# Occurrence, Associations, and Impacts of Nocturnal Parafunction, Daytime Parafunction, and Temporomandibular Symptoms in 38-Year-Old Individuals

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**Aims:** To investigate the occurrence, associations, and impacts of self-reported nocturnal parafunction, daytime parafunction, temporomandibular joint (TMJ) pain, and TMJ clicking in a New Zealand birth cohort of 38-year-old individuals. **Methods:** A cross-sectional analysis of data from a longstanding prospective observational study of a Dunedin, New Zealand birth cohort was undertaken. A questionnaire was used to measure self-reported nocturnal parafunction, daytime parafunction, TMJ pain, and TMJ clicking, and the short-form Oral Health Impact Profile (OHIP-14) tool was used to measure the impacts of these factors while controlling for personality traits. **Results:** Of the 912 participants (49.7% female) who were dentally assessed and had completed questionnaire data, 31.6% reported nocturnal parafunction and 48.3% reported daytime parafunction. TMJ pain was reported by 29.4% and TMJ clicking by 34.8%. The prevalence of daytime grinding was significantly greater among women (54.2%) than men (42.5%), as was the prevalence of TMJ pain (34.5% and 24.1%, respectively). Those with parafunction or TMJ symptoms had higher mean OHIP-14 scores, and this difference remained significant after controlling for sex, socioeconomic status, xerostomia, untreated dental caries, missing teeth, and personality traits. **Conclusion:** People with parafunction or TMJ symptoms have poorer oral health–related quality of life than those without these symptoms. *J Oral Facial Pain Headache 2019;33:254–259. doi: 10.11607/ofph.2221*

**Keywords:** *adults, epidemiology, orofacial pain, quality of life, temporomandibular dysfunction*

The term temporomandibular disorders (TMD) encompasses the manifestation of musculoskeletal disorders associated with the masticatory system, with particular emphasis on the temporomandibular joint (TMJ).[1] The most common TMD symptoms—either self-reported or clinically determined—are intense pain and TMJ sounds, such as functional clicking. Many people are affected by TMD; up to 12% of the general population experience signs and symptoms of TMD at some point in their lifetime.[2] TMD have been reported to affect oral health–related quality of life (OHRQoL) in people over a wide age range[3,4] and to an extent that can be greater than for oral conditions such as edentulism or periodontitis.[5]

Self-report is considered to be an appropriate approach for measuring TMD experience, which is largely based on a personal symptom report and requires a biopsychosocial approach that taps into the effect on the sufferer's day-to-day life for an accurate characterization.[1] Chronic pain has an adverse effect on OHRQoL.[6] OHRQoL is most commonly measured using the short-form Oral Health Impact Profile[7] (OHIP-14), which addresses functional, physical, psychologic, and social disabilities, as well as pain, all of which affect people with TMD.[8,9] The OHIP-14 has also been widely used to study the association between OHRQoL and indicators of poor oral health, such as tooth loss and xerostomia.[10,11]

Existing knowledge of the possible effects of TMD on OHRQoL has come largely from research involving TMD patients attending specialist clinics.[12–15] Such investigations are susceptible to the clinician's illusion,[16] whereby those presenting for treatment tend to have more severe

and more recalcitrant symptoms, leading the treating clinicians to assemble an unduly pessimistic picture of a condition's occurrence in the general population. For example, one study reported that treatment-seeking patients have considerably greater OHIP scores than those in the general population.[8] Half of patients with anterior disc displacement have little to no pain upon muscular palpation,[17] but even patients with these clinical findings have been shown to have OHIP scores twice those of the general population on average.[8] Having data from a representative birth cohort with a high retention rate would allow the investigation of valid and generalizable symptom data to enhance understanding of the nature and impact of TMD among the general population. Accordingly, the aim of the present study was to describe the occurrence, associations, and impact of nocturnal parafunction, daytime parafunction, and TMD symptoms in a birth cohort of 38-year-old individuals.

## Materials and Methods

The Dunedin Multidisciplinary Health and Development Study (DMHDS) is a longitudinal study of a birth cohort of children born at the Queen Mary Hospital, Dunedin, New Zealand between April 1, 1972 and March 31, 1973.[18] The sample of 1,037 children forms the basis for the longitudinal study, and the children were assessed within a month of their third birthdays. Data on their health and development (including dental examinations) have been collected periodically since then. This study uses data collected from dental examinations at ages 26 and 38. Ethical approval for the study was obtained from the Otago Ethics Committee, and written informed consent was obtained from the participants.

