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LITERATURE REVIEW:

Why Dental Anthropology Should be Taught in Dental Schools?: Ten Years Experience at the University of Costa Rica

¿Por qué la antropología dental debería ser enseñada en las facultades de odontología?: diez años de experiencia en la Universidad de Costa Rica

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ABSTRACT: Dentistry and anthropology are now more interconnected than ever, as teeth serve as critical evidence for studying ancient civilizations. Several topics in Dental Anthropology can be effectively integrated into dental school curricula. Currently, the absence of such training in undergraduate and postgraduate programs limits students' understanding of teeth from a broader, interdisciplinary perspective, thereby hindering the application of these insights in clinical practice. This article aims to provide an overview of what has been taught during the first ten years of introducing the basic concepts of Dental Anthropology at the Dental School of the University of Costa Rica. Similar projects implemented in Latin America are also discussed. Finally, it examines the achievements, challenges, and strategies to be implemented in the future.

KEYWORDS: Education; Dental anthropology; Undergraduate students; Prehispanic dentition; Indigenous peoples; Costa Rica.

RESUMEN: La odontología y la antropología están ahora más interconectadas que nunca, ya que los dientes sirven como evidencia fundamental para el estudio de civilizaciones antiguas. Varios temas dentro de la Antropología Dental podrían integrarse de manera efectiva en los planes de estudo de las facultades de Odontología. Actualmente, la ausencia de formación en Antropología Dental en los programas de pregrado y posgrado limita la comprensión de los estudiantes sobre los dientes desde una perspectiva más amplia e interdisciplinaria, dificultando la aplicación de estos conocimientos en la práctica clínica. El objetivo de este artículo es ofrecer un recuento de lo que se ha enseñado durante los primeros diez años de

la introducción de conceptos básicos de la Antropología Dental en la Facultad de Odontología de la Universidad de Costa Rica. Además, se comentan proyectos similares ejecutados en América Latina. Finalmente, se analizan los logros, desafíos y estrategias a implementar en los próximos años.

PALABRAS CLAVE: Enseñanza; Antropología dental; Estudiantes de grado; Dentición prehispánica; Pueblos originarios; Costa Rica.

INTRODUCTION

In past civilizations and even today, teeth served not only for smiling, speaking, chewing, and supporting oral and facial tissues, but also as a key element of cultural identity. Historically, teeth have reflected an individual´s life and role in society. For example, in ancient times, teeth were used as tools for various tasks, and dental modifications such as inlays or fillings were employed as symbols in rituals, combats, and to signify hierarchical positions.

Over 800 years ago, in prehispanic cultures, many Mesoamerican civilizations, carved dental pieces for both medical and esthetic purposes. They also used stone fragments that were fitted into dental cavities measuring 3-6 mm in diameter with a depth of approximately 1.5 mm. It is believed that this procedure was performed by prehispanic dentists with millimeter precision, ensuring that the stone fitted perfectly into the perforation (1-7). This dynamic left us with an invaluable heritage, revealing their approaches to dentistry. This legacy is evident in the wide range of knowledge related to dental esthetics, the use of various materials and instruments, pain management, and therapeutic root canal treatments (7, 8). The Mayan culture spanned a region that today includes several states in the Republic of Mexico, extending its influence as far south as Nicaragua and northern Costa Rica.

The complex population history of Central America contributes considerably to variations in craniomandular morphology. The dramatic differences in the socioeconomic status and nutrition of various human groups in urban and rural settings further complicate the epidemiology of oral health. The aim of this literature review is to discuss the reasons, methods, and specific concepts behind the introduction of basic Dental Anthropology (DA) into the curriculum at the University of Costa Rica's Dental School ten years ago, to assess the achievements made so far and plan future goals and challenges.

INSIGHTS FROM THE DENTAL SCHOOL OF THE UNIVERSITY OF COSTA RICA

The Dental School of the University of Costa Rica was founded in 1942. It is one of the first dental schools in Central America. Since 2009, it has been fully accredited by The National System for the Accreditation of Higher Education (SINAES, Spanish acronym), the official body accrediting higher education in Costa Rica (9).

Owing to the limited number of interdisciplinary projects involving dentistry and anthropology in Costa Rica in the last decade (10-13), an educational strategy to implement DA at this faculty has been implemented since 2014 in the first course taken by junior students, called "Descriptive and Functional Dental Anatomy I." The main objective of this course is to identify each tooth morphologically through theoretical classes, drawing, carving, and digital waxing exercises. Since 2014, a specific class of DA has been included. The objective is to provide basic concepts of this disci-

pline so students can visualize the integral role of human teeth within society. There is a need to teach the biological and cultural factors relevant to the understanding of teeth shape and function from a DA perspective. For these students, clinical relevance involves achieving a more accurate clinical diagnosis and greater efficiency when designing the treatment plan and during the treatment itself. Therefore, they will not only be confronted with the tooth as a biological organ susceptible to diseases but will also be able to broaden their vision to include the entire stomatognathic system as a fundamental part of a human being who, as described previously, takes part in a series of social and historical events.

