



ARCL0116: Dental Anthropology

2023-24, Term 2
MSc BAFA Core Module
15 Credits

Co-ordinator: Dr Carolyn Rando
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Room 312, 3rd Floor Institute of Archaeology
Office Hours: Mondays, 14.30 – 16.30

IMPORTANT INFORMATION REGARDING ASSESSMENTS:

The **coursework coversheet** is available on the course Moodle pages and here:
<https://www.ucl.ac.uk/archaeology/current-students> under “Policies, Forms and Guidelines”.

Please enter **your five-digit candidate code on the coversheet and *in the subject line***
when you upload your work in Moodle.

Please use **your five-digit candidate code as the name of the file** you submit.

Please refer to <https://www.ucl.ac.uk/archaeology/current-students/ioa-student-handbook/13-information-assessment>

<https://www.ucl.ac.uk/archaeology/current-students/ioa-study-skills-guide/referencing-effectively-and-ioa-guidelines>

<https://www.ucl.ac.uk/students/exams-and-assessments/academic-integrity>

<https://library-guides.ucl.ac.uk/referencing-plagiarism/acknowledging-AI>

for instructions on coursework submission, IoA referencing guidelines and marking criteria, as well as UCL policies on penalties for late submission, over-length work, the use of text generation software (AI) and academic misconduct.

1. MODULE OVERVIEW

MODULE DESCRIPTION

This half-unit module gives a detailed introduction to the methodology used in the study of the dentition in archaeology and physical anthropology, and the main current issues in research. It provides an anatomical background to the dentition, morphological variation, histology, changes with age and development, and pathology, dealing especially with anatomically modern humans, but also introducing the evolutionary background.

MODULE AIMS & OBJECTIVES

It is intended that this course will provide students with the specialist skills required to plan a dental anthropology research project, carry it out and interpret the results. With this in mind, when they have successfully completed the course, students should:

- Be able to identify confidently all elements of human jaws and dentition.
- Be able to label the main features of each tooth.
- Have an understanding of variation in size and shape of the dentition, and its interpretation in terms of sexual dimorphism, evolution, migration and growth.
- Have an understanding of developmental processes in the formation of teeth, and aging, together with the ways in which these can be applied to archaeological and forensic questions.
- Understand the different types of wear and their progression with age.
- Recognise the different types of pathological lesions seen in archaeological assemblages and understand the limits to their interpretation.

LEARNING OUTCOMES

On successful completion of the course, in addition to specialist knowledge and skills, students should have developed skills of observation and inference, critical reflection and application of acquired knowledge.

METHODS OF ASSESSMENT

This course is assessed by means of:

- (a) **one essay of 2500 words**, which will contribute 60% to the final grade for the course. This is due on the **4th of March 2024**.
- (b) **one practical examination**, to be held on **TUESDAY 19th March 2024**, which will contribute 40% to the final grade for the course

COMMUNICATION

- Moodle and MS Teams** are the main hubs for this module.
- Important information will be posted by staff in the **Announcements section of the Moodle page** and you will automatically receive an email notification for these.
- Please email any general queries relating to module content, assessments, and administration to the course coordinator.
- For personal queries, please contact the co-ordinator by email.

WEEK-BY-WEEK SUMMARY

Week	Lectures (Monday 13.00 – 14.00; Room 230, 14 Taviton St)	Practical Session (Tuesdays, Room 308 loA; 10.00 – 12.00 or 13.00 – 15.00)
1	Lecture: Introduction to Dental Anthropology	Practical: Introduction to the dentition
2	Lecture: Enamel, Dentine and Cement	Practical: Incisors and Canines
3	Lecture: Age Estimation from the Dentition	Practical: Permanent Molars
4	Lecture: Variation in Tooth Size	Practical: Permanent Premolars
5	Lecture: Variation in Tooth Shape	Practical: Deciduous Premolars; Age Estimation using Dental Eruption
6	Reading week	
7	Lecture: Tooth wear – Macro & Micro	Practical: Tooth Morphology & Variation
8	Lecture: Enamel Hypoplasia	Practical: Assessing Hypoplastic Defects
9	Lecture: Dental Disease Part 1 – Carious Lesions	Practical: Identifying and Recording Caries
10	Lecture: Dental Disease Part 2 – Periodontal Disease	Practical: Identifying Periapical Lesions; REVISION
11	Lecture: Occlusion and Malocclusion	EXAM