At age 38, participants were asked questions pertaining to their experiences with nocturnal grinding, daytime clenching/grinding, TMJ pain, and TMJ clicking with the response options always, frequently, occasionally, and never. Those responding always, frequently, or occasionally were deemed to have the condition being measured.

The OHIP-14[7] was used to evaluate participants' OHRQoL at age 38. The OHIP-14 comprises 14 items relating to the 7 dimensions of OHRQoL. Participants reported how often they had experienced a problem in the previous 4 weeks. Responses were coded as very often (score of 4), fairly often (3), occasionally (2), hardly ever (1), or never (0). The OHIP-14 score was calculated by summing the responses over all 14 items, and the prevalence of the impacts was computed by identifying those who experienced one or more impacts very often or fairly often. Item weights were not used.

Personality traits were measured at age 26. Participants completed the 177-item modified version (Form NZ) of the Multidimensional Personality Questionnaire (MPQ), a self-report personality tool.[19,20] There are 10 MPQ subscales, and their relative independence has been previously described.[19] The subscales define the three superfactors negative emotionality, positive emotionality, and constraint. Negative emotionality consists of the aggression, alienation, and stress reaction subscales. Individuals with high scores are more easily stressed and harassed and are more likely to experience strong negative emotions such as anxiety or anger. The positive emotionality factor comprises the wellbeing, social potency, achievement, and social closeness subscales. Individuals with high scores tend to interact positively with their environment and are amenable to the positive emotions arising from those experiences, while those with low scores report fear of these pleasurable interactions, have a low degree of self-efficacy, and are less likely to be happy. The constraint factor comprises the traditionalism, harm avoidance, and control subscales. Individuals with high scores tend to be restrained, cautious, and conventional, while those with low scores tend to be impulsive, fearless, and sensation-seeking and reject conventional behavioral strictures.[19]

Data on caries and missing teeth were collected during dental examinations carried out by two calibrated examiners (W.M.T., J.M.B.) who examined approximately half of the study participants each. Before each participant was examined, forms were updated to account for the teeth that were already missing from the previous assessments at age 32. The accumulated tooth loss due to caries by age 38 was estimated by observing the presence or absence of each tooth at age 38 and asking about the reason for its absence. Teeth were then examined for caries and restorations, with the buccal, lingual, distal, and mesial surfaces categorized for anterior teeth (canines and incisors) and the occlusal surface included for posterior teeth (premolars and molars). In the event that a surface could not be visualized by the examiner (eg, due to excessive calculus or being covered by gingival tissue), the surface was not included in the examination and later analyses. Xerostomia was measured using the question: "How often does your mouth feel dry?" The responses frequently or always indicated xerostomia.[11]

Participants were categorized into socioeconomic status (SES) groups based on occupational information obtained during the age-38 interview and using standard New Zealand occupationally based indices, which comprise a 6-interval scoring system (where, for example, a doctor scores 1 and a laborer scores 6).[21,22] The resulting scores were used to

**Table 1 Self-Reported Parafunction and Temporomandibular Disorders Symptoms by Sex and Socioeconomic Status (SES)**

| | Overall no. (%) | Night grinding, n (%) | Daytime grinding, n (%) | TMJ pain, n (%) | TMJ clicking, n (%) | Any |
|---|---|---|---|---|---|---|
| Sex | | | | | | |
| Male | 460 (50.3) | 143 (31.1) | 195 (42.5)* | 111 (24.1)* | 157 (34.1) | 309 (67.2) |
| Female | 455 (49.7) | 146 (32.1) | 246 (54.2) | 157 (34.5) | 161 (35.4) | 338 (74.3) |
| All combined | 915 (100.0) | 289 (31.6) | 441 (48.3) | 268 (29.3) | 318 (34.8) | 647 (70.7) |
| SES | | | | | | |
| Low | 178 (19.5) | 53 (29.8) | 88 (49.4) | 56 (31.5) | 70 (39.3) | 127 (71.3) |
| Med | 458 (50.1) | 147 (32.1) | 211 (46.3) | 131 (28.6) | 163 (35.6) | 324 (70.7) |
| High | 275 (30.1) | 88 (32.0) | 140 (50.9) | 81 (29.5) | 84 (30.5) | 194 (70.5) |
| All combined | 911 (99.6) | 288 (31.6) | 439 (48.3) | 268 (29.4) | 317 (34.8) | 645 (70.8) |

*$P < .05$.

