) descriptions of their present financial status by placing themselves in one of the following five categories: "(a) I really can't make ends meet; (b) I manage to get by; (c) I have enough to manage plus some extra; (d) Money is not a problem; or (e) I can buy about whatever I want." Participants also were asked to assess their ability to pay an unexpected $500 dental bill. Response choices were: able to pay comfortably, able to pay but with difficulty, and not able to pay the bill. Census-tract median-income level was used as a proxy for family income.

Survey items were pilot-tested in English- and Spanish-speaking groups, and individual interviews to verify respondent's interpretation of instructions and item wording. The 7-day test–retest reliability of the Spanish and English versions of the survey instrument was pilot-tested in 65 and 100 community-dwelling adults, respectively. Reliability

coefficients for the pain measures ranged from 0.92 to 0.79, for health behaviors from 0.94 to 0.69, and for economic variables 0.78-0.74.

Statistical analysis

All results were weighted estimates that reflect the two South Florida counties sampled, rounded to the nearest whole number. Weights were developed by using special tabulations provided by the US Census Bureau that detailed the distribution of target populations provided by age, sex, race, and poverty status. For dependent variables measured on an interval of measurement (pain intensity, pain-related affect, and physical function), the general linear model was used, with diabetes status as the independent variable. Race/ethnicity, sex, age, dental insurance, and financial status variables were entered as covariates. Interaction terms were computed for diabetes by race/ethnicity and diabetes by sex, and tested in the statistical models for significance. For dependent variables measured on a nominal scale of measurement (pain onset, frequency, continuity, and the health behavior variables), logistic regression models were used, with diabetes status as the independent variable, and race/ethnicity, sex, age, dental insurance, and the financial status variables were entered as covariates. Race and ethnicity were entered as dummy-coded variables (one each for Hispanic Americans and non-Hispanic Blacks) using non-Hispanic Whites as the reference group, whereas sex was coded so that males were the reference group. Age was converted into a four-category ordinal variable: 18-24, 25-44, 45-64, and ≥65 years. As the proportional odds assumption that the regression parameters are the same across the logits was violated for several of the health behavior variables, they were dichotomized and recoded as never = 0, and sometimes, often, and always = 1. The critical value of 0.05 was used for all analyses.

Results

Of the 10,341 who were screened, 1,767 reported toothache pain (16.8 percent), 877 reported painful oral sores (8.9 percent), and 995 reported diabetes (9.6 percent). Forty-three respondents reported diabetes diagnosis at 18 years of age or younger, and 18 were unable to recall the age of onset and were excluded from further analysis. The 6-month point prevalence of toothache pain (18.3 percent) and painful oral sores (9.6 percent) were higher among persons that reported diabetes than among those not reporting diabetes (16.5 and 8.8 percent, respectively). Adjusting for sex, age, and race/ethnicity, diabetes was a significant risk factor for both toothache pain [odds ratio (OR) = 1.3, 95 percent confidence interval of 1.1-1.5] and painful oral sores (OR = 1.6, 1.3-2.0). Significant covariates included female sex (OR = 1.3, 1.2-1.5), Black (OR = 0.8, 0.7-0.9), Hispanic (OR = 0.7, 0.6-0.8), and older age group (OR = 1.6, 1.5-1.7) for toothache pain, and female sex (OR = 1.3, 1.2-1.5), Black (OR = 1.5, 1.2-1.8), and older age group (OR = 1.6, 1.5-1.8) for painful oral sores.

Toothache pain and diabetes status

When we excluded the 24 who reported onset of diabetes before 25 years of age or could not recall their age at diagnosis, the sample size for persons with toothache pain was 1,743 persons. These data from 153 adults with adult-onset diabetes and 1,590 without diabetes underwent the data analysis (see Table 1 for demographic distributions).

