



DUNEDIN STUDY CONCEPT PAPER FORM

Provisional Paper Title: Patterns and determinants of tooth wear over the life-course: age 45 findings from the Dunedin Study

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P.I. Sponsor: Professor Jonathan Broadbent

Today's Date: 30/09/23

Please describe your proposal in 2-3 pages with sufficient detail for helpful review.

Objectives of the study:

To investigate determinants of tooth wear patterns, including parafunctional habits, psychological disorders, vomiting/regurgitation, dental/occlusal factors, and tooth brushing frequency.

Data analysis methods:

Data analysis will be conducted under biostatistical guidance (co-supervisor Andrew Gray), using Stata/SE 18 software (Stata, Texas, USA). Associations will be investigated involving plausible determinants of tooth wear using nominal/multinomial logistic regression with tooth wear patterns at age 45 as the dependent variable, both univariably and in adjusted models. Adjusted models will be informed by developing an underlying causal model from the literature and clinical experience, with childhood SES, childhood IQ, and sex included in all adjusted models. The STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines¹ will be utilised. Missing data are expected to be minimal given the nature of the study and consequently imputation for missing data will not be conducted. Confidence intervals will be used throughout to assist with interpretation of practical/clinical significance.

Variables needed at which ages:

Dependent Variable – Tooth Wear

Intraoral scan data from **age 45** dental assessment.

Independent Variable(s) –

Analysing associations between tooth wear patterns and plausible determinants.

Table 1 - Variables (at specified ages)

Variable	Age (years)
Average Childhood IQ	Average of IQ scores at ages 7, 9, 11
Mean Childhood Socioeconomic Status (SES)	0-15
Study Member sex	
Adverse Childhood Experiences (ACEs)	From data recorded at ages 3, 5, 7, 9, 11, 13, 15
Prospective	
Nail/finger biting	5, 7, 9, 11
Thumb/finger sucking	5, 7, 9, 11
Hyperactivity	5, 7, 9, 11
Tooth clenching/grinding	45
Psychological Disorders: <ul style="list-style-type: none"> - Externalising Disorders - ADHD, Conduct Disorder, Alcohol Dependence, Tobacco Dependence, Cannabis Dependence, Drug Dependence. - Internalising Disorders - Anxiety, Depression, Fears, Eating Disorders (Bulimia, Anorexia), PTSD. - Thought Disorders - Obsessive Compulsive Disorder, Mania, Schizophrenia. <p>An 'ever diagnosis' of externalizing disorders, internalizing disorders, and thought disorders (i.e., three separate variables) will be investigated. The specific psychological conditions within these three disorders will also be analysed at an 'ever diagnosis' level. For variables that do not have an existing 'ever diagnosis' variable this will be created from the available data.</p>	Age diagnosis was made varies from 11-45 (variable specific).
Vomiting/Regurgitation	26 (Bowel Symptom Questionnaire) (and also using ED variables mentioned above)
Occlusal Dental Assessments	15, 18, 45
Missing Teeth	15, 18, 45
History of Orthodontic Treatment	45
DMF Trajectories	Dental examination data from ages 9, 15, 18, 26, 32, 38, 45
Tooth Brushing Frequency	26, 32, 38, 45

Significance of the Study (for theory, research methods or clinical practice):

Tooth wear is the process via which tooth structure is lost over time. A degree of tooth wear is considered normal with age.² However, severe wear can lead to sensitivity, pain, tooth loss, and impact oral health-related quality of life.^{2,3} Causal factors of tooth wear can affect specific groups of teeth and, as a result, patterns of tooth wear can occur.⁴

The five main categories of potential causal factors to be investigated are: parafunctional habits, psychological disorders, vomiting/regurgitation, dental/occlusal factors, and tooth brushing frequency. The parafunctional habits of interest are bruxism, nail-biting, and thumb-sucking. The exact role of bruxism in the development/progression of tooth wear appears to be complex and is not well understood.^{5,6} Associations have been reported between bruxism and particular psychological disorders. Bruxism has been reported to be associated with anxiety, stress, and depression.^{7,8} Alcohol, tobacco, and methamphetamine use has been linked to tooth wear in some studies.^{7,9} There is a paucity of evidence investigating a possible causal pathway between nail-biting and tooth wear. Additionally, there is little evidence about thumb sucking and tooth wear.

Vomiting/regurgitation can cause erosive tooth wear due to the acidity of stomach acid contacting tooth surfaces. Correspondingly, individuals with purgative eating disorders and digestive disorders such gastroesophageal reflux disease (GORD) are at an increased risk of erosive tooth wear.¹⁰ It is controversial whether dental/occlusal factors that contribute to defined orthodontic malocclusions can predispose individuals to tooth wear.¹¹⁻¹³ Several studies have reported that a greater frequency of tooth brushing can contribute to abrasive tooth wear.^{14,15}

Most of the tooth wear research since the mid-1990s has studied erosive tooth wear in children and young adults.^{16,17} Few adult tooth wear studies have been undertaken since this time.¹⁶ There is little evidence about the relationship between tooth wear patterns and potential causative factors.

