Profiling Mandibular Remains from a Taxidermy Shop in the North Country, NY State

Ellie Foster
SUNY Potsdam Presidential Scholars Program

Abstract:
This research focuses on profiling mandibles belonging to seven complete skulls remanded from a taxidermy shop in North Country by New York States Forensic Investigation Unit, Ray Brook, NY. The bones showed postmortem modifications as part of taxidermy practice, but no further context was available at the time of recovery from the property. Traditional metric and non-metric methods in osteology were employed in this study to profile each specimen to estimate the ancestry, sex, age, and other characteristics of skeletal remains. For instance, measurement of various dimensions of the jaws and teeth were done using a digital caliper and a mandiblometer for ancestry and sex estimations. Nonmetric traits of jaws and teeth were compiled from various published sources to assess ancestry, sex and age of the remains. Dental eruption and wear patterns were also utilized in age estimations; however, the employment of decision tables was incorporated to assess conflicting results in ancestry and sex protocols. The results shows that four of the specimens were of European descent, two of Asian descent, and one of African descent. The sexing resulted in three males and four females. The aging results show that five specimens were of young adults aged between 16-35 with the other two specimens showing older ages of over 45 years. A record of pathological occurrence shows the presence of dental fillings, cavities, tooth extractions, calculus, and edentulous jaw conditions. This research contributes to further identification of human remains investigated for a closed forensic case.

Introduction:
Anthropology is the field of holistic study of all aspects of life including sub-categories of cultural, physical, biological, linguistic anthropologies, and archeology. Within each of these sub-fields, there are other categories of study for specific fields. For example, one of the branches of biological anthropology is Forensic Anthropology, which specifically deals with the study of humans through skeletal remains.
Forensic Anthropology deals with the study of human remains by using skeletal analysis, and techniques from the study of human osteology, to find the identity of an individual. Forensic anthropology is often used in investigation of crimes (violent crimes, murder, cold cases, etc.) to help determine the identity of the victim. Within today's criminal world there is a section of violent crime, homicides, in which counts for around 1.3% of violent crime offenses (FBI 2016). Within homicide, it is not always a clean and cut case or easy to solve. In circumstances that the investigation doesn't have a suspect or enough evidence, they may become unsolved or in other words become a Cold Case Homicide. Evidence from the project cold case website described that out of the 14,715 homicides committed in the year 2021, only around 51% were cleared cases, meaning they had been solved, with a national overall average of 66% (Accountability Project 2024). In some cases, these remains are later examined for more evidence, in others the only evidence found may be that of skeletal remains, in which forensic anthropologists are called in by law enforcement to profile the remains to help determine who this individual is and what has happened to them. Profiling involves the determination of ancestry, sex, age, and other characteristics of skeletal remains, such as pathologies and trauma, through metrical and non-metrical analysis.

Methods:
Forms of profiling:
Mandibular Profiling:
- Ancestry- non-metrical: pinching of the ascending ramus, chin shape, chin profile, undulation, and rocker jaw traits
- Sexing- non-metrical: frontal and basal views of the Chin were used, as well as the basal view of the mandibular shape, flexing of ascending ramus, and gonial eversion
  - Metrical: ascending ramus width and gonial angle.
- Aging- non-metrical: wear and the eruption of teeth were analyzed.

Cranial:
- Ancestry- non-metrical: analysis of full skull anatomy, nasal structures, cheek bones, eye orbits, and incisors.
- Sexing- non-metrical: observation of nuchal crest, mastoid process, supraorbital margin and glabella/supraorbital ridges.
- Aging- non-metrical: Cranial closures, specifically epiphyseal closure.

Post-Cranial:
- Ancestry- N/A
- Sexing- metrical: Long bone and Pelvic measurements
  - Non-metrical: Pelvic observation
- Aging- metrical: Length of long bones, radiographic analysis, and bone microstructure analysis.
  - Non-metrical: analysis of pubic symphyseal surfaces, auricular surface of the ilium and sternal rib ends.