Parameter estimates for pain and pain impact for diabetic and nondiabetic persons experiencing toothache pain are presented in Table 2. Persons with adult-onset diabetes reported greater toothache pain intensity than did those without diabetes ($P = 0.008$). Persons with diabetes reported toothache pain every day more often than did nondiabetics

Table 1 Demographic Distributions for Each Orofacial Pain Condition by Diabetes Status

	Toothache pain (n = 1743)*			Painful oral sores (n = 865)†		
Demographic variable	No diabetes	Comorbid diabetes	Total sample	No diabetes	Comorbid diabetes	Total sample
Age, mean (SD)	55.5 (11.1)	42.4 (15.3)	43.7 (15.5)	56.8 (13.8)	43.7 (15.3)	45.0 (15.6)
Sex, *n* (%)						
Male	427 (90)	49 (10)	476	209 (89)	25 (11)	234
Female	1,163 (92)	104 (8)	1,267	573 (91)	58 (9)	631
Race/ethnicity, *n* (%)						
Hispanic	673 (92)	62 (8)	735	331 (88)	43 (12)	374
Non-Hispanic White	459 (92)	42 (8)	501	272 (91)	26 (9)	298
Non-Hispanic Black	458 (90)	49 (10)	507	179 (93)	14 (7)	193

* Twenty-four persons who were given the diagnosis of diabetes before 25 years of age or could not recall their age at diagnosis were excluded from the original sample of 1,767 that reported toothache pain.

† Twelve persons who were given the diagnosis of diabetes before 25 years of age or could not recall their age at diagnosis were excluded from the original sample of 877 that reported painful oral sores.

SD, standard deviation.

Table 2 Pain, Pain Impact, and Health-Care Variables by Diabetes Mellitus Status

	Toothache pain			Painful oral sores		
Pain variables	Parameter estimate	No DM (*n* = 1,590), DM (*n* = 153)	*P*-value	Parameter estimate	NO DM (*n* = 782), DM (*n* = 83)	*P*-value
Pain characteristics						
Pain intensity	B = 0.696	5.3 (0.1), 6.3 (0.2)	0.008	B = 0.295	4.7 (0.1), 5.0 (0.3)	n.s.
Began >3 months ago	OR = 0.97	70%, 68%	n.s.	OR = 1.52	63%, 75%	0.040
Every day	OR = 1.67	20%, 31%	0.018	OR = 1.79	7%, 15%	0.027
Continuous	OR = 0.98	29%, 30%	n.s.	OR = 1.08	28%, 30%	n.s.
Emotional impact of pain						
Depression	B = 0.796	4.2 (0.1), 4.9 (0.3)	0.024	B = –0.211	3.2 (0.1), 2.9 (0.4)	n.s.
Anxiety	B = 0.612	5.1 (0.1), 6.0 (0.3)	0.062	B = –0.100	3.7 (0.1), 3.5 (0.4)	n.s.
Think it was terrible	B = 0.776	6.4 (0.1), 7.4 (0.3)	<0.001	B = 0.132	5.1 (0.1), 5.3 (0.4)	n.s.
Functional impact of pain						
Daily activities	B = 0.951	4.4 (0.1), 5.2 (0.3)	<0.001	B = 0.307	2.6 (0.1), 2.7 (0.4)	n.s.
Sleep	B = 1.286	4.8 (0.1), 6.3 (0.3)	<0.001	B = 0.874	2.8 (0.1), 3.7 (0.4)	0.035
Eating	B = 0.341	6.8 (0.1), 7.2 (0.3)	n.s.	B = 0.309	5.5 (0.1), 5.8 (0.4)	n.s.

Models were adjusted for sex, race/ethnicity, age, financial status, and dental insurance. Coefficients were calculated with weighted data. No DM = no diabetes mellitus and was coded 0; DM = diabetes mellitus and was coded 1. A significant β of greater than zero or an OR of greater than one represents a positive association between the DM variable and the outcome.
B, beta; OR, odds ratio; n.s., not significant.

(31 percent versus 20 percent, $P = 0.018$). Moreover, individuals with diabetes who experienced toothache pain reported greater feelings of pain-related depression than did nondiabetics ($P = 0.024$). Similarly, persons with diabetes reported pain was terrible to a greater extent than did nondiabetics ($P < 0.001$). Feelings of anxiety when pain was at its worst approached significance ($P = 0.062$). Persons with comorbid diabetes and toothache pain also experienced greater interference with daily activities ($P < 0.001$) and sleep ($P < 0.001$) than did nondiabetics. Interaction terms using race/ethnicity and sex with diabetes were not significant for any of the pain variables and dropped from the final models.

