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Molecular Identification and Analysis of Treponematosi (Syphilis, Bejel, Yaws, or Pinta)

Abstract:

This study will assess the presence of treponematosi in the DNA of skeletal and mummified human remains from Chinchorro cemeteries. Chinchorro culture includes pre-ceramic, pre-metallurgical fishing and gathering groups from the Atacama coast of southern Peru and northern Chile; it dates from approximately 8,970 B.P. \pm 255 to 3,060 \pm 380 B.P. (7,020 B.C. \pm 255 to 1,110 \pm 380 B.C.) (Arriaza, 1995a:39-43). These groups all shared an elaborate mortuary ritual, which involved natural and artificial mummification (Arriaza, 1995a:7; Sutter and Mertz, 2004:130). It tests the viability of, and the molecular techniques for the recovery and analysis of pathogenic bacteria from ancient DNA. It further seeks to explore which cultural factors may have contributed to the rate and spread of treponematosi in the Chinchorro population. Their remains exhibit high frequencies of bone lesions indicative of treponemal infection; this rate is unusual in a small nonagricultural population that did not travel or trade widely. There are four main forms of treponematosi that affect the bones; syphilis is the best known.

Samples of bone, organ, and/or tissue were collected from 16 individuals displaying skeletal lesions indicative of treponematosi. Analytical procedures to test for treponematosi were conducted at a dedicated ancient DNA laboratory. Approximately one half of the samples (9/16) represent pre-contact Chinchorro culture; the remainder come from local coastal and inland populations dating from about 2,950 B.P. (1,000 B.C.) to 950 B.P. (1,000 A.D.).

Molecular and osteological data were used to obtain a temporal and environmental comparison of treponemal rates between coastal fishing and gathering populations and later inland horticultural/agricultural populations. These data clarify the potential relationship between changing cultural practices and disease transference. Molecular analysis of additional specimens showing suspected treponemal lesions has the potential to reconstruct the evolution of the pathogen. This study adds to the growing body of anthropological evidence for treponematosi in Native American populations prior to European contact. It also provides future researchers with a replicable methodology for the molecular analysis of similar samples.

Preliminary results show treponemes can be successfully recovered and amplified from ancient tissues and organs; that the Chinchorro suffered from a systemic infection, probably yaws, or syphilis; and based on osteological data, that earlier coastal residents suffered a higher rate of treponematosi than later regional coastal and inland populations. These results suggest that cultural practices unique to the Chinchorro increased the rate of treponematosi.