

Assessing the prevalence and risk of tooth wear in Parkinson's disease: A narrative review

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Abstract

Tooth wear is an increasingly common problem that affects the quality of life. Although previous research suggested that oral health is adversely affected in individuals with Parkinson's disease (PD) compared to healthy controls, tooth wear has not been extensively studied in this context. Particularly, there is a paucity of data on the prevalence and risk factors associated with tooth wear in PD patients. The aim of this study is to review the current literature on the prevalence and risk factors of tooth wear in PD patients and to propose hypotheses for future research on this topic. A literature search was conducted in PubMed. A total of 4 publications were identified: 1 case report and 3 questionnaire-based studies. These articles suggest that tooth wear is a more significant issue in PD patients than in healthy controls. In addition, potential associations between oral health-related quality of life (OHRQoL), bruxism and temporomandibular disorder (TMD) pain on the one hand, and tooth wear on the other hand, were identified in PD patients. Due to the limited number of articles published on this topic, it is not possible to definitively conclude whether tooth wear is a common problem in PD patients. However, the following hypotheses could be formulated: 1) tooth wear is more prevalent in PD patients than in healthy controls; 2) risk factors for tooth wear observed in healthy individuals are more prevalent among PD patients; and 3) multiple risk factors for tooth wear likely coexist in people with PD, potentially influencing the prevalence and progression of tooth wear in this population.

Keywords: tooth wear, Parkinson's disease, oral health, quality of life

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Introduction

Tooth wear is a phenomenon that involves the loss of dental hard tissues. The prevalence of tooth wear increases with age, and the severity of tooth wear is progressive.¹ This could result in the acquisition of a severe form of tooth wear with increasing age, which may develop into pathological wear (i.e., moderate tooth wear in combination with 1 or several described signs and symptoms, such as sensitivity).² Severe tooth wear is present in 3–17% of the adult population.³ Although a specific cause may be dominant, the etiology of tooth wear is often multifactorial, and therefore, the individual mechanisms (intrinsic and/or extrinsic mechanical and/or chemical) are rarely present in isolation.⁴ This makes tooth wear an interesting phenomenon, yet it is difficult to diagnose and treat. Importantly, the loss of dental hard tissues has a negative impact on the oral health-related quality of life (OHRQoL).⁵ Therefore, tooth wear, in all its complexity, is an important component of oral health-related diseases and their management.

Prior research has indicated that OHRQoL is negatively altered in individuals with Parkinson's disease (PD), a neurodegenerative disorder affecting specific parts of the brain, such as the substantia nigra.⁶ Symptoms of PD vary between individuals, and both motor and non-motor symptoms can occur, including tremors, a masked face, pain, and cognitive decline.⁷ Although younger adults can also be affected by PD, it is more prevalent in the older population.⁸ Treatment of PD consists primarily of symptom relief using medications that increase dopamine levels in the structures of the extrapyramidal system, such as levodopa (a precursor of dopamine that can pass the blood–brain barrier). In addition, physiotherapy, speech therapy and brain surgery could also be indicated and helpful in alleviating the symptoms of PD.⁹

A recent study has indicated that oral health, in its broadest sense, is worse in PD patients than in healthy controls.¹⁰ Although tooth wear is an ever-growing problem, there is a paucity of data regarding the prevalence and risk of tooth wear in PD patients. Consequently, the question arises whether tooth wear is a larger problem in PD patients than in their healthy peers, and whether the risk factors for tooth wear, which are known to be present in the general population, are also present in PD patients. Therefore, the aim of this study is twofold: to review the current literature on the prevalence and risk of tooth wear in PD patients; and to propose hypotheses for future research on this topic.

Material and methods

To address the first aim of the study, a PubMed search using Medical Subject Headings (MeSH) terms “Parkinson's disease” and “tooth wear” was conducted

on January 2, 2024. In addition, free terms such as “tooth wear” and “dental wear” were included in the search strategy. Only original articles were analyzed, with no restrictions on language or publication year. Furthermore, the authors conducted a review of the references cited in all included articles.