References:

1. von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. *The Lancet*. 2007;370(9596):1453-1457.
2. Bartlett D, O'Toole S. Tooth wear and aging. *Australian Dental Journal*. 2019;64(S1).
3. Mehta SB, Loomans BAC, Banerji S, Bronkhorst EM, Bartlett D. An investigation into the impact of tooth wear on the oral health related quality of life amongst adult dental patients in the United Kingdom, Malta and Australia. *Journal of dentistry*. 2020;99:103409-103409.
4. Kaidonis JA. Tooth wear: the view of the anthropologist. *Clinical Oral Investigations*. 2008;12(S1):21-26.
5. Johansson A, Omar R, Carlsson GE. Bruxism and prosthetic treatment: A critical review. *Journal of Prosthodontic Research*. 2011;55(3):127-136.
6. Beddis HP, Davies SJ. Relationships between tooth wear, bruxism and temporomandibular disorders. *British Dental Journal*. 2023;234(6):422-426.
7. Goldstein G, DeSantis L, Goodacre C. Bruxism: Best Evidence Consensus Statement. *Journal of Prosthodontics*. 2021;30(S1):91-101.
8. Bayar GR, Tutuncu R, Acikel C. Psychopathological profile of patients with different forms of bruxism. *Clinical Oral Investigations*. 2012;16(1):305-311.
9. Hamamoto D, Rhodus N. Methamphetamine abuse and dentistry. *Oral Diseases*. 2009;15(1):27-37.
10. Rangé H, Colon P, Godart N, Kapila Y, Bouchard P. Eating disorders through the periodontal lens. *Periodontology 2000*. 2021;87(1):17-31.
11. Mwangi CW, Richmond S, Hunter ML. Relationship between malocclusion, orthodontic treatment, and tooth wear. *American Journal of Orthodontics and Dentofacial Orthopedics*. 2009;136(4):529-535.
12. Carlsson E, Egermark I, Magnusson T. Predictors of bruxism, other oral parafunctions, and tooth wear over a 20-year follow-up period. *The Journal of Prosthetic Dentistry*. 2003;89(6):564.
13. Janson G, Oltramari-Navarro PVP, de Oliveira RBS, Quaglio CL, Sales-Peres SH de C, Tompson B. Tooth-wear patterns in subjects with Class II Division 1 malocclusion and normal occlusion. *American Journal of Orthodontics and Dentofacial Orthopedics*. 2010;137(1):14.e1-7; discussion 14-15.
14. Wiegand A, Schlueter N. The Role of Oral Hygiene: Does Toothbrushing Harm? In: Lussi A, Ganss C, eds. *Monographs in Oral Science*. Vol 25. S. Karger AG; 2014:215-219.
15. Özgöz M, Arabaci T, Sümbüllü MA, Demir T. Relationship between handedness and toothbrush-related cervical dental abrasion in left- and right-handed individuals. *Journal of Dental Sciences*. 2010;5(4):177-182.
16. Spijker A van 't, Roiguez JM, Kreulen CM, Bronkhorst EM, Bartlett DW, Creugers NHJ. Prevalence of tooth wear in adults. *The International Journal of Prosthodontics*. 2009;22(1):35-42.
17. Johansson AK, Omar R, Carlsson GE, Johansson A. Dental Erosion and Its Growing Importance in Clinical Practice: From Past to Present. *International Journal of Dentistry*. 2012;2012:632907-632917.

DATA SECURITY AGREEMENT

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Please keep one copy for your records and return one to the PI Sponsor

Please initial your agreement: (customize as necessary)

ZB	I am current on Human Subjects Training [CITI www.citiprogram.org] or equivalent.
ZB	My project is covered by the Dunedin Study's ethics approval OR I have /will obtain ethical approval from my home institution (please specify).
ZB	I will treat all data as "restricted" and store in a secure fashion. My computer or laptop is: <ul style="list-style-type: none"> • encrypted (recommended programs are FileVault2 for Macs, and Bitlocker for Windows machines) • password-protected • configured to lock-out after 15 minutes of inactivity AND • has an antivirus client installed as well as being patched regularly.
ZB	I will not "sync" the data to a mobile device.
ZB	In the event that my laptop with data on it is lost, stolen or hacked, I will immediately contact my PI Sponsor or Study Director, Richie Poulton (richie.poulton@otago.ac.nz).
ZB	I will not share the data with anyone, including my students or other collaborators not specifically listed on this concept paper.
ZB	I will not post data online or submit the data file to a journal for them to post. <i>Some journals are now requesting the data file as part of the manuscript submission process. The Dunedin Study Members have not given informed consent for unrestricted open access, so we have a managed-access process. Speak to your PI Sponsor or Richie Poulton for strategies for achieving compliance with data-sharing policies of journals.</i>
ZB	I will delete all data files from my computer after the project is complete. Collaborators and trainees may not take a data file away from the office. The data remains the property of the Study and cannot be used for further analyses without an approved concept paper for new analyses.