WEEKLY MODULE PLAN

The module is taught through lectures and practicals. Students will be required to undertake set readings, and complete pre-class activities in order to be able to actively participate in discussion and undertake class work.

WORKLOAD

This is a 15-credit module which equates to 150 hours of learning time including session preparation, background reading, and researching and writing your assignments. With that in mind you should expect to organise your time in roughly this way:

40 hours	Staff-led teaching sessions (lectures and practical sessions)
40 hours	Self-guided session preparation (reading, listening, note-taking and online activities), about 6 hours a week
35 hours	Reading for, and writing, the research essay
35 hours	Preparing for the Practical Examination

2. ASSESSMENT

Each assignment and possible approaches to it will be discussed in class, in advance of the submission deadline. If students are unclear about the nature of an assignment, they should discuss this with the module co-ordinator in advance (via office hours or class Moodle forum). You will receive feedback on your written coursework via Moodle, and have the opportunity to discuss your marks and feedback with the co-ordinator in their office hours.

For more details see the 'Assessment' section on Moodle. The coursework coversheet is available on the course Moodle pages and here: <https://www.ucl.ac.uk/archaeology/current-students> under "Policies, Forms and Guidelines".

Please make sure you enter your five-digit candidate code on the coversheet and in the subject line when you upload your work in Moodle.

Please use your five-digit candidate code as the name of the file you submit.

The [IoA marking criteria](#) can be found in the IoA Student Handbook (Section 13: Information on assessment). The [IoA Study Skills Guide](#) provides useful guidance on writing different types of assignment.

Please note that **late submission, exceeding the maximum word count and academic misconduct (unacknowledged use of text generation software and plagiarism)** will be penalized and can significantly reduce the mark awarded for the assignment and/or overall module result. Please do consult

- <https://www.ucl.ac.uk/archaeology/current-students/ioa-student-handbook/13-information-assessment> with sections 13.7–13.8: coursework submission, 13.10: word count, 13.12–14: academic integrity
- <https://www.ucl.ac.uk/students/exams-and-assessments/academic-integrity> for UCL's guidance on academic integrity
- <https://library-guides.ucl.ac.uk/referencing-plagiarism/acknowledging-AI> for UCL's guidance on how to acknowledge the use of text generation software.

Generative Artificial Intelligence is a form of artificial intelligence (AI) that can be used to produce new content including images, audio, video, and text. The use of AI software to generate content for your essay is *not* permitted and its use will be taken very seriously. You can, however, use AI software for 'language and writing review', specifically using software for checking the grammar, spelling, and punctuation of your writing. Should you choose to use AI software in any way, it must be acknowledged in the relevant section of the coursework coversheet following the Library's guidance below (e.g. noting its use in your 'Acknowledgments'):

<https://library-guides.ucl.ac.uk/referencing-plagiarism/acknowledging-AI>

ASSESSMENT 1: Essay of 2500 words (60%)

Deadline: 4th March 2024

Please select from **ONE** of the following essay topics:

1. 'Malocclusion is a disease of modernity'. Support or refute this statement using both archaeological and modern clinical evidence.
2. Recent studies have suggested that dental calculus can be used to identify disease. How strong is the evidence for this application? Use both archaeological and modern investigations to support your stance.
3. Considering laboratory constraints, compare and contrast the efficacy of aDNA and enamel peptide proteomics for sex estimation. Use both archaeological and modern evidence.
4. How reliable is root dentine translucency in the forensic estimation of age-at-death in adults? Does the method meet the standards of the UK legal system?
5. Ritual tooth ablation has been used to infer cultural behaviours and social structures in ancient peoples, specifically regarding post-marital residence. Discuss this topic, detailing the quality/robustness of the evidence and using case studies to support your assertions.