The class consists of a two-hour in-person training session followed by a theoretical assessment. The topics covered include the role of DA in the academic field, the characteristics that make teeth valuable sources of data and differentiate them from other human tissues, the genetic factors that define them, the definition and characteristics of dental traits, traditional and modern methods of measuring teeth, and recent national and international studies in this field.

The initial expectations were to open a nonexistent space to DA as essential basic knowledge within the curriculum framework for general dentists. After ten years, several generations have graduated with this complementary knowledge. Introducing this knowledge opens up the possibility of participating in research projects or developing a thesis as part of graduation requirements (14).

KEY CONCEPTS IN DENTAL ANTHROPOLOGY COVERED

The main objective of introducing DA to students is to highlight an interdisciplinary area of knowledge that integrates anthropology, dentistry, biology, paleontology, and paleopathology. Anatomical, evolutionary, pathological, cultural, and therapeutic considerations provide clues regarding the conditions of life, culture, food, and adaptation processes in past human populations (1-3, 5, 15-17). From a genetic perspective, tooth form reflects phylogenesis and population history, whereas from an environmental perspective, it reflects dietary habits. Epigenetics contributes to phenotypic variation within the same species or within the same human population (18). This is why the processes that bridge past with present populations to understand concepts such as quality of life based on the state of the teeth require a series of perceptions that emerge from research in DA, from which the social and biocultural context acquires particular importance when intervening in the health, function, and aesthetics of an individual (5, 17, 19, 20).

Characteristics of human teeth: Preservability, observability, and variability (21). In addition, teeth are fundamental in data collection in studies on origin and population using hereditary morphology owing to their high heritability and strong genetic control in the presence and expression, little environmental influence in presence and expression, minimal effect of sexual dimorphism in presence and expression, minimal effect of asymmetry in antimeric expression, little or no correlation between discriminating traits, and correspondence between prevalence and distribution in geographic areas (2, 5,16).

Methodologies: Maximum length (mesiodistal diameter, MD) and breadth (buccolingual diameter, BL) are measured. The crown index=[BL/MD] x100) is used to describe the over-all proportion of tooth crowns. The crown module ([MD + BL]/2) and area (robustness value= MD × BL) indicate the overall crown size (18).

Non-metric traits such as tooth crown and root variants. Each trait is studied in two phases: the first involves evaluating whether a dental trait

is based on the presence or absence dichotomy; in the second phase, the development of the trait is scored based on a standardized model that represents various developmental stages (16,18, 22). The analysis of the morphology of a tooth is carried out through the observation and recording of the coronal and root dental morphological features by means of various methods, such as the Arizona State University Dental Anthropology System (ASUDAS), which is mentioned to help students classify non-metric traits; however, its use still does not transcend the boundaries of anthropology, making the system practically unknown in the dental context (18, 20, 23-25).

Dental complex: or "population dental complex" refers to the way in which past and pre-sent human populations can be grouped based on the frequency and variability of dental morphological traits. This allows for grouping populations based on their Asian, European, and African origins, as well as the way in which they behave intragroup and intergroup (17, 19, 26). However, for contemporary indigenous populations, the study of dental morphology and its association with the described dental complexes has been complicated because of the 500 years of mixed origin resulting from the arrival of several groups-Western European groups, represented by the Spanish conquistadors, and African groups, represented by African slaves-who populated the American territory in three historical processes recognized as discovery, conquest, and colony (25).

Educational relevance: Combining anthropological evidence with clinical knowledge and experience is most likely to provide the best informed and biologically based approach for the management of tooth wear, malocclusion, caries, gum illness, and all dental pathologies in modern societies (27). A successful application of this knowledge would be when students demonstrate the general skills of observation and inference, critical reflection, and application of acquired knowledge when performing clinical examinations in any type of population (28, 29). Dentistry can contribute to examining how genealogical dental research has refined methods for reconstructing evolutionary processes and has the potential to build upon current advances in dental phenomics (30).

ADVANCES IN METHODOLOGIES AND NEW TECHNIQUES

The contributions of anthropology to the conception of human biological variation and the study of the multiple factors that shaped it throughout the evolutionary history of species emerged from a discussion of the concept of race and the subsequent adoption of an evolutionary framework (5). For example, in contrast to the anthropologist's perspective, tooth wear research from the dentist's viewpoint has traditionally focused on restorative management and has only become a major topic of interest among dentists during the last 20 years (27). Learning the methods and tools for assessing and analyzing shape covariation specific to the anthropological field, from measuring linear distances with calipers to using landmark or mesh based geometric morphometrics, can benefit dentists by improving their understanding of the implications of morphology and by solving potentially conflicting methodological competencies, especially in clinical contexts (31, 32).

Currently, palaeoimaging methodology creates large volumes of data, which may be reviewed for a specific or target interpretation; however, there remains a vast amount of information that may be of interest to other researchers as it becomes more prevalent in bioarcheological research (33).

