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Age-Related Dental Erosion in a Female Chimpanzee from Jos Zoo, Plateau State, Nigeria

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ABSTRACT

This case-report described the presentation of age-related dental erosion in a 60-year-old female chimpanzee (*Pan troglodytes*) housed at Jos Zoo, Plateau State, Nigeria. The animal exhibited extensive enamel loss, with characteristic dentine exposure and altered tooth morphology. Post-mortem examination revealed generalized progressive dental erosion and exposure of the swollen gingival surface; indicative of advanced dental wear. The observed dental erosion is attributed to a combination of intrinsic factors associated with aging, such as decreased salivary flow rate, alterations in enamel resilience, and reduced reparative capacity, as well as extrinsic factors including dietary composition, particularly the intake of high-sugar or abrasive foods and environmental conditions within captivity that may accelerate wear. These findings highlight the critical need for routine oral health assessments, tailored dietary management, and proactive veterinary interventions to prevent pain, secondary infections, and further deterioration, thereby enhancing the welfare of aging primates. This case underscores the importance of integrating dental care into comprehensive health management protocols for elderly non-human primates and provides insights into the pathogenesis of dental erosion in captive settings.

Keywords: Dental Erosion, Chimpanzee, Jos Zoo, Dental care, Nigeria.

INTRODUCTION

Dental erosion refers to the irreversible loss of dental hard tissue through series of chemical processes without the involvement of bacteria; both enamel and dentine are demineralized because of the acidification of the oral cavity (Wang *et al.*, 2010; Shellis, 2015; Johansson *et al.*, 2017; Blancato*et al.*, 2023; Schneider, 2023). Dental health is a vital component of overall health and survival in non-human primates, including *Pan troglodytes*, the common chimpanzee (Lowenstine*et al.*, 2016; Gerstner and Pruetz, 2022; Smith and Warrinner, 2022Abdul-Azees*et al.*, 2024). Among various dental pathologies, dental erosion has emerged as a noteworthy concern, particularly given its potential to compromise feeding efficiency, nutrition, and overall well-being of the animal (Moynihan *et al.*, 2014; Kvapil*et al.*, 2025)

As highly intelligent and behaviorally adaptable animals, chimpanzees possess complex social and dietary behaviors that influence their oral health (Chappell and Thorpe, 2022). While enamel is inherently resistant to many forms of wear, it is susceptible to acid-mediated dissolution when exposed repeatedly over time to acidification. In humans, dental erosion has been extensively studied owing to dietary and lifestyle factors such as consumption of acidic foods and beverages. In contrast, limited research exists on its occurrence, etiology, and implications in non-human primates, especially in wild and captive populations of chimpanzees (Saraka*et al.*, 2020; Alt *et al.*, 2022).

Several factors may contribute to dental erosion in *Pan troglodytes*(Carter *et al.*, 2008; Elgart, 2010; Towle, 2017). Natural dietary components, particularly acid-rich fruits, play a significant role in wild populations. The consumption of such foods can lead to localized enamel demineralization, especially when exposure is frequent or prolonged (Constantino*et al.*, 2009; Fuss *et al.*, 2018; Towle*et al.*, 2022; Towle*et al.*, 2024). In captivity, dietary compositions often include processed foods, sweetened treats, or water sources with low pH, all of which may exacerbate the risk of erosion (Gerstner and Pruetz, 2022). Behavioral factors, such as chewing on acidic plant materials or objects, further influence susceptibility (Zero, 1996; Ungar, 2015; Thiery and Lazzari, 2017; Fecchio*et al.*, 2019; Towle*et al.*, 2022). Additionally, health conditions involving regurgitation and vomiting-conditions more common in captive or stressed animals can increase intra-oral acid exposure (Hill, 2009; Hill, 2018; Bakker and Bomzon, 2022).

