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A FACIAL CONGENITAL ANOMALY IN A MATURE MALE WHITE-TAILED DEER (*ODOCOILEUS VIRGINIANUS*)

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ABSTRACT

Congenital anomalies are rarely documented in wild ungulates. This study describes a congenital facial malformation in a mature male white-tailed deer harvested in central Georgia in 2020. The skull displays a mediolateral deflection of the rostrum, and the mandibles display similar deflection with posterior rotation at the mandibular symphysis, a maxillofacial malformation commonly called wry face. Based on physical examination and radiographic imagery, there were no signs of neoplasia or healed bone trauma on the skull or jaws, suggesting a congenital origin for the deformity. Studies of domestic horses displaying wry face conclude that the malformation arises from fetal mispositioning within the uterus during late term pregnancy. Lacking contrasting evidence, fetal mispositioning is a plausible cause for the anomaly documented here. It is likely that such anomalies in wild ungulates are rarely documented due to reduced survivability of afflicted neonates.

***Keywords*:** Wry face, white-tailed deer, congenital malformation

INTRODUCTION

In the United States, mortality of white-tailed deer (*Odocoileus virginianus*) neonates is attributed to predation (44-88%), disease and/or starvation (6-20%), unknown causes (2-22%), and accidents (2%) (Carstensen et al. 2009; Cook et al. 1971; Grovenburg et al. 2011; Kilgo et al. 2012; Nelson and Woolf 1987; Shuman et al. 2017; Vreeland et al. 2004). One of the possible unknown causes contributing to mortality is congenital defects. In general, congenital anomalies in ungulates include musculoskeletal deformities, abnormal organ size, bone defects, heart diseases, and mental impairments (Leipold et al. 1994). Congenital deformities are rarely documented in white-tailed deer, likely due to reduced survival of afflicted fawns. However, a few studies have documented congenital malformities in white-tailed deer such as brachygnathism (Johnson 1935; Ryel 1963; Short 1964), supernumerary molars, enlarged femur, deformed hind feet (Verme 1968), arthrogryposis (joint contractures), fused metacarpal bones, incomplete digits, and misaligned incisors (Barrett and Chalmers 1975). Another abnormality observed in ungulates is a maxillofacial defect known as campylorrhinus lateralis/campylognathia, also called wry face/wry nose. Only one instance of this deformity has been documented in academic literature for white-tailed deer (Jenks et al. 1986). This lack of reporting is

somewhat surprising since an internet search for "crooked face deer" returns a number of images and videos of white-tailed does and bucks displaying wry face.

Wry face is a congenital defect in which the rostrum and mandible are contorted mediolaterally. This can negatively affect suckling, mastication, and proper functioning of the upper respiratory tract in afflicted animals. Several species of artiodactyls within the animal husbandry industry have been documented with wry face. In an Egyptian study, out of thirty-one domestic cows (*Bos taurus*) with congenital issues, one displayed wry face, although it resulted in no clinical significance (Abdelhakiem and Elrashidy 2017). The authors of this study did not speculate to the origin of this anomaly. Goats (*Capra hircus*) and sheep (*Ovis aries*) have also been recorded to display wry face (Basrur and Yadav 1990). The anomaly does not appear to be genetically linked and heritable in these taxa. Facial deformities are one of the more common congenital defects in llamas (*Lama glama*). A study of 19 facially deformed cria found wry face to be the most common facial malformation (Leipold et al. 1994). Wry face in llamas may be associated with choanal atresia (blockage of the nasal airway) which is suspected to be genetically transmitted in this taxon (Leipold et al. 1994; Tibary et al. 2014). It is worth noting that swine have been recorded to have a similar condition of distorted snout (Pond et al. 2005). However, the condition is due to nutritional secondary hyperparathyroidism induced by a calcium and phosphorus imbalance, and therefore not congenital.