ASSESSMENT 2: In-Class Practical Examination (40%)

The practical examination will take place on **Tuesday 19th March 2024** during your normal practical session, in Room 308 (Osteology Lab). You will not have seen the specimens beforehand, and you are not allowed to use notes/books while taking the exam. The specific nature of the exam will be discussed extensively during classes.

The test is written on a set of sheets which are provided for you, with a numbered area for each specimen that you can write in. So long as you write clearly, it will not matter what you write with (I will have some "emergency" pens and pencils that you can use in case of accident). It will not matter if your use of English is not grammatically correct so long as it is comprehensible – note form is satisfactory. If you spell terms correctly, you will be credited for it, but so long as your meaning is clear you will at least receive some credit for recognising that a feature is there.

Please let the module coordinator know in advance of the examination if you are registered with UCL as having dyslexia or any other learning difficulty which requires me to offer you extra examination time or the use of a computer. Please also contact Judy Medrington (email: j.medrington@ucl.ac.uk) about this.

3. RESOURCES & PREPARATION FOR CLASS

You are expected to read the essential readings as well as review any practical content (through videos and extra resources) Moodle each week. Completing the readings is essential for your effective participation in the activities and discussions that we will do, and it will greatly enhance your understanding of the material covered. Further readings are provided via the online-reading list for you to get a sense of the range of current work on a given topic and for you to draw upon for your assessments. Online reading list will be found in Moodle under Basic texts and online resources.

PRIMARY TEXTS:

Hillson, S., 2023. Dental Anthropology Second Edition. Cambridge University Press: Cambridge.

Hillson, S., 2014. Tooth Development in Human Evolution and Bioarchaeology. Cambridge University Press: Cambridge.

Hillson, S., 2005. Teeth, Second Edition. Cambridge University Press: Cambridge.

4. SYLLABUS

The following is an outline for the module content (week by week) and identifies essential readings relevant to each session. Information is provided as to where in the UCL library system individual readings are available; their location and Teaching Collection (TC) number, and status (whether out on loan) can also be accessed on the eUCLid computer catalogue system.

Week 1: INTRODUCTION TO DENTAL ANTHROPOLOGY

Essential Readings:

-Hillson, S., 2023. *Dental Anthropology Second Edition*. Cambridge University Press: Cambridge. (PLEASE READ THE PREFACE AND PAGES 1-24)

-Hillson, S. W., 2005. *Teeth*. Cambridge University Press: Cambridge. (PLEASE READ PAGES 8 TO 19 AND 44 TO 46.)

Week 2: ENAMEL, DENTINE AND CEMENT

Essential Readings:

-Hillson, S., 2023. *Dental Anthropology Second Edition*. Cambridge University Press: Cambridge. (CHAPTERS 5.1, 6.1 and 7.1)

-Hillson, S., 2014. *Tooth development in human evolution and bioarchaeology*. Cambridge University Press. (CHAPTER 4)

Suggested Readings:

-Robinson, C., 2014. 'Enamel maturation: a brief background with implications for some enamel dysplasias'. *Frontiers in Physiology*, 5, p.388.

-Antoine, D., Hillson, S. and Dean, M.C., 2009. 'The developmental clock of dental enamel: a test for the periodicity of prism cross-striations in modern humans and an evaluation of the most likely sources of error in histological studies of this kind'. *Journal of Anatomy*, 214(1), pp.45-55.

-Reid, D. J. & Dean, M. C., 2006. 'Variation in modern human enamel formation times'. *Journal of Human Evolution*, 50, pp. 329-346.