Despite these potential sources, the prevalence, clinical presentation, and progression of dental erosion in chimpanzees remain inadequately documented (Elgart, 2010; Lowenstine*et al.*, 2016; Kalluri, 2021). Given the importance of dental integrity for survival functions like feeding and social interactions, understanding the etiology and patterns of erosion is crucial for developing effective management and conservation strategies (Pachaly and Gioso, 2001; Ungar, 2015). This case report aims to synthesize current knowledge on the causes, clinical features, and implications of dental erosion in chimpanzees, emphasizing the need for further research and tailored preventative measures.

CASE HISTORY

A 60-year-old female chimpanzee, weighing approximately 55 kg, was observed exhibiting watery discharge from the left eye, generalized weakness, and in-appetence toward all preferred food items. Fecal materials contained poorly digested food items including groundnuts, garden egg, carrots, and beans. The animal was housed in a stainless-steel cage alongside another female chimpanzee of similar age, with both sharing a sleeping quarter of a round mud-house apartment.

The animal's diet consisted of a variety of food items which were consistently accepted previously, including groundnuts, cooked beans, sugar cane, cabbage, assorted fruits (such as bananas, watermelons, oranges, garden eggs, and other seasonal fruits), and carrots. Despite these dietary preferences, the affected chimpanzee showed a progressive decline in body weight over the subsequent weeks. According to the zoo staff, attempts at management include provision of tea with sugar cube, honey and multivitamins to boost energy. Approximately one-month following the initial presentation, the animal succumbed. The carcass was subsequently submitted to the Central Diagnostic Laboratory of the National Veterinary Research Institute, Vom, for necropsy examination.

GROSS PATHOLOGICAL FINDINGS

The carcass exhibited marked emaciation with significant weight loss (Plate 1). The ocular mucosa was diffusely hyperemic. In the oral cavity, there was a complete absence of dental tissues, with the exception of a single remaining tooth stub on the left side. The remaining tooth displayed extensive erosion of the crown, characterized by grooving and cupping lesions, with exposed dentine surfaces. The eroded dental surfaces were associated with surrounding gingival tissues exhibiting localized inflammatory and reactive changes. Apart from the patchy residual at parasympathetic effector sites. The absence of oxime reactivators such as pralidoxime, a standard adjunct in OP therapy was a limitation from field logistics challenges. Nevertheless, the early atropinization significantly reduced mortality, consistent with the findings of Peter and Cherian (2015) [16] that timely atropine remains the single most life-saving intervention in OP toxicity.

The use of meloxicam (0.5 mg/kg SC SID for 3 days) as the preferred NSAID was justified on pharmacokinetic and safety grounds. Although flunixin meglumine provides a broader anti-endotoxin profile [12], meloxicam's selective COX-2 inhibition, extended half-life, and reduced gastrointestinal adverse effects make it ideal for field therapy in ruminants [5]. Diclofenac and piroxicam, though available, were avoided due to their narrow therapeutic margins in stressed livestock. Thus, meloxicam provided a sustained analgesic support while maintaining favorable pharmacodynamic safety.

The IV administration of 5% dextrose-saline ensured hydration and maintained perfusion during shock [15]. Activated charcoal was used in animals that could still swallow, serving as a toxin adsorbent [17]. Supportive nursing care, including hand-feeding and protection from direct sunlight, was essential for recovery [18].

The survival of 280 animals despite massive exposure underscores the efficacy of prompt field response and the pharmacological soundness of the chosen regimen. Comparable herd-level interventions reported by Ogunseitan (2021) [14] and Adesokan *et al*. (2020) [2] demonstrated that mortality can be significantly reduced when antidotal and supportive care are instituted within 1 hour of exposure.

Beyond clinical management, this episode exposes broader One Health failures in Nigeria's agro-ecosystem. The use of dichlorvos as a tool for retaliation reflects weak pesticide regulation, inadequate public awareness, and escalating land-use conflicts. The subsequent processing and sale of poisoned carcasses for human consumption raised a serious food safety and toxicological crisis, since dichlorvos residues are

items which were consistently accepted previously, including groundnuts, cooked beans, sugar cane, cabbage, assorted fruits (such as bananas, watermelons, oranges, garden eggs, and other seasonal fruits), and carrots. Despite these dietary preferences, the affected chimpanzee showed a progressive decline in body weight over the subsequent weeks. According to the zoo staff, attempts at management include provision of tea with sugar cube, honey and multivitamins to boost energy. Approximately one-month following the initial presentation, the animal succumbed. The carcass was subsequently submitted to the Central Diagnostic Laboratory of the National Veterinary Research Institute, Vom, for necropsy examination.