Results

A total of 8 articles were identified, with only 4 articles describing aspects of tooth wear in PD patients. Magee described a 53-year-old woman with PD who developed tooth wear due to “pursing mouth movements” as a side effect of high levels of levodopa (4.5 g).¹¹ However, after reducing the dosage, grinding of the teeth was still present. After 10 months, further damage to the teeth was described as “not acceptable”. However, the patient was unwilling to end the therapy due to the alleviation of the PD-related symptoms. Splint therapy was then recommended, and after 7 months, no further progression of tooth wear was observed.¹¹ Furthermore, a questionnaire-based pilot study found a significant association between self-reported tooth wear and the presence of PD.¹² However, the authors discussed the low reliability of self-reported data regarding tooth wear,¹² suggesting that this finding should be interpreted with caution. In a secondary analysis of the questionnaire data from the study by Verhoeff et al.,¹² the authors found that self-reported tooth wear was associated with more sleep and awake bruxism in PD patients.¹³ Finally, in another questionnaire-based study with a case-control design, self-reported tooth wear was associated with worse OHRQoL in PD patients compared to matched controls.⁶ In summary, the available data on tooth wear in PD patients is limited to self-reporting. Furthermore, the same sample was used in 2 of the 4 included articles. There is a dearth of data on the prevalence of tooth wear in PD patients, and only data on associated factors such as medication, bruxism and OHRQoL is present.

Discussion

The aim of this article was to review the literature on the prevalence and risk of tooth wear in PD patients and to propose hypotheses for future research on this topic. The available studies suggest that tooth wear-related issues are more prevalent in PD patients compared to controls. However, these studies primarily rely on self-reporting. Additionally, only medication usage, bruxism and OHRQoL have been identified as associated factors for tooth wear in PD patients.

Tooth wear is a complex phenomenon with several key aspects that require investigation. These include assessment, epidemiology, etiology, consequences, and management.

A review of the literature revealed that only a few of these aspects have been explored in relation to PD. Given the scarcity of literature on the prevalence of tooth wear in PD patients, this issue should be investigated in representative patient samples and compared with healthy controls using reliable assessment tools.⁴ Importantly, risk factors for tooth wear in PD, which are important across all 5 key aspects, have been largely understudied and represent significant gaps in the literature. Addressing these gaps requires well-designed studies in representative PD populations. Drawing insights from established risk factors for tooth wear in the healthy population^{14–18} and examining these factors in relation to the various characteristics of PD may provide a further understanding of the risk of tooth wear in PD patients.

Therefore, the following sections will explore the medical, social and miscellaneous risk factors for tooth wear identified in healthy individuals, considering their potential implications for PD. This exercise is intended to propose hypotheses for future research in this field.

Medical risk factors

Slater et al.¹⁷ identified several medical risk factors for tooth wear that are present in the general population. These factors include genetics, orofacial pain, psychology, salivary flow, sleep disorders, medication

usage, and stomach acid regurgitation (Table 1). However, no studies have been published regarding the genetics that are hypothesized to be involved in the higher risk development of tooth wear in PD patients. Pain is a common non-motor symptom in PD patients, with a reported prevalence ranging from 68% to 85%.²² Yet, the presence of pain in the orofacial area, such as temporomandibular disorder (TMD) pain, and its proposed etiology (i.e., bruxism) have not been examined broadly. Nevertheless, a recent scoping review found that both TMD pain and bruxism were more prevalent in PD patients than in healthy controls, with prevalence ranging from 0% to 33% and from 2% to 57%, respectively.^{23,24} This suggests that tooth wear due to bruxism may be more prevalent in PD patients. In addition to sleep bruxism, other sleep disorders are associated with PD. For example, both central and obstructive sleep apnea have been mentioned, with prevalence rates of 0–49% and 42–60%, respectively. However, these conditions have not been studied in depth.^{25–30} Also, a correlation has been found between sleep parameters, such as the mean oxygen saturation and the percentage of rapid eye movement (REM) sleep, and the severity of PD.²⁸ However, the proposed mechanism remains unclear. The location of the degeneration in the brain is a potential contributing factor.³¹ When sleep disorders are more prevalent, leading to increased arousals and episodes of bruxism, the risk of tooth wear is potentially increased.