-Reid, D. J., Guatelli-Steinberg, D. & Walton, P., 2008. 'Variation in modern human premolar enamel formation times: implications for Neandertals'. *Journal of Human Evolution*, 54, pp. 225-235.

-McFarlane, G., Guatelli-Steinberg, D., Loch, C., White, S., Bayle, P., Floyd, B., Pitfield, R. and Mahoney, P., 2021. 'An inconstant biorhythm: The changing pace of Retzius periodicity in human permanent teeth'. *American Journal of Physical Anthropology*, 175(1), pp.172-186.

Week 3: AGE ESTIMATION FROM THE DENTITION

Essential Readings

-Hillson, S., 2023. *Dental Anthropology Second Edition*. Cambridge University Press: Cambridge. (CHAPTER 4)

-AlQahtani, S.J., Hector, M.P. and Liversidge, H.M., 2010. 'Brief communication: The London atlas of human tooth development and eruption'. *American Journal of Physical Anthropology*, 142(3), pp.481-490.

-AlQahtani, S.J., Hector, M.P. and Liversidge, H.M., 2014. 'Accuracy of dental age estimation charts: Schour and Massler, Ubelaker and the London Atlas'. *American journal of Physical Anthropology*, 154(1), pp.70-78.

Suggested readings:

- Moorrees, C.F., Fanning, E.A. and Hunt Jr, E.E., 1963. 'Age variation of formation stages for ten permanent teeth'. *Journal of Dental Research*, 42(6), pp.1490-1502.
- Moorrees, C.F., Fanning, E.A. and Hunt Jr, E.E., 1963. 'Formation and resorption of three deciduous teeth in children'. *American Journal of Physical Anthropology*, 21(2), pp.205-213.
- Demirjian, A., Goldstein, H. and Tanner, J.M., 1973. 'A new system of dental age assessment'. *Human Biology*, pp.211-227.
- Roberts, G. and Lucas, V.S., 2021. 'Is the Demirjian, Goldstein, and Tanner method of dental age estimation obsolete? A critical review and re-assessment.' *Insights in Anthropology*, 5, pp.325-336.
- Bertrand, B., Cunha, E., Bécart, A., Gosset, D. & Hédouin, V. 2019. 'Age at death estimation by cementochronology: Too precise to be true or too precise to be accurate?' *American Journal of Physical Anthropology*, 169(3), pp. 464-481.
- Le Cabec, A., Tang, N. K., Ruano Rubio, V. & Hillson, S. 2019. 'Nondestructive adult age at death estimation: Visualizing cementum annulations in a known age historical human assemblage using synchrotron X-ray microtomography'. *American Journal of Physical Anthropology*, 168, pp. 25-44.

Week 4: VARIATION IN TOOTH SIZE

Essential Readings:

- Hillson, S. W., Fitzgerald, C. M. & Flinn, H. M., 2005. 'Alternative dental measurements – proposals and relationships with other measurements'. *American Journal of Physical Anthropology*, 126, pp. 413-426.
- Hillson, S., 2023. *Dental Anthropology Second Edition*. Cambridge University Press: Cambridge. (CHAPTER 2, pp. 96-120.)

Suggested readings:

- Plavcan, J. M., 2012. 'Sexual size dimorphism, canine dimorphism, and male-male competition in primates'. *Human Nature*, 23(1), pp. 45-67.
- Adams, D. M. & Pilloud, M. A. 2019. 'Sex Estimation from Dental Crown and Cervical Metrics in a Contemporary Japanese Sample'. *Forensic Anthropology*, 2(4), pp. 222-232.
- Stewart, N.A., Gerlach, R.F., Gowland, R.L., Gron, K.J. and Montgomery, J., 2017. 'Sex determination of human remains from peptides in tooth enamel.' *Proceedings of the National Academy of Sciences*, 114(52), pp.13649-13654.
- Pilloud, M.A. and Hillson, S., 2012. 'Brief communication: The use of alternative dental measurements on deciduous teeth.' *American Journal of Physical Anthropology*, 149(2), pp.299-306.
- Rando, C., Hillson, S. and Antoine, D., 2014. 'Changes in mandibular dimensions during the mediaeval to post-mediaeval transition in London: A possible response to decreased masticatory load'. *Archives of Oral Biology*, 59(1), pp.73-81.
- Hanihara, T. and Ishida, H., 2005. 'Metric dental variation of major human populations'. *American Journal of Physical Anthropology*, 128(2), pp.287-298.