The application of 3D printing in anthropology highlights the great potential of using a non-destructive and non-invasive method to obtain information that would otherwise be difficult to access. Digital dentistry has evolved so quickly and

can benefit research in DA in the years to come for the preservation of extremely fragile human skeletal remains and minimize unnecessary duplication of data collection (14, 34, 35). New dental technologies such as extra and intraoral scanners provide valuable information without being invasive.

During the process of forensic identification and medical-legal documentation, DA plays a crucial role in the identification and analysis of human remains in forensic and archaeological contexts. Teeth provide significant information for estimating age (chronology of dental development and eruption, as well as dental wear), sex (dental measurements), and population pattern (dental morphology), and in many cases, are the only element capable of providing biological and cultural information on an individual or human population (25, 26). Trained dentists can use dental analysis to determine the age, sex, descent, and individual characteristics of the remains, thus contributing to the reconstruction of the history and identity of the deceased (17-19). According to Moreno-Gómez & Coriat (25), considering that forensic dental identification processes rely on comparative and reconstructive methods, it is crucial to urge clinical professionals to include descriptions of the presence and variation of morphological characteristics with marked expressions of teeth in clinical records.

TEACHING DENTAL ANTHROPOLOGY IN LATIN AMERICA

One of the most relevant lines of research has been the bioarcheological analysis of health and stress indicators such as enamel hypoplasia, caries, and tooth wear. For example, Bernal & Luna (20) analyzed the development of dental studies in the field of biological anthropology in Argentina by studying and quantifying the scientific output in the area. During the period (1980-2010) there was remarkable development in dental research, not only regarding the number of papers published (73.81% of all anthropological papers) but also in the variety of topics considered. Several studies on asymmetry, mortuary behavior, general anatomy, and sexual dimorphism have been identified, but they comprise a low percentage (less than 3%), whereas issues such as general analysis of health and demography are much more numerous. General bioarcheological characterizations multiplied, exceeding 12% of the total number of papers, and an increase in studies on biodistances based on dentition was observed (13.10%) (20).

A good example of an academic unit in dentistry that leads a line in DA and Forensic Odontology is the Oral and Maxillofacial Surgery Research Group of the Universidad del Valle, Colombia, created in 2004 in an attempt to disseminate knowledge that other areas of knowledge subtract from the study of teeth, and to apply that information in dental clinical practice (19). Over the last 20 years, this group has integrated knowledge from anthropology, dentistry, biology, paleontology, and paleopathology to characterize the dental morphology of living populations in southwestern Colombia. This was achieved by studying the frequency and variability of dental morphological features in populations of different ancestries, including Euro-descendants, Afro-descendants, and Native Americans. The group has employed strategies such as formative research and the creation of cooperative research networks to publish and disseminate their findings on dental morphology, mainly within the Colombian dental clinical context. Remarkable work has been done by the odontologist Freddy Moreno to raise awareness of the importance of DA from an anthropological point of view (25).

CHALLENGE AND FUTURE PERSPECTIVES

The biggest challenge is to integrate this academic field into dental career curricula, as the increasingly globalized trend is to give priority, time, and space to clinical practice. To keep DA research active, the challenge at the Dental School

of the University of Costa Rica is to continue opening space for future research that incorporates dentistry with anthropology through the following strategies. The first is to continue creating new collaboration links between this university and other national and international faculties and/or institutions, and projects have been developed with the National Museum of Costa Rica (MNCR) and the Materials Science and Engineering Research Center (CICIMA) in San José, Costa Rica. The second is to increase the use of digital technologies to access delicate unique teeth or collections and reduce their manipulation without damage structure. The third strategy involves forming a group of researchers interested in this line of investigation with different specialties, such as endodontics, periodontics, immunology, pediatric dentistry, forensic dentistry, epidemiology, and statistics among the professors. Finally, publication in English journals and participation in dentistry and anthropology conferences must go beyond local and regional impacts to gain visibility in the international community. This way, professors integrate collaborative work into formative research, thus creating a community of interest and a culture of sustainable research over time.

CONCLUSION

Studying the basic concepts of DA allows students to broaden their perspective, viewing teeth not just as individual patient features but also as a larger context. This holistic understanding can be applied to treatment planning, final restoration, and integration of knowledge across various areas of professional careers. Moreno & Moreno (19) stated that the interaction between anthropology and dentistry strengthens the investigative perspective, with which the generation of new knowledge can permeate both the clinical-scientific work of the dentist and the technical-scientific work of anthropologists.

Multidisciplinary teaching is always a challenge, but undergraduate students bring creativity and the unique attributes of their generation (36) unbounded by traditional limitations on what can be done in dentistry. With this mindset, we should aim for more integrated teaching across all schools, not only in relation to the topic discussed in this paper, but also in every field where science can bring benefits.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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DATA AVAILABILITY

Data sharing is not applicable to this article as no datasets were generated.

ETHICAL STATEMENT FOR HUMAN PARTICIPANTS

Not applicable for this research.

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