Table 1. Risk factors for the presence and/or severity of tooth wear in healthy individuals, along with the hypotheses of the underlying mechanisms

Risk factors		Underlying mechanism
Medical factors	genetics	Genetic variations in, for example, amelogenin, which is involved in the formation of enamel, may be associated with the presence and/or severity of tooth wear. ^{15,19}
	pain	Pain is an indirect marker for tooth wear. The presence of orofacial pain is indicative of the potential for bruxism, which is associated with an increased risk of tooth wear. ^{15,17}
	sleep disorders	Nowadays, bruxism is considered a potential protective factor in the context of sleep apnea, with an increased likelihood of tooth wear. ¹⁷ Furthermore, RBD is associated with bruxism. ²⁰
	psychology	Individuals with psychological issues, such as ADHD, anxiety, or stress, are more prone to bruxism, with a higher likelihood of developing tooth wear. ^{15,17}
	saliva	Saliva plays an essential role in the protection of dental hard tissues. A reduction in salivary secretion or a deterioration in its quality (e.g., an abnormal buffer capacity), increases the likelihood of tooth wear. ^{14,15,17}
	medication usage	The use of certain medications has an influence on bruxism activity ²¹ and reduces salivary flow. ¹⁷
	stomach acid regurgitation	In the presence of reflux, the pH of the oral cavity is lower, which in turn leads to erosive tooth wear. The risk of reflux is also higher in individuals with sleep disorders, such as obstructive sleep apnea, or due to dietary intake. However, the dietary intake alone can be responsible for influencing the pH of the oral cavity. ^{14,15,17,18}
Social factors	stimulant usage (alcohol, caffeine, drugs, smoking)	The use of stimulants has been associated with the aggravation of bruxism and a reduction in the pH of the oral cavity, which in turn increases the risk of tooth wear. ^{17,18}
	erosive diet	Please refer to the section on stomach acid regurgitation.
	sports	Physical activity may contribute to dry mouth. Additionally, there is a hypothesis that some types of athletes, such as those engaged in strength training, may be prone to clenching. ²⁷
Miscellaneous factors	ageing	Tooth wear is a progressive phenomenon, the prevalence of which increases with age. ^{17,18}
	occlusion	Occlusal force and premature contacts may influence the presence and/or severity of tooth wear. ^{16–18}
	oral hygiene	The type of toothbrush and the frequency of oral hygiene practices may influence the presence and/or severity of tooth wear. ¹⁴

RBD – rapid eye movement sleep behavior disorder; ADHD – attention deficit hyperactivity disorder.

Furthermore, REM sleep behavior disorder (RBD), a parasomnia of PD, is present in 3–60% of PD patients.³² In patients with RBD, sleep bruxism was found in 25% of the cases,^{20,23} which is considerably higher than the prevalence of sleep bruxism observed in the general population. A high prevalence of sleep bruxism may be associated with an increased risk for tooth wear.

Patients with PD are more prone to psychological disorders, such as depression and anxiety, with a prevalence of 38% and 31%, respectively.^{33,34} In the general population, psychological disorders are primarily regarded as risk factors for tooth wear due to their association with bruxism. It is therefore possible that the risk of tooth wear is also increased in PD patients.

In addition, salivary problems are more pronounced in PD patients than in their healthy peers. A systematic literature review showed that an objectively lower salivary flow was found in PD patients than in healthy controls.³⁵ This could be due to the medication used by PD patients. Oonk et al. reported that the number of drugs taken by PD patients is, on average, 7.4 ± 2.5 pills per day, with a median of 5 times of drug intake per day.³⁶ Verhoeff et al. demonstrated that dopaminergic medication, often used to treat PD patients, is probably associated with bruxism and TMD pain.²⁴ Therefore, in addition to salivary problems, the risk factors of bruxism and TMD pain may be involved in the presence of tooth wear in PD patients due to medication usage.

Gastroesophageal reflux (GERD) was found to be associated with PD (odds ratio (OR): 1.29–4.05).^{37,38} In addition, Maeda et al. showed that GERD is present in 26.5% of PD patients.³⁷ A 65% increase in the incidence of gastrointestinal disorders, including dysphagia, constipation and GERD, was observed in patients with PD within the first 4 years following diagnosis.³⁹ Thus, as in healthy individuals, reflux is a potential, and perhaps even more significant, risk factor for tooth wear in PD patients.

As previously stated, several medical factors may increase the risk of tooth wear in PD patients, including sleep-related problems. However, it is important to note that awake bruxism is also prevalent (46%) in PD patients.¹⁴ In addition, PD is a movement disorder, which could also be accompanied by phenomena such as dyskinesias (i.e., an involuntary, recurrent, or intermittent movement disorder characterized by fragmentary, jerky, dystonic, or chorea-like movements).^{40,41} Therefore, it is hypothesized that more tooth-to-tooth contact could be present in PD patients than in healthy controls, at least in part due to increased craniofacial muscle tone, which may result in the loss of dental hard tissues.