**Table 2 Mean OHIP-14 Score and Prevalence of One or More OHIP-14 Impacts by Nocturnal Parafunction, Daytime Parafunction, TMJ Pain, and TMJ Clicking**

| | Mean OHIP-14 score (SD) | 1+ OHIP-14 impacts, n (%) |
|---|---|---|
| Nocturnal parafunction | | |
| No | 7.8 (7.9)* | 142 (22.7) |
| Yes | 9.4 (8.9) | 74 (25.6) |
| Daytime parafunction | | |
| No | 7.2 (7.5)* | 99 (21.0) |
| Yes | 9.6 (8.9) | 117 (26.5) |
| TMJ pain | | |
| No | 7.3 (7.3)* | 129 (19.9)* |
| Yes | 10.8 (9.8) | 87 (32.5) |
| TMJ clicking | | |
| No | 7.4 (7.4)* | 119 (19.9)* |
| Yes | 10.1 (9.4) | 97 (30.5) |
| Any of the above | | |
| No | 6.2 (6.6) | 42 (15.7)* |
| Yes | 9.2 (8.7) | 174 (26.9) |
| All combined | 8.3 (8.3) | 216 (23.6) |

*$P < .05$. SD = standard deviation.

assign each individual to one of three SES groups using predetermined thresholds: Scores of 1 and 2 were allocated to the high SES group; those scoring 3 or 4 were allocated to the medium SES group; and the remainder (scores 5 or 6) to the low SES group.

Chi-square tests were used to examine the statistical significance of differences observed between categorical dependent variables (such as the prevalence of impacts), and analysis of variance (ANOVA) was used for continuous dependent variables. Linear regression modeling was used to examine the association between TMD aspects and total OHIP-14 score while controlling for clinical oral health characteristics, sex, smoking status, and standardized MPQ superfactor scores.

## Results

A total of 928 participants (over 90% of whom self-identified as being of European origin) were clinically assessed in the age-38 dental examinations. Data on TMD aspects were available for 912 (98.5%) of those individuals, 49.7% of whom were women.

Summary data on self-reported nocturnal parafunction, daytime parafunction, and temporomandibular symptoms are presented in Table 1 by sex and SES. The highest prevalence was for daytime grinding, followed by TMJ clicking, night grinding, and then TMJ pain. Female individuals had a higher prevalence than male individuals for all TMD symptoms, but only the differences for daytime grinding and TMJ pain were statistically significant. Almost three-quarters of participants reported having experienced one or more of the four aspects.

Summary data on OHIP-14 scores are presented in Table 2 by nocturnal parafunction, daytime parafunction, and temporomandibular symptom type. Participants with parafunction or TMD symptoms had higher OHIP-14 scores than those without. TMJ pain appeared to have the greatest impact, and nighttime grinding the least. Just under one-quarter of the cohort reported one or more OHIP-14 impacts; this proportion was higher among those with TMJ pain or TMJ clicking.

Summary data on mean standardized personality scores are presented in Table 3. Participants reporting nocturnal parafunction, daytime parafunction, or temporomandibular symptoms scored higher on negative emotionality. Those reporting TMJ pain or clicking scored lower on positive emotionality. Lower constraint scores were apparent in those reporting daytime grinding.

The outcomes of the multivariate models for the mean OHIP-14 scores are presented in Table 4. After controlling for sex, SES, xerostomia, untreated dental caries, missing teeth, and personality traits, daytime parafunction and TMD symptoms

were associated with a higher OHIP-14 score (indicating poorer OHRQoL).

A multivariate model for mean OHIP-14 score was also undertaken for participants experiencing any parafunction or TMD symptoms (Table 5). After controlling for sex, SES, xerostomia, clinical oral conditions, and personality traits, experiencing any parafunction or TMD symptoms was still associated with a higher OHIP-14 score.

**Table 3 Mean Standardized Multidimensional Personality Questionnaire (MPQ) Scores by Nocturnal Parafunction, Daytime Parafunction, TMJ Pain, and TMJ Clicking**

| | Mean MPQ Z scores (SD) | | |
|---|---|---|---|
| | Negative emotionality | Positive emotionality | Constraint |
| Nocturnal parafunction | | | |
| No | −0.1 (1.0)* | 0.0 (1.0) | 0.0 (1.0) |
| Yes | 0.1 (1.0) | 0.0 (1.0) | −0.0 (1.0) |
| Daytime parafunction | | | |
| No | −0.1 (1.0)* | 0.0 (1.0) | 0.1 (1.0)* |
| Yes | 0.1 (1.0) | −0.0 (1.0) | −0.1 (1.0) |
| TMJ pain | | | |
| No | −0.1 (0.9)* | 0.1 (1.0)* | 0.0 (1.0) |
| Yes | 0.3 (1.1) | −0.1 (1.0) | −0.0 (1.0) |
| TMJ clicking | | | |
| No | −0.1 (1.0)* | 0.1 (1.0)* | 0.0 (1.0) |
| Yes | 0.2 (1.1) | −0.1 (1.0) | −0.0 (1.0) |
| Any of the above | | | |
| No | −0.2 (0.9)* | 0.1 (1.0) | 0.1 (0.9) |
| Yes | 0.1 (1.0) | −0.0 (1.0) | −0.0 (1.0) |

*$P < .05$. SD = standard deviation.