Wry face is particularly well documented in the domestic horse (*Equus caballus;* Perissodactyla). Congenital anomalies in horses are generally uncommon and are estimated to affect only 3-3.5% of equines (Pintore and Cantile 2015). Foals that do experience these anomalies are more likely to have either cryptorchism (the absence of one or both testicles in the scrotum) or musculoskeletal, eye, and/or heart issues. While wry face is one of the more uncommon defects, it often occurs in foals along with brachygnathism (overbite). An overbite by itself often develops after birth rather than congenitally. Extreme cases of equine wry face occur with palatoschosis (cleft lip) (Gaughan and DeBowes 1993). Contracted foal syndrome has been recorded in congruence with wry face in a foal as well (Binanti et al. 2014). The condition has also been surgically corrected several times (Rangel et al. 2019; Valdez et al. 1978). In horses, wry face has been attributed to mispositioning of the fetus in the uterine horn during the latter half of pregnancy (Gaughan and DeBowes 1993). While congenital defects in domestic ungulates are well studied, literature describing congenital anomalies in wild ungulates is less common. Within cervids, wry nose has been noted in seven deer species, excluding white-tailed deer (see table 1 in Flueck and Smith-Flueck 2011). Wry nose was reported in less than 1% of a large study sample (n = 776) of introduced red deer (*Cervus elaphus*) in Patagonia, South America (Flueck and Smith-Flueck 2012). The authors concluded that the malformation was not genetically related and suggested that Coriolis forces may play a role in the "handedness" of the defect. This current study documents wry face in a mature male white-tailed deer from central Georgia.

MATERIALS & METHODS

The abnormal skull and mandible of a 3.5 year-old male white-tailed deer were obtained from a hunter in Jones County, Georgia. The animal was legally harvested during the hunting season in November 2020. The material was de-fleshed, dried, and cleaned using dermestid beetles. The skull was aged using the known pattern of tooth eruption and wear (Thompson 1958). Photographs were taken to document the

abnormality. In addition, radiograph images of the malformed skull were taken at a local veterinary clinic. The developmental abnormalities evident in the skull were compared with published literature to determine the nature of the pathology. In addition, 778 white-tailed deer dentaries (248 females, 530 males) from the Piedmont National Wildlife Refuge (PNWR) within the Georgia College Mammal Collection (GCM) were examined for signs of similar bone deformities. The PNWR is located in Jones and Jasper counties and lies approximately 32 kilometers west of the skull's harvest location. The dentaries were previously collected in 2001 (Morris and Mead 2016) and 2016-2017 (Powers and Mead 2019). Following examination and imaging, the skull was returned to the hunter.

RESULTS

The Jones Co. skull displays right mediolateral deflection of the rostrum and anterior portion of the mandible (Figure 1A). The deer appeared healthy (not emaciated) at the time of harvest and carried a well-developed, nearly symmetrical set of antlers.

