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Commentary

Sound Induced Dental Sensitivity

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INTRODUCTION

Tooth sensitivity is a common complaint of patients [1], which can be defined as an exaggerated response to a stimulus such as thermal, chemical, tactile, osmotic, or air-current that usually causes no response in a normal, healthy tooth [2-4] but have you ever winced when hearing the screech of nails on a chalkboard or felt sharp discomfort in your teeth at the sharp sounds, such as the sound of metal scraping against metal? These reactions are common among people, as most of us feel during our lifetime. The scientific community has yet to fully explain why certain sounds cause physical discomfort in teeth. Most of the dental and facial pain had a psychological or behavioural impact. Thus, dental and facial pain is a relevant problem that is mostly associated with tooth sensitivity [5]. Direct research on the phenomenon of sound-induced teeth sensitivity is almost nil which is a void to be filled by scientists. Deep studies on misophonia, auditory-tactile synesthesia, polyvagal theory, cross-modal sensory processing, and teeth conduction provide reasonable insights that can help us understand this phenomenon. Analyzing opinion-based clues from different studies, we can explain how sharp sounds such as metal scratching can induce sensitivity in our teeth. Misophonia means "hatred or dislike of sound." It is a neurobehavioral syndrome phenotypically characterized by heightened autonomic nervous system arousal and negative emotional reactivity (e.g. irritation, anger, anxiety) in response to a decreased tolerance for specific sounds [6-8]. It is characterized by a negative reaction to a sound with a specific pattern and meaning to a given individual. Trigger sounds include food chewing, sniffling, persistent coughing, knuckle cracking, metal scratching, and nail scratching [9, 10]. The phenomenon of tooth sensitivity can be explained by misophonia in certain ways in light of different research and theories. No direct link has been explained by the researchers to teeth sensitivity, but as professionals, we have selected the lines that reflect the concept of sound-induced teeth sensitivity. The concept we extract from the condition of misophonia is that teeth sensitivity is the negative response of the body to the triggering misophonic sounds like screeching of metal. Another study suggests that individuals with misophonia exhibit stronger activation in the orofacial motor area in response to trigger sounds, indicating a motor response to misophonia [11]. Dr. Stephen Porges devised the polyvagal hypothesis, which explains how the neurological system reacts to safety or danger by concentrating on the vagus nerve, which connects the brain to the face, neck, and

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internal organs. Sensations of security and calm are brought on by healthy vagus nerve activity. On the other hand, when it malfunctions, dangerous reactions might occur even in the absence of real dangers. This idea links the body's stress response to sound-induced oral sensitivity. The autonomic nervous system, in particular the vagus nerve, is responsible for inducing a "fight, flight, or freeze" reaction in response to perceived dangers, such as specific noises, according to the polyvagal theory [12-15]. Certain noises may cause an unconscious stress reaction in those who have sound-induced dental sensitivity, which makes them more sensitive to oral stimuli. This response is like how people have misophonia, and strongly react to specific noises. Essentially, the nervous system may interpret sound as a threat, causing unpleasant sensations. There could be a neural connection between hearing and touch, according to a study by Oxford University Press, which indicates that the auditory and somatosensory systems are well related. An anatomical basis for multisensory interactions is provided, explaining why some unpleasant sounds irritate. Within this framework, the correlation between metallic scraping noises and tooth sensitivity can be twigged as cross-modal perception, which can be elucidated in two ways: (1) Sensory Association: The brain interprets unpleasant sounds with high pitch as physical sensations, causing tooth pain. (2) Neural Overlap: When certain noises are heard, the activation of neural circuits linked to tooth pain may result from the overlap of auditory and somatosensory regions [16]. Auditory-Tactile Synesthesia: This condition involves sounds evoking tactile sensations due to cross-modal processing and hyper-connectivity in the brain. Different sounds can induce various tactile sensations such as vibrations, warmth, and tingling, varying among individuals [17]. In the context of this study, we can suppose that certain sounds can induce painful tactile sensations in the teeth in the form of sensitivity. This study suggests that specific sounds can trigger painful tactile sensations in teeth, manifesting as sensitivity. Both teeth and bones serve as sound conductors. High-frequency sounds, like metal scratching, are conducted through the skull's bone to the teeth or directly by the teeth, causing sensitivity. These sounds disturb dental tubular fluid, which stimulates baroreceptors and leads to teeth sensitivity according to the concept of hydrodynamic theory [18, 19]. Despite, various plausible reasons discovered by linking several studies, further study is needed to recognize the exact source of sound-induced oral sensitivity. Researchers must also determine the prevalence of this condition, whether it is general or affects only a small percentage of the population. Future studies may focus on neuroimaging studies to detect brain activity in people who experience this phenomenon, or it could look into whether there is a genetic predisposition that renders certain people more prone to this form of multimodal pain. The phenomenon known as sound-induced dental sensitivity is a fascinating nexus between the fields of neuroscience, psychology, otolaryngology, and dentistry to investigate the relationship between pain in the teeth and the other systems. The interdisciplinary approach involving neurology, otolaryngology, and psychology can help the researchers understand the idea of sound-induced tooth sensitivity, which will ultimately help those who are affected by it. Identifying the gap could help dentists improve their dental practices by enabling them to investigate sound-induced dental discomfort and provide specialized, comfortable, anxiety-free, high-quality services. The results could also help develop customized treatment plans that take into account a patient's sensitivity to particular sounds or discover and use cutting-edge technical solutions like sound-mitigating devices during dental procedures. Additionally, the introduction of innovative dental materials that reduce sound vibration transmission might be considered.