Week 5: VARIATION IN TOOTH SHAPE

Essential readings:

-Hillson, S., 2023. *Dental Anthropology Second Edition*. Cambridge University Press: Cambridge. (CHAPTER 2, pp. 120-144.)

Hanihara, T., 2008. 'Morphological variation of major human populations based on nonmetric dental traits'. *American Journal of Physical Anthropology*, 136(2), pp.169-182.

-Irish, J.D., Morez, A., Girdland Flink, L., Phillips, E.L. and Scott, G.R., 2020. 'Do dental nonmetric traits actually work as proxies for neutral genomic data? Some answers from continental-and global-level analyses'. *American Journal of Physical Anthropology*, 172(3), pp.347-375.

Suggested readings:

-Scott, G. R. & Irish, J. D., 2017. *Human tooth crown and root morphology. The Arizona State University Dental Anthropology System*. Cambridge University Press: Cambridge.

-Scott, G. R., Turner II, C. G., Townsend, G. C. & Martín-Torres, M., 2018. *The anthropology of modern human teeth. Dental morphology and its variation in recent and fossil Homo sapiens*. Cambridge University Press: Cambridge. (Please read Chapter 7.)

-Scott, G.R. and Schomberg, R., 2016. 'A baffling convergence: Tooth crown and root traits in Europe and New Guinea'. In M.A. Pilloud, & J.T. Hefner, eds., *Biological Distance Analysis: Forensic and Bioarchaeological Perspectives*. Academic Press: Amsterdam, pp. 411-424.

-Irish, J.D. and Guatelli-Steinberg, D., 2003. 'Ancient teeth and modern human origins: an expanded comparison of African Plio-Pleistocene and recent world dental samples'. *Journal of Human Evolution*, 45(2), pp.113-144.

-Chapple, S.A. and Skinner, M.M., 2023. 'A tooth crown morphology framework for interpreting the diversity of primate dentitions'. *Evolutionary Anthropology: Issues, News, and Reviews*, 32(5), pp.240-255.

Week 6: READING WEEK - NO CLASSES!

Week 7: TOOTH WEAR – MACRO AND MICRO WEAR

Essential Readings:

--Hillson, S., 2023. *Dental Anthropology Second Edition*. Cambridge University Press: Cambridge. (CHAPTER 10)

-Smith, B. H. (1984). 'Patterns of molar wear in hunter-gatherers and agriculturalists'. *American Journal of Physical Anthropology*, 63, pp. 39-56.

-Hinton, R. J. (1982). 'Differences in interproximal and occlusal tooth wear among prehistoric Tennessee Indians: implications for masticatory function'. *American Journal of Physical Anthropology*, 57(1), pp. 103-115.

Suggested readings:

-Clement, A. F., Hillson, S. W. & Aiello, L. C., 2012. 'Tooth wear, Neanderthal facial morphology and the anterior dental loading hypothesis'. *Journal of Human Evolution*, 62(3), pp. 367-376.

-Kullmer, O., Benazzi, S., Fiorenza, L., Schulz, D., Bacso, S. & Winzen, O., 2009. 'Technical note: occlusal fingerprint analysis: quantification of tooth wear pattern'. *American Journal of Physical Anthropology*, 139(4), pp. 600-605.

-Fiorenza, L., Benazzi, S., Tausch, J., Kullmer, O., Bromage, T. G. & Schrenk, F., 2011. 'Molar macrowear reveals Neanderthal eco-geographic dietary variation'. *PLoS One*, 6(3), pp. e14769.