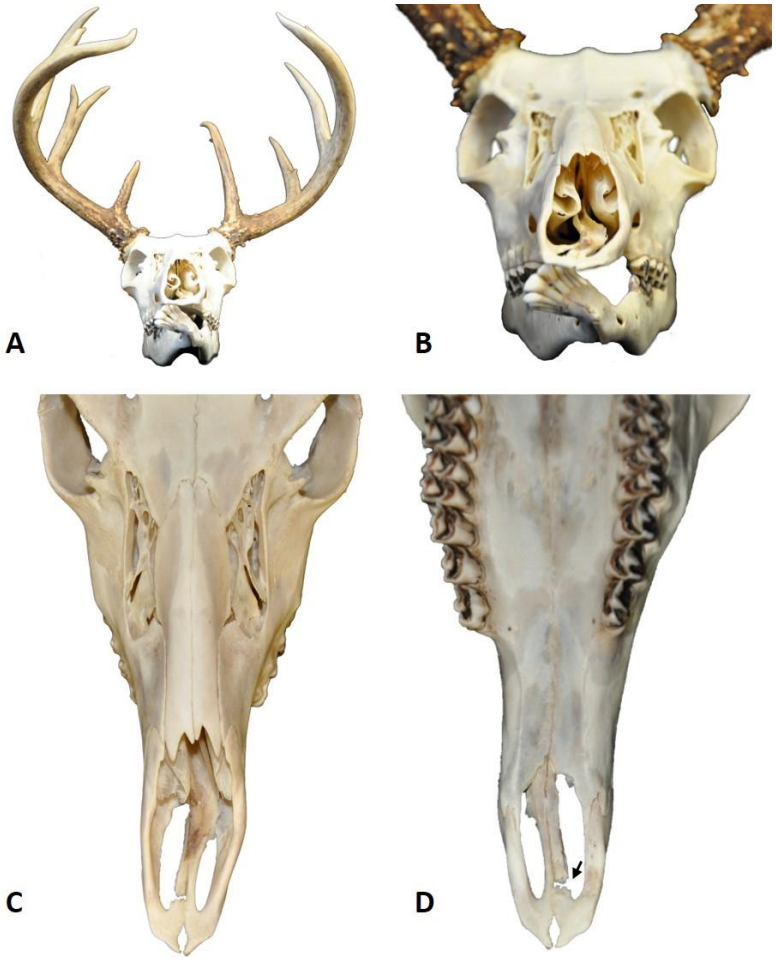

Figure 1. Skull and jaws of a mature, 3.5-year-old male white-tailed deer (*Odocoileus virginianus*) from Jones County in central Georgia. A) anterior view of skull and jaws, right mediolateral deflection of the anterior portion of the mandible is evident; B) close up anterior view, right mediolateral deflection of the anterior portion of the mandible and deviated nasal septum are evident; C) dorsal view of the rostrum, right mediolateral deflection and deviated nasal septum evident; D) ventral view of the rostrum, pathologic bone remodeling (arrow) evident on the palatal branch of the right premaxilla.

Closer examination of the nasal cavity shows a deviation of the nasal septum (Figure 1B). A slight right mediolateral deflection of the rostrum is evident in the dorsal perspective (Figure 1C). The slight deviation and localized bone pathology are evident in the ventral view (Figure 1D). Pathologic bone on the palatal branch of the premaxilla along the incisive foramen reflects damage caused by the left incisiform canine during mastication.

Right mediolateral deflection with posterior rotation of the anterior portion of the mandible is evident in the occlusal view (Figure 2A). This orientation also presents the location of the left incisiform canine where it would impede the premaxilla pad. In comparison to a like-aged male deer, tooth row alignment of the two mandibles shows slight brachygnathism in the Jones Co. skull. A ventral radiograph of the skull records the deviated nasal septum, but shows no signs of breakage, bone trauma, or neoplasia (Figure 2B). Radiograph images of the mandible once again displays right mediolateral deflection of the anterior region, and again shows no evidence of breakage, bone trauma, or