Health-care practices

There were differences between persons with adult-onset diabetes and nondiabetics in the use of some of the traditional health-care practices associated with toothache pain (Table 3). More diabetics visited the emergency room (17 percent versus 8 percent) and were more likely to have used prescription pain medication (58 percent versus 44 percent) than nondiabetics ($P = 0.023$ and $P < 0.001$, respectively). Similarly, individuals with diabetes were more likely than nondiabetics to report needing a pain-related health-care visit (39 percent versus 22 percent, $P = 0.017$). No differences were found for having a health-care visit or using over-the-counter pain medications ($P > 0.05$). For toothache pain, persons with diabetes were less likely to have used home remedies (25 percent versus 38 percent) or self-medicate with alcohol (14 percent versus 28 percent) than nondiabetics ($P = 0.046$ and $P = 0.001$, respectively). A greater percentage of diabetics reported using rest/relaxation as self-care for toothache pain than nondiabetics (86 percent versus 65 percent, $P < 0.001$). There was no difference in the use of therapeutic heat or cold ($P > 0.05$).

Painful oral sores and diabetes status

The sample of persons with painful oral sores consisted of 865 persons once the 12 that reported onset of diabetes before the age of 25 years or could not recall were excluded. These data from 83 adults with adult-onset diabetes and 782 without diabetes underwent data analysis (see Table 1).

Parameter estimates for pain and pain impact for diabetic and nondiabetic persons experiencing pain associated with oral sores are reported in Table 2. A greater proportion of diabetics than nondiabetics reported painful oral sores of 3 months duration (75 percent versus 63 percent, $P = 0.040$). Similarly, a greater proportion of diabetics experienced daily pain associated with oral sores than nondiabetics (15 percent versus 7 percent, $P = 0.027$). There were no differences between the groups in pain intensity, whether pain was constant, depression, anxiety, or thinking pain was terrible ($P > 0.05$). Painful oral sores had a significantly greater impact upon sleep among diabetics than nondiabetics ($P = 0.035$). However, the effects of pain on daily activities and eating were not different ($P > 0.05$). Interaction terms for diabetes with race/ethnicity and sex were not significant for any of the pain variables and dropped from the final models.

Table 3 Pain, Pain Impact, and Health-Care Variables by Diabetes Mellitus Status

	Toothache pain			Painful oral sores		
Pain variables	Parameter estimate	No DM (n = 1,590), DM (n = 153)	P-value	Parameter estimate	NO DM (n = 782), DM (n = 83)	P-value
Traditional health care						
Health-care visit	OR = 1.25	39%, 45%	n.s.	OR = 1.2	45%, 60%	n.s.
Need a visit for oral pain	OR = 1.66	22%, 39%	0.017	OR = 1.60	19%, 35%	0.022
Emergency room visit	OR = 2.34	8%, 17%	0.023	OR = 2.2	8%, 20%	0.048
Prescription pain medication	OR = 2.28	34%, 58%	<0.001	OR = 1.32	26%, 36%	0.044
OTC pain medication	OR = 1.23	68%, 75%	n.s.	OR = 1.24	67%, 68%	n.s.
Self-care						
Home remedy	OR = 0.65	38%, 25%	0.046	OR = 0.62	48%, 36%	0.050
Alcohol	OR = 0.36	28%, 14%	0.001	OR = 0.39	31%, 11%	0.023
Rest/relax	OR = 1.74	65%, 86%	<0.001	OR = 1.87	43%, 67%	<0.001
Heat/cold	OR = 1.11	33%, 31%	n.s.	OR = 0.97	27%, 28%	n.s.

Models were adjusted for pain duration, sex, race/ethnicity, age, financial status, and dental insurance. Coefficients were calculated with weighted data. No DM = no diabetes mellitus and was coded 0; DM = diabetes mellitus and was coded 1. A significant beta of greater than zero or an OR of greater than one represents a positive association between the DM variable and the outcome.
OR, odds ratio; n.s., not significant.