-Ungar, P. S., Grine, F. E., Teaford, M. F. & El Zaatari, S., 2006. 'Dental microwear and diets of African early Homo'. *Journal of Human Evolution*, 50(1), pp. 78-95.

-van Casteren, A., Strait, D. S., Swain, M. V., Michael, S., Thai, L. A., Philip, S. M., Saji, S., Al-Fadhlah, K., Almusallam, A. S. & Shekeban, A., 2020. 'Hard plant tissues do not contribute meaningfully to dental microwear: evolutionary implications'. *Scientific Reports*, 10(1), pp. 1-9.

-Grine, F. E., Sponheimer, M., Ungar, P. S., Lee-Thorp, J. & Teaford, M. F., 2012. 'Dental microwear and stable isotopes inform the paleoecology of extinct hominins'. *American Journal of Physical Anthropology*, 148(2), pp. 285-317.

Week 8: ENAMEL HYPOPLASIA

Essential Readings:

-Hillson, S., 2023. *Dental Anthropology Second Edition*. Cambridge University Press: Cambridge. (CHAPTER 5.5)

-Hillson, S., 2014. *Tooth development in human evolution and bioarchaeology*. Cambridge University Press. (CHAPTERS 7 & 8)

Suggested readings:

Henriquez, A.C. and Oxenham, M.F., 2020. 'A new comprehensive quantitative approach for the objective identification and analysis of linear enamel hypoplasia (LEH) in worn archaeological dental assemblages'. *Journal of Archaeological Science*, 113, p.105064.

Bocaege, E. and Hillson, S., 2016. 'Disturbances and noise: Defining furrow-form enamel hypoplasia'. *American journal of physical anthropology*, 161(4), pp.744-751.

Week 9: DENTAL DISEASE PART 1 – CARIOUS LESIONS

Essential readings:

-Hillson, S., 2023. *Dental Anthropology Second Edition*. Cambridge University Press: Cambridge. (CHAPTER 11.4)

-Hillson, S. W., 2007. 'The current state of dental decay'. In: J. D. Irish and G. Nelson, Eds. *Technique and Application in Dental Anthropology*. Cambridge University Press: Cambridge, pp. 111-136.

-Hillson, S., 2001. 'Recording dental caries in archaeological human remains'. *International Journal of Osteoarchaeology*, 11(4), pp.249-289.

Suggested readings:

Inskip, S., Zachary, L., Serrano Ruber, M. and Hoogland, M., 2023. 'Pipe smoking and oral health in males from The Netherlands during the 18th–19th century'. *Post-Medieval Archaeology*, 57(1), pp.94-107.

Corbett, M. E. & Moore, W. J., 1976. 'Distribution of dental caries in ancient British populations: IV The 19th Century'. *Caries Research*, 10, pp. 401-414.

Eshed, V., Gopher, A., Pinhasi, R. & Hershkovitz, I., 2010. 'Paleopathology and the origin of agriculture in the Levant'. *American Journal of Physical Anthropology*, 143(1), pp. 121-133.

Bertilsson, C., Borg, E., Sten, S., Hessman, E., Sjöblom, H. and Lingström, P., 2022. 'Prevalence of dental caries in past European populations: a systematic review'. *Caries Research*, 56(1), pp.15-28.

Mant, M. and Roberts, C., 2015. 'Diet and dental caries in post-medieval London'. *International Journal of Historical Archaeology*, 19, pp.188-207.

Towle, I., Davenport, C., Irish, J.D. and De Groote, I., 2023. 'High frequency of dental caries and calculus in dentitions from a British medieval town'. *Archives of Oral Biology*, 155, p.105777.