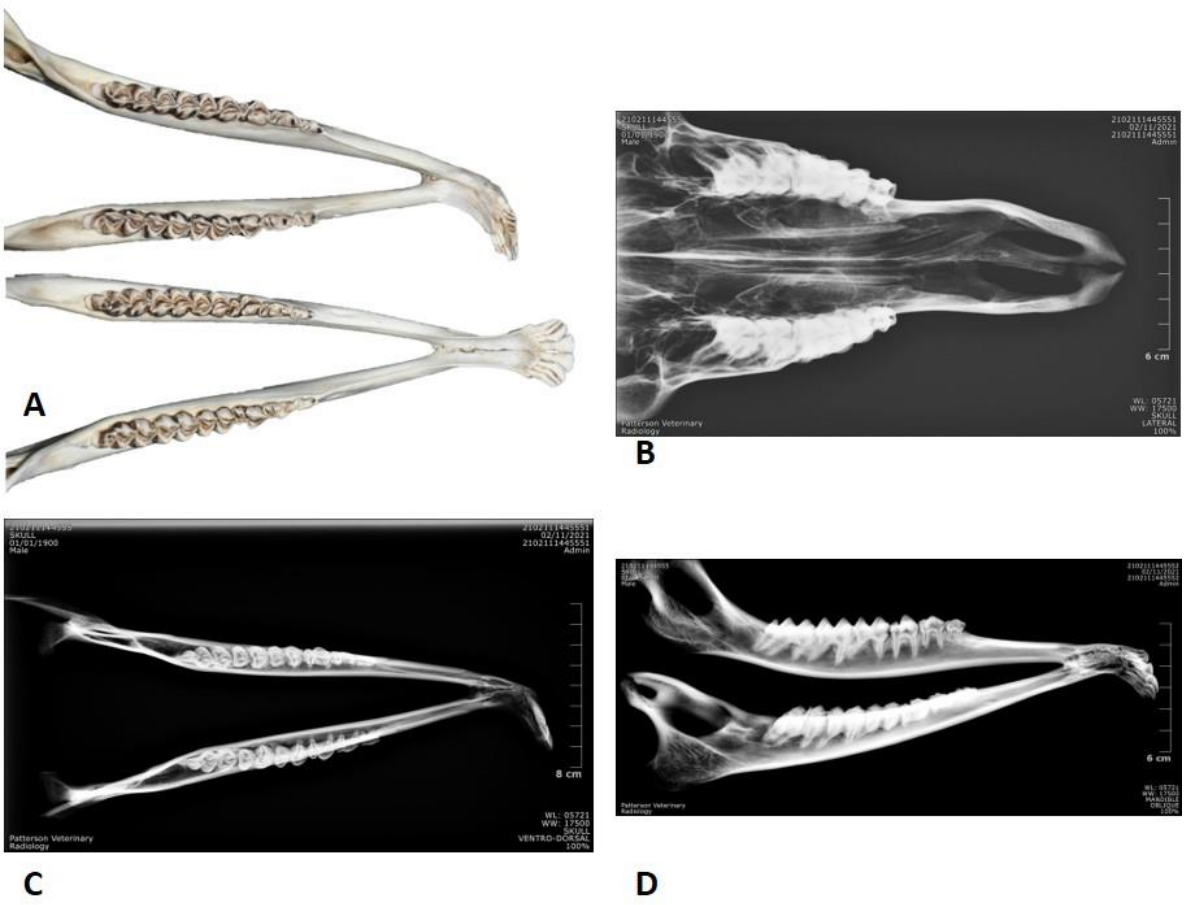

Figure 2. Skull and jaws of a mature, 3.5-year-old male white-tailed deer (*Odocoileus virginianus*) from Jones County in central Georgia. A) dorsal view of malformed mandible (top) compared to a normal mandible for a same aged male (bottom), right mediolateral deflection of the anterior portion of the mandible and slight brachygnathism is evident; B) ventral view radiograph of the deformed rostrum, deviated nasal septum evident; C) dorsal view radiograph of the deformed mandible, right mediolateral deflection of the anterior region evident; D) right oblique dorsal view of the deformed mandible, open mandibular canal evident showing no bone remodeling due to trauma.

neoplasia (Figure 2 C & D). The analysis of the 778 deer jaws from the PNWR revealed a single jaw that exhibited brachygnathism (Powers and Mead 2019, fig. 1). However, no other mandible displayed any type of mediolateral deflection that would have suggested the occurrence of wry face.

DISCUSSION

Reports of healed injuries in white-tailed deer are not uncommon (Free et al. 1972; Mech et al. 1970; Powers and Mead 2017; Ryel 1963), however, documentation of congenital malformities in this taxon are rare. The lack of neoplasia and healed injuries in the Jones Co. skull suggests the facial malformation is a congenital anomaly. In general, congenital deformities of the skull and jaws lead to improper alignment of the jaws preventing suckling, and most afflicted fawns die shortly after parturition. This is a likely reason why wry face has only been described in a single white-tailed deer fawn (Jenks et al. 1986). However, numerous anecdotal reports from the internet indicate that the abnormality may occur more frequently than is suggested in research literature. Minor malformations may only be noticeable if a skull is cleaned. The Jones Co. skull exhibits wry face with minor mediolateral deflection of the rostrum and significant mediolateral rotation of the anterior portion of the mandible. In this orientation the lower incisors did not contact the premaxillary pad properly, but the upper and lower lips were correctly positioned, and presumably allowed normal suckling. The alignment of the upper and lower cheek teeth was normal, allowing conventional mastication of food. The misaligned lower incisors would have affected the browsing abilities of this deer. However, the Jones Co. deer was 3.5 years old and by all outward appearances healthy. Supplemental feeding stations were available in this animal's home range, possibly negating negative feeding impacts of the facial abnormality.

Etiology of wry face in the Jones Co. skull is speculative. The lack of reports of wry face in white-tailed deer suggests that it rarely occurs and is not genetically linked. This conclusion is supported by the lack of a genetic link for the occurrence of wry face in red deer from Patagonia (Flueck and Smith-Flueck 2012). In llamas, wry face is often associated with choanal atresia and understood to be genetically linked (Tibary et al. 2014). However, observations of wry face in horses have indicated that wry face is not genetically linked. In horses, mispositioning of the fetus within the uterine horn during gestation is a likely cause of the defect (Vandeplassche et al. 1984). The head of the fetus is positioned in an awkward angle within the uterus during endochondral ossification, resulting in malformation of the facial bones. Gaughan and DeBowes (1993) suggest that this defect is related to underdeveloped uteri which limit fetal movement, especially during the second half of gestation. However, wry face has been documented in offspring of both primiparous mares and mares with several offspring, and interestingly occurred twice as frequently in the latter group (Vandeplassche et al. 1984). In the absence of evidence of neoplasia and healed injuries as the cause, limited intrauterine movement is a reasonable explanation for the origin of the facial anomaly in the Jones Co. skull.

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