

ASUDAS: A Novel Tool to Study Dental Morphological Variations in An Indian Context.

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Abstract:

These dental morphological traits have been studied world over using a Dental plaque based anthropology method devised at Arizona State University a.k.a ASUDAS. This short communication is to disseminate knowledge contemporaneous with our original two papers published using these plaques. In the first study, we explored the frequency of non-metric crown traits in Delhi and NCR population. Subsequently, in the second study, we assessed the frequency of non-metric crown traits in different classes of malocclusion. In both the studies we used ASUDAS reference plaques for comparative analysis.

We recommend to plan geo-population based ASUDAS studies for analysing non-metric dental crown traits with larger sample size in various populations of India.

Frequency trends of non-metric traits of teeth (crowns) in our study and previous studies did not show sexual dimorphism. Therefore sex pooled studies using ASUDAS plaques should be planned.

We recommend usage of “Dental Anthropology Data Collection Table” generated recently. Authorities should be recommended that ASUDAS should be applied to various teeth exhumed in graves in future.

Keywords, ASUDAS plaques, Carabelli trait, Shovelling, Winging

Introduction:

Anthropology is the study of variation and evolution in humans. Physical anthropology is concerned with the biology and anatomy of variation in humans. Dental Anthropology (DA), on the other hand is a branch of physical anthropology concerned with the formation, evolution and variation of teeth and associated oral-para-oral structures.¹ DA deals with various scientific analysis, which includes “morphology, matrices health, evolution, growth, genetics, usage, forensic, and ethnographic treatment.”² DA involves evaluation, documenting and interpreting of dental metric traits and non-metric traits. These traits can be evaluated on both crowns and roots of teeth.³

Arizona State University Dental Anthropology System (ASUDAS)

Dental morphological traits have been studied and catalogued by scientists for understanding variations in human populations.^{3,4} These non-metric dental characteristics play an important role in the ethnic classification of a population that aids in forensic racial identification.⁵ These dental morphological variations have been studied globally using a popular plaque based method called as Arizona State University Dental Anthropology System (ASUDAS).^{3,5,6} (Figure 1)

This system has attributes like easily recordable, consistent observer results, no sexual dimorphism, evolutionarily conservative behaviour and low chances of selecting/bias in



Figure 1: Dental plaque-based anthropology method devised at Arizona State University a.k.a ASUDAS

expression.⁷ A web application of the ASUDAS (i.e. rASUDAS) is also available.^{8,9}

Root traits:

Since ASUDAS based study was on dental cast we did not study the root traits. The two root variables that are studied are root number and supernumerary roots. Although tooth roots do not exhibit the same complexity as documented tooth crown morphology, they can nevertheless offer a limited range of changes that can be used to differentiate between populations.¹⁰

Insight

This short communication has an aim to disseminate

knowledge contemporaneous with our team's original two papers published using ASUDAS.^{3,11} Our first study derived frequency trend of twenty non-metric dental crown traits (NCDTs) assessed on samples from National Capital region (NCR) of India.³ The study also checked for any sexual dimorphism in those studied twenty traits. According to the study, there was little to no sexual dimorphism in the dental features, although there was a substantial correlation between the lingual cusp variation and cusp number. Our second study identified the NCDTs which expressed variations of scoring and frequency in different malocclusion classes in a sample from India, New Delhi population.¹¹

Recommendations and Road Ahead

It is well established that the interactions between genetic and environmental factors lead to anatomical variations. These variations also reflect in dental morphology¹² and the usage of crown and root teeth traits for estimating population relationships has a long history in dental anthropology.⁹ By adopting innovations like ASUDAS etc India can be poised on the very cusp of dental anthropology advancements. We encourage researchers and students to plan geo-population based ASUDAS studies for analysing NCDTs with larger sample size in India. NCDT frequency trends found in our study and previous studies did not show any sexual dimorphism of data, hence studies with sex pooled sample should be planned. We recommend using “Dental anthropology data collection table” generated in our study recently.³ Authorities should recommend that ASUDAS be applied to various teeth exhumed in graves in future.

References

1. Forensic Dentistry and Anthropology [Internet]. [cited 2023 Sep 9]. Available from: <https://www.ada.org/resources/research/science-and-research-institute/oral-health-topics/forensic-dentistry-and-anthropology>
2. Scott GR, Turner CG. Dental Anthropology. *Annu Rev Anthropol.* 1988 1;17(1):99–126.
3. Chowdhry A, Popli DB, Sircar K, Kapoor P. Study of twenty non-metric dental crown traits using ASUDAS system in NCR (India) population. *Egypt J Forensic Sci.* 2023 23;13(1):8.
4. Acharya AB, Sivapathasundharam. Forensic Odontology. In: Shafer's Text Book of Oral Pathology. 8th ed. New Delhi: Elsevier; p. 724.
5. Baby TK, Sunil S, Babu SS. Nonmetric traits of permanent posterior teeth in Kerala population: A forensic overview. *J Oral Maxillofac Pathol JOMFP.* 2017;21(2):301–8.
6. Turner C, Nichol C, Scott GR. Scoring procedures for key morphological traits of the permanent dentition: The Arizona State University dental anthropology system. In: *Advances in dental anthropology.* New York: Wiley-Liss; 1991. p. 13–31.
7. Irish JD, Morez A, Girdland Flink L, Phillips ELW, Scott GR. Do dental nonmetric traits actually work as proxies for neutral genomic data? Some answers from continental and global level analyses. *Am J Phys Anthropol.* 2020;172(3):347–75.
8. rASUDAS [Internet]. [cited 2022 Jun 25]. Available from: <https://osteomics.com/rASUDAS/>
9. Scott GR, Pilloud M, Navega D, Coelho J, Cunha E, Irish J. rASUDAS: A New Web-Based Application for Estimating Ancestry from Tooth Morphology. *Forensic Anthropol.* 2018;1(1):18–31.
10. Scott GR, Maier C, Heim K. Identifying and Recording Key Morphological (Nonmetric) Crown and Root Traits. In: Irish JD, Scott GR, editors. *A Companion to Dental Anthropology* [Internet]. 1st ed. Wiley; 2015 [cited 2023 Sep 13]. p. 245–64. Available from: <https://onlinelibrary.wiley.com/doi/10.1002/9781118845486.ch17>
11. Kapoor P, Bablani Popli D, Maryam S, Negi A, Natarajan S, Chowdhry A. Evaluation of Twenty Non-Metric Dental Crown Traits in Different Types of Malocclusions in a Sample from India, New Delhi Population. *ACTA Stomatol Croat.* 2023;57(4): 364-380.
12. Chowdhry A, Kapoor P. Anatomical Attributes of the Tooth. In: Nanda A, Singh J, editors. *Forensic Odontology: A Handbook for Human Identification* [Internet]. BENTHAM SCIENCE PUBLISHERS; 2023 [cited 2023 Sep 13]. p. 1–27. Available from: <https://www.eurekaselect.com/node/218881>