Cracked Teeth and Poor Oral Masticatory Habits: A Matched Case-control Study in China

Feng Qiao, MDS,[*] Min Chen, MDS,[†] Xiaoli Hu, BDS,[†] Kaijun Niu, PhD,[‡] Xu Zhang, PhD,[†] Yanqiu Li, BDS,[§] Zhou Wu, BDS,[†] Zhengyan Shen, BDS,[†] and Ligeng Wu, MDS[†]

Abstract

Introduction: Previous studies have suggested that masticatory forces are associated with cracked teeth, but it is not clear which specific poor oral masticatory habits may be more likely to cause cracks. The aim of this study was to quantitatively assess risk factors for cracked teeth among poor oral masticatory habits and create a model for individualized risk predictions. **Methods:** We enrolled 35 patients with cracked teeth matched to 70 controls without cracked teeth by age, sex, position of the affected tooth, presence/absence of systemic disease, and diagnosis of symptomatic irreversible pulpitis from the Stomatology Hospital of Tianjin Medical University, Tianjin, China. Odds ratios (ORs) were calculated using conditional logistic regression analysis. **Results:** Thermal cycling eating habits (OR = 3.296; 95% confidence interval [CI], 1.684–6.450), eating coarse foods (OR = 2.727; 95% CI, 1.340–5.548), chewing on hard objects (OR = 2.087; 95% CI, 1.041–4.182), and unilateral mastication (OR = 2.472; 95% CI, 1.255–4.869) were independent risk factors for cracked teeth. The corresponding risk scores were 2.182, 1.691, 1.467, and 1.589, respectively. The area under the receiver operating characteristic curve and its 95% CI were 0.920 (0.868–0.973); the sensitivity and specificity were 0.943 and 0.800, respectively. **Conclusions:** Thermal cycling eating habits were strongly associated with cracked teeth, whereas eating coarse foods, chewing on hard objects, and unilateral mastication were also independent risk factors for cracked teeth. These findings yield insights into ways to promote the prevention of risky behaviors for cracked teeth. *(J Endod 2017;■:1–5)*

Key Words

Clinical practice guidelines, dental health surveys, eating behavior, epidemiology, prevention, risk factors

Significance

This hospital-based case-control study showed that thermal cycling eating habits was found to be strongly associated with cracked teeth, while eating coarse foods, chewing on hard objects, and unilateral mastication were also independent risk factors for cracked teeth. A quantitative evaluation model with the health risk appraisal is beneficial for patient's individualized risk predictions. These findings could yield insights into ways to promote better masticatory behavior to prevent cracked teeth.

A cracked tooth is defined as a fracture plane of unknown depth, which originates in the mesial or distal marginal ridges from the crown and may extend to the subgingival structures (1, 2). The most common symptom is severe pain on chewing or unexplained sensitivity to hot or cold stimulus (3). The occurrence and progression of cracks in teeth are unexpected and hidden. This condition has always presented a restorative dilemma for dentists because cracked teeth have an unpredictable prognosis (4, 5). Therefore, a quantitative evaluation of risk factors related to cracked teeth is not only important for endodontists but also beneficial for patients in terms of prophylactic intervention. It may prevent the occurrence of cracked teeth and make self-assessment, self-monitoring, and self-care under the dentist's guidance possible for individuals with cracked teeth.

Many reports on the etiology of cracked teeth have indicated that it is multifactorial. There are 2 main factors that induce tooth cracks: natural predisposing features (tooth anatomy factors and oral masticatory factors) (6) and iatrogenic causes (cavity preparation and restoration) (7, 8). Many studies have focused on the analysis of iatrogenic factors involving changes in the structural strength of teeth (9–13). Masticatory forces have been proposed to be a contributing factor (14). However, none of these studies have attempted to deeply analyze the roles of various masticatory factors in the development of tooth cracks. For example, unexpected chewing on a hard object may predispose teeth to cracks. An abnormal bite force may derive from bad chewing habits. The role of oral bite habits has only been mentioned as a factor in a few previous reports (15, 16). The relationship between cracked teeth and poor oral masticatory habits has received little attention and requires (vice require) quantitative assessment with the health risk appraisal (17), one of the most widely used screening tools in the field of health promotion.

The aim of this study was to establish a quantitative model for the assessment of risk factors for cracked teeth among poor oral masticatory habits by using a matched case-control study in China, in order to provide individuals with a means to evaluate the risk factors of cracked teeth.

From the Departments of *Oral and Maxillofacial Surgery and †Endodontics and §General Department, School of Stomatology and ‡Nutritional Epidemiology Institute and School of Public Health, Tianjin Medical University, Tianjin, China.