Take home message

- A complex brain-operated multisystem phenomenon caused by metal scrapping that leads to sound-induced dental sensitivity.
- There is a dearth of literature explaining the exact underlying mechanism. To fill this gap further research is required on how to provide long-term relief to the patients suffering from this condition by developing more efficient methods and using advanced technologies leading to a quieter and anxiety-free dental space. We now face a choice: do we continue to endure sensitivity to high-frequency, sharp sounds, or do we commit to eradicating it through dedicated research?

Authors Contribution

Conceptualization: MAK
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Formal analysis: WUN
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Conflicts of Interest

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REFERENCES

[1] Karibe H, Koeda M, Kato Y, Hama T, Tanaka S, Tateno A *et al.* Cerebral Activation Caused by Dental Sounds: a Functional Magnetic Resonance Imaging Study. Odontology. 2024 Feb; 112: 1-9. doi: 10.1007/s10266023-00898-7.

DOI: https://doi.org/10.54393/pjhs.v5i11.2154

[2] Markowitz K and Pashley DH. Discovering New Treatments for Sensitive Teeth: The Long Path from Biology to Therapy. Journal of Oral Rehabilitation. 2008 Apr; 35(4): 300-15. doi: 10.1111/j.1365-2842.2007.01798.x.

[3] Tonguc MO, Ozat Y, Sert T, Sonmez Y, Kirzioglu FY. Tooth Sensitivity in Fluorosis Teeth. European Journal of Dentistry. 2011 Jul; 5(3): 273-80. doi: 10.1055/s-0039-1698892.

[4] Blaizot A, Offner D, Trohel G, Bertaud V, Bou C, Catteau C *et al.* Prevalence of Sensitive Teeth and Associated Factors: A Multicentre, Cross-Sectional Questionnaire Survey in France. BioMed Central Oral Health. 2020 Dec; 20: 1-0. doi: 10.1186/s12903-020012 16-1.

[5] Theodoroff SM and Folmer RL. Hearing Loss Associated with Long-Term Exposure to High-Speed Dental Handpieces. General Dentistry. 2015 Jun; 63(3): 71-6.

[6] Alabdulwahhab BM, Alduraiby RI, Ahmed MA, Albatli LI, Alhumain MS, Softah NA *et al.* Hearing Loss and Its Association with Occupational Noise Exposure among Saudi Dentists: A Cross-Sectional Study. British Dental Journal Open. 2016 Nov; 2(1): 1-5. doi: 10 .1038/bdjopen.2016.6.