## Discussion

This study found that the prevalence of nocturnal parafunction, daytime parafunction, or temporomandibular symptoms in a complete birth cohort of 38-year-old individuals from New Zealand was high, with almost three in four people having experienced one or more of the four aspects investigated. In turn, these aspects were strongly associated with poorer OHRQoL, reflected in the participants' higher mean OHIP-14 scores.

Two strengths of this study are that the data were collected from a representative birth cohort and that the retention rate of this cohort is very high. In other studies investigating TMD and their effect on OHRQoL, participants are gathered from specialist clinics, which makes them systematically different from those in the general population, since treatment-seeking patients have been shown to report poorer OHRQoL and have more pathology than the general population.[8,15] The present study used a representative sample, ensuring generalizability. Another strength of the study was that the association with OHRQoL persisted even after controlling for characteristics such as sex, SES, xerostomia, untreated dental caries, missing teeth, and personality traits. This study also included detailed measurements of personality characteristics and clinical oral conditions and confirmed that OHRQoL is negatively affected by higher negative emotionality scores and poor oral conditions, such as decayed coronal surfaces and missing teeth.

Comparison with the findings of other studies is a challenge. This study differs from others in that no specific clinical examinations of the TMJ and associated structures were conducted to diagnose participants. Instead, measurement relied on the self-reported experience of nocturnal parafunction, daytime parafunction, and temporomandibular symptoms. Time constraints and practicality prevented a proper diagnosis of TMD using the Research Diagnostic Critera for TMD diagnostic tool, and this is considered to be a weakness of this study. In addition, using the 49-item OHIP[23] instead of the shorter OHIP-14 may have led to a more valid measurement of participants' OHRQoL and may have revealed stronger associations between TMD and OHRQoL than found in the present study.

Although some studies have shown a higher prevalence of TMD in female individuals than male individuals,[24,25] most have failed to demonstrate a sex difference.[26] It is noteworthy that the present study observed a higher prevalence of daytime grinding and TMJ pain experience among female participants. According to a previous study, this may be justified by genetic differences, since genetic factors that are sex-linked to females have been identified as risk factors in the development of TMD and general vulnerability to pain.[27] With other factors being equal, it may also be that female individuals tend to report symptoms more readily than male individuals. The United States–based Orofacial Pain Prospective Evaluation and Risk Assessment (OPPERA) study observed no sex difference in TMD symptom prevalence or incidence,[26] suggesting that this issue remains unresolved.

Aside from sample size, the main difference between this study and others is that the present study was focused on a specific age and a representative cohort. Findings from other studies on the association between age and TMD experience have been contradictory. One study reported that TMD symptoms increased in severity with age; a systematic review showed that older people had fewer TMD symptoms; and then a recent study reported that age was not associated with TMD

**Table 4 Linear Regression Models for Oral Health Impact Profile-14 (OHIP-14) Scores for Nocturnal Parafunction, Daytime Parafunction, TMJ Pain, and TMJ Clicking**