Health-care practices

There was a significant difference between individuals with adult-onset diabetes and nondiabetics in emergency room visits and the use of prescription medication for painful oral sores (Table 3). More diabetics than nondiabetics (20 percent versus 8 percent, $P = 0.048$) visited the emergency room for painful oral sores, and more diabetics reported use of prescription medication than did nondiabetics (36 percent versus 26 percent, $P = 0.044$). Individuals with diabetes were more likely to report needing a pain-related health-care visit than nondiabetics (35 percent versus 19 percent, $P = 0.022$). No differences were found for having had a health-care visit or using over-the-counter pain medications ($P > 0.05$). For painful oral sores, diabetics were less likely to have used home remedies (36 percent versus 48 percent) and alcohol (11 percent versus 38 percent) than were nondiabetics ($P = 0.050$ and $P = 0.023$, respectively). However, more diabetics used rest and relaxation (67 percent) than did nondiabetics (43 percent, $P < 0.001$) as an aid for painful oral sores. There was no difference in the use of therapeutic hot or cold ($P > 0.05$).

Discussion

Findings from this study provide new information about the increased functional and emotional impact of orofacial pain when comorbid with adult-onset diabetes. Although several reviews have identified a range of associations between diabetes and clinical signs of oral disease (1-3), to our knowledge, the present study is the first to investigate the impact of comorbid adult-onset diabetes on toothache pain and painful oral sores, and their influence on health behavior. Subjective symptoms of oral disease are known to be important to patients (4), and orofacial pain severity has been reported as a primary reason that individuals seek dental care (6). This study found that diabetes was associated with greater orofacial pain and pain impacts that included reduced psychological and physical functioning.

Our data indicate that adult-onset diabetes may exacerbate the experience of orofacial pain. Diabetes is well known to be associated with neuropathic pain; however, a few studies have examined comorbidities of diabetes with nociceptive pain secondary to actual tissue damage (12). The most consistent finding in our study was the frequency of orofacial pain being more prevalent and more frequent among adults with diabetes than among those without diabetes. A plausible explanation is that diabetes contributes to oral disease severity and resultant pain, possibly through delayed wound healing. Diabetics also were more likely than nondiabetics to require a prescription medication for their orofacial pain. Whether this is a function of increased pain, greater involvement of diabetics with the health-care system, and familiarity with prescription drug, or a combination of these is unknown.

Certainly, for painful oral lesions, there is a reciprocal relationship between orofacial pain and diabetes. It is thought that periodontal disease in and of itself may contribute to systemic inflammation and worsening insulin resistance and diabetes through the generation of inflammatory cytokines (3,12). For toothache pain, typically associated with advanced dental caries or pulp pathology (13), the link is less clear.

We found that diabetics reported higher levels of negative affect than nondiabetics as a result of toothache pain. Persistent pain can be an emotional experience, and this is often referred to as the suffering component of pain (14). Although

the role of depression in chronic temporomandibular joint pain is well documented, a few studies have linked symptom-related emotions with more dentally related orofacial pain symptoms (15). We were able to find a single study that connected anxiety with toothache pain (16), but that study did not consider the influence of disease comorbidities. Patients with adult-onset diabetes suffer a significantly higher rate of depressive symptoms, especially when they develop complications (17). In addition, depression is associated with poor adherence to self-care regimen in individuals with diabetes (18). Our findings serve to emphasize the importance of maintaining good oral health among diabetics, as pain-related depression and anxiety can only further contribute to the difficulty of coping with the complexities of managing diabetes.

We also identified greater decrement in pain-related functioning among those with comorbid diabetes. For example, greater difficulty in sleeping was found for both pain symptoms, and greater loss of daily functioning was reported by diabetics with toothache pain. Previous studies have likewise found that diabetes adversely affects a person's ability to eat or ability to relax (7). Sleep difficulty is also common among patients with diabetic peripheral neuropathy, and measures of poor sleep have been associated with pain, depression, and anxiety (19). Interestingly, we did not find that increases in any of the pain and pain impact variables were disproportionate between men and women or across racial/ethnic groups, suggesting that the exacerbating effects of diabetes on oral symptoms are not disproportionate.