Week 10: DENTAL DISEASE PART 2 – PERIODONTAL DISEASE

Essential Readings:

-Hillson, S., 2023. *Dental Anthropology Second Edition*. Cambridge University Press: Cambridge. (CHAPTER 11.3, 11.5, 11.6 & 11.7))

Hillson, S. W., 2008. Dental pathology. In: M. A. Katzenberg and S. R. Saunders, Ed. *Biological anthropology of the human skeleton*. New York, John Wiley & Sons, Inc., pp. 301-340.

Kerr, N. W., 1991. 'Prevalence and natural history of periodontal disease in Scotland - The mediaeval period (900-1600 A. D.)'. *Journal of Periodontal Research*, 26(4), pp. 346-354.

Suggested readings:

-Whiting, R., Antoine, D. and Hillson, S., 2019. 'Periodontal disease and 'oral health' in the past: new insights from ancient Sudan on a very modern problem'. *Dental Anthropology Journal*, 32(2), pp.30-50.

-Karn, K.W., Shockett, H.P., Moffitt, W.C. and Gray, J.L., 1984. 'Topographic classification of deformities of the alveolar process'. *Journal of Periodontology*, 55(6), pp.336-340.

-Whittaker, D.K., Griffiths, S., Robson, A., Roger-Davies, P., Thomas, G. and Molleson, T., 1990. 'Continuing tooth eruption and alveolar crest height in an eighteenth-century population from Spitalfields, East London'. *Archives of Oral Biology*, 35(2), pp.81-85.

-Wasterlain, S.N., Cunha, E. and Hillson, S., 2011. 'Periodontal disease in a Portuguese identified skeletal sample from the late nineteenth and early twentieth centuries'. *American Journal of Physical Anthropology*, 145(1), pp.30-42.

Week 11: OCCLUSION AND MALOCCLUSION

EXAM (19th March 2024)

Essential Readings:

-Hillson, S., 2023. *Dental Anthropology Second Edition*. Cambridge University Press: Cambridge. (CHAPTER 3)

-Harris, E.F. and Corruccini, R.S., 2008. 'Quantification of dental occlusal variation: a review of methods'. *Dental Anthropology Journal*, 21(1), pp.1-11.

-Kaifu, Y., 2000. 'Tooth wear and compensatory modification of the anterior dentoalveolar complex in humans'. *American Journal of Physical Anthropology*, 111(3), pp.369-392.

Suggested readings:

-Silvester, C.M., Kullmer, O. and Hillson, S., 2021. 'A dental revolution: The association between occlusion and chewing behaviour'. *Plos one*, 16(12), p.e0261404.

-Evensen, J.P. and Øgaard, B., 2007. 'Are malocclusions more prevalent and severe now? A comparative study of medieval skulls from Norway'. *American Journal of Orthodontics and Dentofacial Orthopedics*, 131(6), pp.710-716.

-Pilloud, M.A., 2018. 'The Definition of New Dental Morphological Variants Related to Malocclusion: Traits of Malocclusion'. *Dental Anthropology Journal*, 31(1), pp.10-18.

-Polder, B.J., Van't Hof, M.A., Van der Linden, F.P. and Kuijpers-Jagtman, A.M., 2004. 'A meta-analysis of the prevalence of dental agenesis of permanent teeth'. *Community Dentistry and Oral Epidemiology*, 32(3), pp.217-226.

-Kaifu, Y., Kasai, K., Townsend, G.C. and Richards, L.C., 2003. 'Tooth wear and the "design" of the human dentition: a perspective from evolutionary medicine'. *American Journal of Physical Anthropology*, 122(S37), pp.47-61.

-Begg, P.R., 1954. 'Stone age man's dentition: With reference to anatomically correct occlusion, the etiology of malocclusion, and a technique for its treatment'. *American Journal of Orthodontics*, 40(4), pp.298-312.

Corruccini, R.S., Townsend, G.C. and Brown, T., 1990. 'Occlusal variation in Australian aboriginals'. *American Journal of Physical Anthropology*, 82(3), pp.257-265.