| | B coefficient (95% CI) | *P* value |
|---|---|---|
| Model 1: Nocturnal parafunction[a] | | |
| Constant | 6.0 (5.2, 6.9) | < .01 |
| Night grinding | 0.3 (–0.7, 1.4) | .51 |
| Low SES at age 38 | 0.8 (–0.5, 2.2) | .22 |
| Female | 0.7 (–0.3, 1.7) | .16 |
| Xerostomia at age 38 | 3.3 (1.7, 4.8) | < .01 |
| No. of decayed coronal surfaces | 0.3 (0.2, 0.4) | < .01 |
| No. of missing teeth at age 38 | 0.8 (0.6, 1.1) | < .01 |
| Negative emotionality | 1.8 (1.2, 2.3) | < .01 |
| Positive emotionality | –0.6 (–1.1, –0.1) | .02 |
| Model 2: Daytime parafunction[b] | | |
| Constant | 5.6 (4.7, 6.5) | < .01 |
| TMJ day grinding | 1.4 (0.4, 2.3) | .01 |
| Low SES at age 38 | 0.8 (–0.5, 2.2) | .21 |
| Female | 0.5 (–0.4, 1.5) | .28 |
| Xerostomia at age 38 | 3.1 (1.6, 4.7) | < .01 |
| No. of decayed coronal surfaces | 0.3 (0.2, 0.4) | < .01 |
| No. of missing teeth at age 38 | 0.8 (0.6, 1.1) | < .01 |
| Negative emotionality | 1.7 (1.2, 2.2) | < .01 |
| Positive emotionality | –0.6 (–1.1, –0.1) | .03 |
| Model 3: TMJ pain[c] | | |
| Constant | 5.7 (4.9, 6.5) | < .01 |
| TMJ pain | 1.8 (0.7, 2.9) | < .01 |
| Low SES at age 38 | 0.9 (–0.4, 2.3) | .17 |
| Female | 0.5 (–0.5, 1.5) | .33 |
| Xerostomic at age 38 | 3.0 (1.4, 4.6) | < .01 |
| No. of decayed coronal surfaces | 0.3 (0.2, 0.4) | < .01 |
| No. of missing teeth at age 38 | 0.8 (0.5, 1.1) | < .01 |
| Negative emotionality | 1.6 (1.1, 2.2) | < .01 |
| Positive emotionality | –0.5 (–1.0, –0.0) | .04 |
| Model 4: TMJ clicking[d] | | |
| Constant | 5.7 (4.8, 6.5) | < .01 |
| TMJ clicking | 1.4 (0.4, 2.5) | .01 |
| Low SES at age 38 | 0.8 (–0.5, 2.2) | .22 |
| Female | 0.7 (–0.3, 1.6) | .18 |
| Xerostomia at age 38 | 3.2 (1.6, 4.7) | < .01 |
| No. of decayed coronal surfaces | 0.3 (0.2, 0.4) | < .01 |
| No. of missing teeth at age 38 | 0.8 (0.6, 1.1) | < .01 |
| Negative emotionality | 1.7 (1.2, 2.2) | < .01 |
| Positive emotionality | –0.5 (–1.0, 0.0) | .03 |

CI = confidence interval; SES = socioeconomic status.
[a]Adjusted $R^2$ = 0.255.
[b]Adjusted $R^2$ = 0.253.
[c]Adjusted $R^2$ = 0.252.
[d]Adjusted $R^2$ = 0.246.

**Table 5 Linear Regression Model for OHIP-14 Score for Any TMD Symptom**

| | B Coefficient (95% CI) | *P* value |
|---|---|---|
| Constant | 5.1 (4.0, 6.1) | < .01 |
| 1+ TMD symptoms | 1.6 (0.6, 2.7) | < .01 |
| Low SES at age 38 | 0.9 (–0.4, 2.2) | .2 |
| Female | 0.6 (–0.4, 1.6) | .2 |
| Xerostomia at age 38 | 3.1 (1.6, 4.7) | < .01 |
| No. of decayed coronal surfaces | 0.3 (0.2, 0.4) | < .01 |
| No. of missing teeth at age 38 | 0.8 (0.6, 1.1) | < .01 |
| Negative emotionality | 1.7 (1.2, 2.2) | < .01 |
| Positive emotionality | –0.6 (–1.1, –0.1) | .03 |

CI = confidence interval.

symptoms.[4,24,28] Hence, the role of aging in TMD occurrence requires further investigation. While this cannot be investigated in the current study, the longitudinal nature of the DMHDS means that the natural history of nocturnal parafunction, daytime parafunction, and temporomandibular symptoms can be investigated in future assessment phases.

A strong association between TMD symptoms and OHRQoL was observed, which is consistent with earlier reports.[28,29] Pain is the most common complaint among TMD sufferers, especially if the pain experience affects oral functioning. TMD affects speech, mastication, swallowing, and being able to undertake oral hygiene self-care without difficulty.[13] Dworkin et al found that TMD sufferers reported experiencing pain more frequently than nonsufferers and that this difference persisted despite the similar range of normal functional motion found in both groups.[30] Moreover, those with TMD complained of pain more frequently during similar extensions of mandibular movements. This finding is supported by the current study. Of all the TMD symptoms assessed, pain was found to be most strongly associated with the OHIP-14 score.

## Conclusions

Nocturnal parafunction, daytime parafunction, and temporomandibular symptoms were strongly and independently associated with poorer OHRQoL among individuals in this 38-year-old cohort, even after controlling for notable confounding factors. TMD affects day-to-day life, with pain being the most important symptom. While the natural history of TMD is still unclear, the longitudinal nature of the DMHDS will allow some elucidation in future assessment phases.

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