Oral diseases are amenable to early intervention, so examining to what extent diabetic status motivates persons to seek oral care is important. Additional relevance comes from a report that delaying care once pain occurs is associated with poorer dental outcome and patient dissatisfaction (20). Although no differences were found for having had a pain-related dental visit, diabetics were more likely to require an emergency room visit. Dental treatment has been shown to occur in the time period proximate to toothache pain (21), and associations between characteristics of orofacial pain and health care specifically for pain show that severity and persistence of pain are positively associated with health-care contact (22). That more diabetics reported needing a health-care visit for pain is consistent with their greater intensity and increased frequency of pain that may ultimately result in an emergency room visit. Diabetes is also more prevalent among persons of lower socioeconomic status, and studies have documented that because of the lack of a primary-care home among this group, hospital emergency facilities are used for reasons other than urgencies/emergencies (23). Our controlling of socioeconomic status in the regression models is not likely to have sufficiently adjusted for the economic impact of diabetes.

Unlike traditional health-care treatment reported by diabetics, more nondiabetics in this study reported the use of home remedies or alcohol. Similarly, Arcury *et al.* (24) reported that far fewer diabetic individuals reported using complementary and alternate medicines for health self-management. Additional studies have also reported lay remedies and patient self-medication to alleviate toothache pain among older adults (25). Cohen *et al.*'s (6) focus group study investigating behavioral impact of toothache pain revealed participants' use of numerous prescription and nonprescription medications as well as home remedies and self-care strategies for pain relief.

Diabetes and oral health care

These data indicated that diabetes has a significant negative effect on persons through exacerbating negative pain-related outcomes of oral disease. Dentists and dental hygienists play an important role in patient self-care of diabetes by educating diabetic individuals about the importance of proper oral hygiene, avoiding tobacco use, receiving regular professional care, and self-management of the disease (1,2). Preventive and ongoing oral health care is important, although persons with diabetes are less likely to visit their dentists for preventive examinations and are more prone to visit for dental care only when treatment is needed (26). Consequently, when these patients are seen, dental clinicians must be knowledgeable of adult-onset diabetes and the impact of the disease on the patient's ability to undergo and respond to dental care (1,27).

Several limitations should be considered when interpreting the results of this study. These results address painful symptoms for the 6-month period prior to the study, and it is possible that error in recall may reduce the accuracy of reported information. We used age at doctor-diagnosed diabetes as a proxy for distinguishing between type 1 or type 2 diabetic status. We acknowledge that some persons with maturity-onset diabetes of the young (MODY) may have been included on our sample. However, MODY only accounts for 2-5 percent of all cases of non–type 1 diabetes (28). Also, some respondents may have not been aware of their current diabetic condition as the prevalence of undiagnosed diabetes is likely to be high (1). The data were collected using a cross-sectional design; consequently, we were not able to observe the effects of diabetes on orofacial pain over time. Moreover, respondents in this study did not receive a clinical examination to assess the etiology of their pain. In addition, the extent to which pain intensity or other pain impact variables may or may not have been as a result of greater tissue damage specifically related to diabetes is unknown. It should be noted, however, that the behavioral impacts of oral disease (pain, depression, and loss of quality of life) often correlated poorly with identifiable biomedical components (29). Lastly,

the dearth of studies on orofacial pain associated with diabetic status limits our discussion of the results. As such, our findings suggest the need for further investigations to fill the gap in our knowledge.

Summary

The experience of orofacial pain differs for persons with diabetes compared with persons without the disease. Our results suggest that, in general, individuals with diabetes experience greater adverse effects from orofacial pain symptoms than nondiabetics. It should be noted that the impact of toothache pain appears to be greater than the impact of painful oral sores. Such findings and differences in health behaviors among diabetics may indicate a need for early oral-health intervention, health education, and health promotion to prevent the occurrence and reduce the adverse impact of painful oral conditions.

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