[7] Mosoeuk LG, Weyers C, Rathebe PC. Noise Exposure among Dental Assisting Students from Dental Instruments During Work-Integrated Learning: A Review. 2019 Open Innovations. 2019 Oct: 247-51. doi: 10.1109/OI.2019.8908244.

[8] Yamada T, Nozaki K, Hayashi M, Kuwano S. Sound Environment During Dental Treatment in Relation to COVID-19 Pandemic. In Acoustics. 2023 Oct; 5(4): 987 -998. doi: 10.3390/acoustics5040056.

[9] Tziovara P, Antoniadou C, Antoniadou M. Patients' Perceptions of Sound and Noise Dimensions in the Dental Clinic Soundscape. Applied Sciences. 2024 Mar; 14(6): 2587. doi: 10.3390/app14062587.

[10] Antoniadou M, Tziovara P, Antoniadou C. The Effect of Sound in the Dental Office: Practices and Recommendations for Quality Assurance—A Narrative Review. Dentistry Journal.2022 Dec; 10(12): 228. doi: 10.3390/dj10120228.

[11] Al-Rawi NH, Al Nuaimi AS, Sadiqi A, Azaiah E, Ezzeddine D, Ghunaim Q *et al.* Occupational Noise-Induced Hearing Loss among Dental Professionals. Quintessence International. 2019 Mar 1;50(3):245-50.

[12] Meenderink SW, Lin X, Park BH, Dong W. Sound Induced Vibrations Deform the Organ of Corti Complex in the Low-Frequency Apical Region of the Gerbil Cochlea for Normal Hearing: Sound Induced Vibrations Deform the Organ of Corti Complex. Journal of the Association for Research in Otolaryngology.2022 Oct; 23(5): 579-91. doi: 10.1007/s10162-022-00856-0.

[13] Marouf AA and Khairallah YA. Photoemission Spectra of Sound Tooth and Those of Different Carious Stages. European Journal of Biophysics. 2019 Aug;7 (1): 23-6. doi: 10.11648/j.ejb.20190701.14.

[14] Dierickx M, Verschraegen S, Wierinck E, Willems G, van Wieringen A. Noise Disturbance and Potential Hearing Loss Due to Exposure of Dental Equipment in Flemish Dentists.International Journal of Environmental Research and Public Health. 2021 May; 18(11): 5617. doi: 10.3390/ijerph18115617.

[15] Zhou W, Ye C, Wang H, Mao Y, Zhang W, Liu A *et al.* Sound Induces Analgesia Through Corticothalamic Circuits. Science.2022 Jul; 377(6602): 198-204. doi: 10.1126/science.abn4663.

[16] Ro T, Ellmore TM, Beauchamp MS. A Neural Link Between Feeling and Hearing. Cerebral Cortex. 2013 Jul; 23(7): 1724-30. doi: 10.1093/cercor/bhs166.

[17] Ali SA, Ali SN, Khan R. Sensing Sounds on the Skin: A Review of Auditory-Tactile Synesthesia and Its Implications for Perception and Attention. 2023 Apr. doi: 10.20944/preprints202304.0164.v1.

[18] Ahlquist M, Franzén O, Coffey J, Pashley D. Dental Pain Evoked by Hydrostatic Pressures Applied to Exposed Dentin in Man: A Test of the Hydrodynamic Theory of Dentin Sensitivity. Journal of Endodontics. 1994 Mar; 20(3): 130-4. doi: 10.1016/S0099-2399(06)80058-0.

[19] Liu XX, Tenenbaum HC, Wilder RS, Quock R, Hewlett ER, Ren YF. Pathogenesis, Diagnosis and Management of Dentin Hypersensitivity: An Evidence-Based Overview for Dental Practitioners. BioMed Central Oral Health.2020 Dec; 20:1-0. doi: 10.1186/s12903-020-01199-z.