Social risk factors

The social risk factors for tooth wear, and the hypotheses on how these factors may contribute to tooth wear are

described in Table 1. Upon examination of the literature, it was found that lifestyle factors such as alcohol consumption are negatively associated with the risk of developing PD.^{42,43} Additionally, there may be a negative association between caffeine intake⁴⁴ and smoking,⁴³ and the risk of developing PD. In the healthy population, these lifestyle factors are described as risk factors for tooth wear, as they induce bruxism activity. However, considering the negative association between alcohol and caffeine consumption and the risk of developing PD, it is possible that fewer PD patients use alcohol or caffeine, although this is not necessarily the case. Consequently, the risk of increased tooth wear concerning these factors is likely the same in PD patients as in healthy controls. However, the exact prevalence of alcohol, caffeine and tobacco use among PD patients is not described. Thus, caution is recommended in interpreting the results.

No information regarding the dietary preferences in PD has been documented. However, the intake of particular types of nutrients, such as vitamin C, is known to exert beneficial effects. However, they can also have a counteracting effect (e.g., high-protein and ferrous sulfate supplements) with dopaminergic medication,⁴⁵ and thus should be stimulated or discouraged by physicians. Tooth wear is frequently associated with dietary intake, particularly with the consumption of acidic nutrients. However, no research is available on the dietary preferences of PD patients. Nevertheless, we can hypothesize that some factors are important. For example, one of the non-motor symptoms of PD is loss of smell.⁷ This can result in a diminished sense of taste, which may lead to the use of more pronounced flavors, including acidity, and thus an increased risk of erosive tooth wear. Furthermore, vitamin C has been suggested to be beneficial for the pharmacokinetics and effectiveness of dopaminergic medication.⁴⁵ Therefore, physicians may advise PD patients to take vitamin C supplements or consume more fruits that contain high amounts of vitamin C. However, both have high acidity levels, which could potentially increase the risk of erosive tooth wear.

Finally, PD patients are encouraged to engage in regular physical activity, although there is a paucity of data regarding their use of sports drinks or participation in endurance sports. In healthy athletes, both sports drinks and endurance sports have been identified as risk factors for tooth wear. In particular, endurance sports have been identified as a risk factor for tooth wear, due to the increased clenching that occurs during the activity. Although PD patients are encouraged to engage in sports, it is unlikely that their level of sporting activities will differ significantly from that of healthy controls.

Miscellaneous risk factors

In addition to medical and social factors, aging, dental occlusion and oral hygiene measures may contribute to

increased tooth wear (Table 1). Although the prevalence of PD during younger years is also increasing, the incidence of PD is higher in older individuals.⁹ Previous studies have demonstrated that older individuals tend to have worse oral health. This phenomenon is also observed in PD patients, resulting in the loss of teeth or the presence of more root remnants.¹⁰ Factors such as reduced self-care in PD patients may contribute to the etiology of poor oral health. However, a literature review on oral health revealed that oral hygiene frequencies in PD patients were not found to be significantly different from those of healthy controls.¹⁰ It can be hypothesized that because PD patients are informed about their higher risks of poor oral health, they may improve their self-care practices. Furthermore, due to the motor difficulties associated with PD, uncontrolled movements can occur, resulting in abrasion (i.e., tooth wear as a consequence of mechanical causes, other than tooth-to-tooth contact). However, no data is available on oral hygiene practices in individuals with PD.

Conclusions

The existing literature on the prevalence and risk factors of tooth wear in patients with PD is limited. However, it is reasonable to assume that factors such as reduced salivary flow, bruxism, medication usage, and reflux commonly co-occur in PD patients, thereby increasing the risk of tooth wear. Consequently, oral healthcare providers should focus on the risk of more severe tooth wear in PD patients compared to healthy controls, which may further compromise their OHRQoL. However, it remains unclear whether tooth wear is perceived as a problem by PD patients themselves or by their oral healthcare providers.

Based on the findings of this study, the following hypotheses for future studies could be formulated: 1) tooth wear, particularly in severe cases, is more prevalent in PD patients than in healthy controls; 2) risk factors for tooth wear observed in healthy individuals are more prevalent among PD patients; and 3) multiple risk factors for tooth wear co-exist in people with PD, potentially influencing the prevalence and progression of tooth wear in this population.

Ethics approval and consent to participate

Not applicable.

Data availability

All data generated and/or analyzed during this study is included in this published article.

Consent for publication

Not applicable.

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