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Plate 1: Chimpanzee carcass with protruded chest, gray hair around the chin and moderately emaciated

Plate2: Showed advanced dental erosion in a chimpanzee with swollen gingival mucosa. The right maxillary tooth shows groove with a cupping lesion and exposed dentine. Eroded surfaces preserve remnants of root structure, indicating substantial dentine exposure.

DISCUSSION

Dental erosion is a progressive, non-carious condition characterized by the chemical dissolution of dental hard tissues due to exposure to acids that are not produced by bacterial activity (Bhushan*et al.,* 2011; Karagianna, 2012; Shellis, 2015; Schneider, 2023). In the case of the sixty-year-old female chimpanzee at Jos Zoo, Nigeria, the presence of significant dental erosion highlights the complex interplay of age-related physiological changes, dietary factors, and environmental influences that contribute to this condition in captive primates.

Aging in primates is associated with a decline in salivary flow and altered composition, which diminishes the natural buffering and re-mineralization capacities which are critical for maintaining enamel integrity. Consequently, older individuals become more susceptible to enamel loss when exposed to acidic challenges. In captivity, dietary practices often involve the provision of fruits and processed foods, some containing natural or added acids, which may exacerbate erosion (Ullrey, 1986; Rothman and Bryer, 2019). Environmental factors, such as water source and hygiene conditions within the zoo, may also influence levels of acid exposure (Raje, 2016). The postmortem presentation observed in this case including reduced enamel thickness, exposed dentin, and possible hypersensitivity can impair feeding efficiency and overall well-being, especially in aged animals with limited regenerative potential.

Similar findings in other studies reinforce the significance of age as a risk factor for dental erosion in captive primates, emphasizing the importance of routine dental assessments and preventive interventions (Robinson, 1979; Albrecht *et al.*, 2024; Kvapil*et al.*, 2025). Dietary management strategies, such as reducing acidic foods, ensuring the availability of neutral pH water, regular dental examinations and restorative procedures, are essential to mitigate further tissue loss and improve health outcomes (Felton *et al.*, 2009; Chapman *et al.*, 2012; Ismail *et al.*, 2013). Overall, this case underscores the importance of proactive, tailored dental care for geriatric primates to enhance their welfare in captive settings.

It is noteworthy that the dental diseases observed in apes and monkeys are essentially similar to those seen in humans, although their frequency can differ (Schou*et al.*, 1993; Elgart, 2010; Bertelsen, 2013). Dental erosion specifically results from sustained contact between tooth surfaces and acidic substances (Moss, 1998; Amaechi and Higham, 2005; Wang and Lussi, 2010; Lussi*et al.*, 2011). It has been well established that demineralization of dental enamel occurs once the oral environmental pH drops below the critical threshold of 5.5 (Abou Neel *et al.*, 2016; Lacruz*et al.*, 2017). In chimpanzees, dental erosion is age-related and progressive, typically becoming obvious in adulthood rather than early in life. Generally, this is found to occur at about the age range of approximately 35-43 years (Lowenstine*et al.*, 2016).