Address requests for reprints to Dr Ligeng Wu, Department of Endodontics, School of Stomatology, Tianjin Medical University, #12 Qi Xiang Tai Road, He Ping District, Tianjin 300070, PR China. E-mail address: lwu06@tmu.edu.cn

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Materials and Methods

Study Design

We designed a hospital-based case-control study in the Stomatology Hospital of Tianjin Medical University, Tianjin, China. Oral masticatory habits were assessed by the dietary recall method using the Tianjin Masticatory Habit Questionnaire. The sample size was determined according to the following formula (18):

$$\pi_2 = \frac{\pi_1 OR}{1 + \pi_1(OR - 1)} \quad \pi_c = \frac{\pi_2 + C\pi_1}{1 + C}, \quad N = \left[\frac{Z_{\alpha/2}\sqrt{\pi_c(1-\pi_c)\left(Q_1^{-1} + Q_2^{-1}\right)} + Z_\beta\sqrt{\pi_1(1-\pi_1)/Q_1 + \pi_2(1-\pi_2)/Q_2}}{\pi_1 - \pi_2}\right]^2$$

where α is type I error, β is type II error, $1-\beta$ is power, π_1 is the exposure ratio of the control group, and C is the matching ratio (C = 2). According to the literature and epidemiologic investigations, it was estimated that the exposure ratio of unilateral chewing was 20% in the control group, and the estimated odds ratio (OR) was 3, α = 0.05 (2-sided), β = 0.20, Q_1 = 0.67, and Q_2 = 0.33. Power analyses indicated that 29 cases would be necessary to detect differences with a power of 80%.

The study protocol was approved by the Institutional Review Board of the Stomatology Hospital of Tianjin Medical University. The research conforms to the Strengthening the Reporting of Observational Studies in Epidemiology guidelines and was approved by the Human Ethics Committee at Tianjin Medical University (TMUSHhMEC2015015).

Population Definition and Case Selection

Our study population consisted of individuals ranging in age from 20–79 years with a mean age (standard deviation) of 55.7 (14.8) years who visited the Department of Endodontics at the Stomatology Hospital of Tianjin Medical University. Written informed consent was obtained from all participants.

All participants were selected according to the following diagnostic criteria for a cracked tooth:

1. A chief complaint of discomfort or a sharp pain upon mastication
2. Clinical manifestations of an intact crown with crack lines observed across the mesial marginal ridge or distal marginal ridge by naked eyes or under a microscope with positive responses to pulp sensitivity tests
3. Auxiliary examination using the bite test, staining with methylene blue dye, transillumination, and microscopy to confirm the presence of cracks (19)

Exclusion criteria included the following: traumatized tooth, restoration and/or root canal treatment of the tooth, caries, extensive attrition, root resorption, and vertical root fracture. Patients with any history of cracked teeth before this study or facial trauma were excluded. Thirty-five patients with a diagnosis of cracked teeth were selected from March 2014 to December 2015.

Control Selection

Controls were selected from patients who visited the Department of Endodontics at the Stomatology Hospital of Tianjin Medical University. When more than 2 controls for each case of cracked teeth were matched, we used a random selection method for the enrollment of controls. Overall, 70 of 135 eligible controls were enrolled. Based on clinical experience and a literature review, controls were matched to cases by the patient's age (plus or minus 1 year), sex, position of the affected tooth, presence/absence of systemic disease, and diagnosis of symptomatic irreversible pulpitis. We eventually analyzed 35 cases with a cracked tooth and 70 matched controls.

Data Collection and Questionnaires

A standardized questionnaire, the Tianjin Masticatory Habit Questionnaire, for cracked teeth was adopted to collect data on potential risk-bearing oral masticatory habits. This questionnaire captures information related to poor oral masticatory habits. Endodontists surveyed each patient with cracked teeth regarding their long-term oral masticatory habits rather than their habits after the symptoms of the cracked tooth appeared. We adhered to the principles of quality control throughout (ie, from the design to the conduct of the whole study). To avoid recall bias, we randomly selected 25% of the participants for a secondary assessment of the questionnaire. The kappa value was 0.9, indicating that the results were reliable.

Four staff members were involved in the study: 1 trainer and 3 inspectors. The trainer was an endodontist with more than 20 years of clinical experience. The inspectors were endodontic graduate students from the same year who were trained to use a dental operating microscope. In addition, their interview languages were standardized. After training, the mean kappa value for the 3 inspectors was 0.77, and the kappa value among the 3 inspectors was 0.68; because both were greater than 0.6, the results could be considered reliable.

The following are definitions of items assessed in the questionnaire:

1. Sleep bruxism: a repetitive jaw muscle activity characterized by clenching or grinding of the teeth and/or by bracing or thrusting of the mandible during sleep
2. Thermal cycling eating habits: alternately eating hot or cold food immediately after eating cold or hot food, respectively, as it is the habit of some Chinese individuals
3. Unilateral mastication: only using the teeth on the right side or the left side while chewing
4. Likes eating coarse foods: a preference for eating food with a coarse texture, such as corn
5. Chewing on hard objects: eating hard foods such as nutshells (eg, pine nuts), or biting on other hard objects such as opening beer bottle caps with the teeth
6. Temporomandibular disorders: any symptoms of pain and dysfunction of the muscles involved in mastication and the temporomandibular joints, including pain and restricted mandibular movement

TABLE 1. Characteristics of Cases and Controls

Characteristics	Cases (*n* = 35)	Controls (*n* = 70)
No. (%) of females	16 (45.7)	32 (45.7)
No. (%) of males	19 (54.3)	38 (54.3)
Female to male ratio	0.842:1	0.842:1
Mean (SD) age (y)	55.77 (15.024)	55.70 (14.821)

SD, standard deviation.

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