Evolutionary Dentistry: What your Dentist Does Not Know About the Natural State of Human Dentition
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INTRODUCTION
Caries, periodontal disease, and the crowding of teeth that require orthodontics to straighten are relatively recent problems, increasing in frequency since the Industrial Revolution. Studies on prehistoric people, modern foragers, and apes demonstrate that dentists were rarely needed prior to a dietary shift to sugar, soft, processed foods in Western culture. Thus, many dental diseases and orthodontic problems are a product of civilization and present as a "mismatch" between the diet for which we are adapted and our present diet (Fig. 1).

Evolutionary dentistry is a burgeoning discipline that applies evolutionary theory to clinical practice in order to alleviate certain dental pathologies caused by civilization. Oral scourges such as periodontal disease have a direct correlation with an individual’s fitness; it is associated with adverse pregnancy outcomes, cardiovascular disease, and diabetes1, although the systemic implications of the disease are not well understood.

Wild apes do not eat the high quantities of sugar and starch that are found in Western diets. In order to test a link between the incidence of caries and periodontal disease to diet, the frequency of these diseases were examined in our closest relatives: chimpanzees and gorillas. If low rates are found in apes and humans with low sugar diets, an increase in sucrose is a factor in high frequencies of dental pathologies.

MATERIALS
I measured the incidence of dental pathologies in 238 skulls of wild-caught gorillas and chimpanzees in three museum collections:
- The National Museum of Natural History, Washington, DC
- The Musée Royal de l’Afrique Centrale, Tervuren, Belgium
- The Cleveland Museum of Natural History

Mountain gorillas were also measured at the Institute of Tropical Forest Conservation, Bafou, Uganda.

Species examined:
- From left, common chimpanzee (Pan t. troglodytes), bonobo (P. paniscus), Eastern chimpanzee (Pan t. schweinfurthii), Western lowland gorilla (G. g. gorilla), Eastern lowland gorilla (G. g. graueri), mountain gorilla (G. beringei).

METHODS
Several dental pathologies were scored on gorilla and chimpanzee skulls: 1. caries at the gross level, 2. periodontal disease as measured by horizontal bone loss, abscesses and ante-mortem tooth loss and 3. linear enamel hypoplasia. Frequencies of these were compared to published frequencies of these diseases in various human populations.

RESULTS
Periodontal disease
- Who suffers the most?
  1. Low frequency in all apes except one sample of bonobos (Fig. 3)
  2. Differing criteria make comparisons difficult, but frequencies rise in humans after the Industrial Revolution (Fig. 4)
- Factors:
  1. Increases with age and dental wear
  2. In chimpanzees, higher when crowding and refuse
- Complex etiology, no definitive correlation with oral hygiene

DISCUSSION
The higher frequency of caries seen in chimpanzees compared to gorillas positively correlates with the amount of fruit in their diet. Between 55-76% of the diet of chimpanzees (Pan troglodytes) consists of ripe fruit10,10, while the most frugivorous subspecies of gorilla, the western lowland gorilla, consumes only 10-55%10. The high amounts of caries and periodontal disease in this sample of bonobos is inexplicable. It is possible that they engaged in crop raiding, which would alter their diet considerably, making it resemble the diet of human agriculturalists. Mountain gorillas also have greater frequencies of periodontal disease than is expected from their low fruit diet (Fig. 2). An unusual buildup of calculi on their diet may be the culprit.

Frequencies of caries are low in gorillas and in human foragers1,2 moderate in chimpanzees and human agriculturalists3, and high in modern humans7,8 (Fig. 4). Periodontal disease is low in apes and foragers5 in comparison to post-Industrial Revolution humans4. Caries incidence can be linked to the amount of sucrose in the diet, but the cause of periodontal disease is multifactorial.

REFERENCES


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