The dietary profile of this long-lived chimpanzee, characterized by frequent ingestion of acidic fruits such as oranges and watermelons, as well as sugar-rich tea, has significant implications for dental erosion. Organic acids, particularly citric acid in citrus fruits, markedly lower oral pH, creating an environment conducive for enamel demineralization with recurrent exposure (Fuss *et al.,* 2018; Roberts *et al.,* 2022; Xie*et al.,* 2023). Although watermelons are less acidogenic, they still contribute to the overall acidic challenge (Zero, 1996; Zerob, 2004; Schneider, 2023). Additionally, the consumption of sugars from tea with cube sugar sustains acidogenic bacterial proliferation within plaque biofilms, resulting in increased production of organic acids that exacerbate enamel demineralization (Cabana and Nekaris, 2015). Environmental factors in Jos zoological garden significantly influence the development of this dental erosion. One of the primary contributors is acidic diet, which includes frequent consumption of soft drinks made available to the primates during festivities and citrus fruits. These substances lower the pH in the oral environment, leading to enamel demineralization (Cabana and Nekaris, 2015). Similarly, prolonged exposure to improperly maintained chlorinated water (West and Joiner, 2014; Kitsahawong*et al.,* 2024) (common during the dry season when water supplies are sourced from Plateau State water board), especially those with low pH, can accelerate enamel erosion. Dry climates and dehydration also pose a risk by reducing salivary flow, thereby compromising the natural buffering and protective functions of saliva (Walsh, 2007; Helmerhorst, 2012; Saleh*et al.,* 2015). Together, these environmental conditions create a hostile environment for dental enamel, increasing the risk and severity of erosion over time (Cuozzo*et al.*, 2012; Towle*et al.*, 2024).

Age-related physiological changes, such as diminished salivary flow and reduced enamel regenerative capacity, further predispose primates to erosion phenomena (Glowacka*et al.*, 2026; Abdul-Azees*et al.*, 2024; Towle *et al.*, 2024). The synergistic effects of dietary acids, fermentable carbohydrates, and declining physiological defenses likely predispose this chimpanzee to progressive dental erosion, manifested clinically as enamel surface loss, dentin hypersensitivity, and structural compromise. These changes impair mastication, induce pain, and increase the risk of secondary dental pathologies.

In the wild, chimpanzees maintain oral hygiene primarily through chewing fibrous sticks, which act as natural toothbrushes by removing debris and stimulating saliva flow (Pachaly and Gioso, 2001; Smith and Warinner, 2022). Their fibrous, low-sugar diet also aids in cleaning tooth surfaces and reduces the risk of dental erosion (Mau *et al.,* 2020; Oezdemir, 2024). Although primates are not immune to dental issues such as wear and periodontal disease, these occur less frequently and with lower severity than in humans, largely due to their natural diet and behaviors (Schou*et al.*, 1993).

CONCLUSION

Preventing age-related dental erosion in captive chimpanzees involves a combination of nutrition, dental care, enclosure management, and regular monitoring. In practice, this means providing a balanced diet with appropriate texture, avoiding long-term exposure to highly acidic or citric foods, and offering fruits in moderation as part of a varied diet. It’s important to limit sticky or sugary items that cling to teeth and avoid or minimize acidic treats given frequently or in large quantities, while ensuring access to clean, fresh water at all times to aid saliva flow and re-mineralization. Enrichment and feeding routines should encourage chewing and processing of hard or fibrous items, but care must be taken to avoid extremely hard objects that could wear teeth excessively, and rotating diets can help reduce repetitive acidic exposure on the same dental surfaces. Regular dental examinations and monitoring are essential, including periodic cleanings and evaluation by a qualified veterinarian or primate dental specialist, establishing a baseline dental health for each individual, and tracking changes over time, with radiographs as needed to assess root health and detect early signs of erosion or wear. A preventive oral health program that includes dental scoring, plaque control and professional cleanings should be developed, and if erosion is detected, contributing factors such as diet, bruxism (medical term for involuntary teeth grinding and clenching, which can happen while awake or asleep), or reflux should be identified and managed accordingly. Treat underlying conditions like gastro-esophageal reflux when diagnosed by a veterinarian, and maintain calm, low-stress environment since chronic stress can influence eating patterns and saliva production. Provide safe, chewable substrates and monitor their use to prevent excessive wear or tooth fracture, while ensuring appropriate temperature and humidity and avoiding environmental stressors that might alter feeding behavior. Pain management and welfare considerations are also crucial; monitor for signs of dental pain and address them promptly, considering analgesia or medical treatment as advised by a veterinarian if dental pathology is present. Detailed record-keeping is important, including dental charts, age, dental wear indices, and dietary history, to adjust care plans as animal’s age.

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