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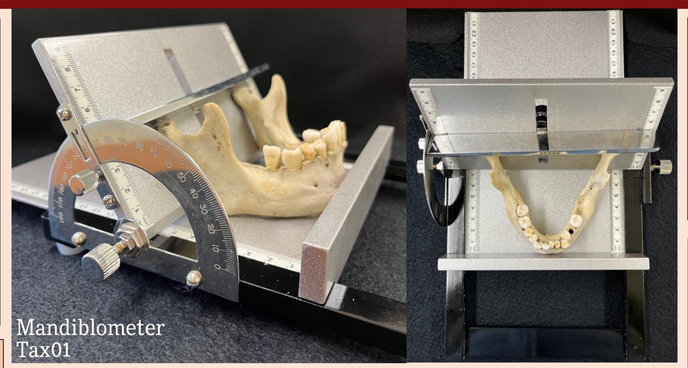
Mandiblometer
Tax01

Tables

Ancestry	Tax01	Tax02	Tax03	Tax04	Tax05	Tax06	Tax07
Pinching of Ascending Ramus	Slightly Pinched	Pinched	Slightly Pinched	Slightly Pinched	Slightly Pinched	Not- Pinched	Not- Pinched
Chin Shape	Bilobate/Square	Bilobate/Square	Bilobate/Square	Round	Bilobate/Square	Round	Round
Chin Profile	Protruding	Protruding	Protruding	Protruding	Vertical	Protruding	Protruding
Undulation	Slight	Undulation	Undulation	None	Undulation	Slight	None
Rocker Jaw	Non-Rocker Jaw	Non- Rocker Jaw	Rocker- Jaw	Rocker- Jaw	Non-Rocker Jaw	Rocker- Jaw	Rocker- Jaw
Estimation	**European**	**European**	**European**	**Asian**	**European**	**African**	**Asian**
Sexing							
Chin Shape	Squared	Rounded	Squared	Rounded	Squared	Rounded	Rounded
Mandibular Shape	U-Shaped	U-Shaped	U-Shaped	V-Shaped	U-Shaped	U-Shaped	V-Shaped
Ascending Ramus Flexion	Flexed	Flexed	Flexed	Straight	Flexed	Flexed	Straight
Ascending Ramus Width (mm)	29.8 (<28mm)	33 (>33mm)	31.2 (>33mm)	29.2 (<28mm)	30.4 (<28mm)	30.3 (<28mm)	33.3 (>33mm)
Gonial Angle	120 (<124*)	123 (<124*)	122 (<124*)	121 (<124*)	115 (<124*)	140 (>125*)	125 (>125mm)
Gonial Eversion	Marked	Marked	Marked	Slight	Marked	Slight	Slight
Estimation	**Male**	**Male**	**Male**	**Female**	**Male**	**Female**	**Female**
Aging							
A (12-18yrs)							
B1 (16-20yrs)		#AO #Adolescent 12-20					
B2 (16-20yrs)		#AO #Adolescent 12-20	#YAd #YoungAdt 20-35	#YAd #YoungAdt 20-35			
C (18-20yrs)		#AO #Adolescent 12-20					
D (20-24yrs)		#AO #Adolescent 12-20			#YAd #Young Adt 20-35		
E (24-30yrs)	#YAd #Young Adt 20-35						
F (30-35yrs)							
G (35-40yrs)							
H (40-45yrs)							#OAd #Old Adults 50+
I (45-55yrs)						#OAd #Old Adults 50+	#OAd #Old Adults 50+
Estimation	**20-35yrs**	**16-24yrs**	**16-20yrs**	**20-35yrs**	**20-24yrs**	**50+**	**45+**

Results:
Tax01: European Female between the years of 20-35 years of age
Tax02: European Male, aged 16-20 years of age
Tax03: European Male, aged 16-20 years of age
Tax04: Asian Female from 20-35 years old
Tax05: young adult male between 20-24 years of age of European descent
Tax06: African female thought to be 50 years or older
Tax07: Asian female 45 years or older but presented younger than Tax06

Discussion:
Ancestry:
- Tax01: appears to slightly rock but has a straight inferior border,, a slightly pinched ascending ramus, a bilobate or square chin shape, protruding chin profile, slight undulation, a round sigmoid notch, everted gonial eversion and a tall, or superior projecting, coronoid process; the specimen is suggested to be European.
- Tax02: straight inferior border, indicating that it is a non-rocker jaw. The mandible has a pinched ascending ramus, bilobate or square chin shape, a protruding chin, and undulation of the antegonial notch. These traits suggest that the specimen is European.
- Tax03: displayed a slightly pinched ascending ramus, and bilobate or square chin shape, a protruding chin profile, undulation, everted gonial angles, round sigmoid notch, tall and anteriorly projecting coronoid process and a round inferior border suggesting it as a rocker jaw, suggesting specimen Tax03 is European.
- Tax04: No undulation, rounded inferior border, suggesting it is a rocker jaw. The ascending ramus is slightly pinched, the chin shape and profile are round and protruding, the sigmoid notch appears to have a wide shape, inverted gonial angle, and a short coronoid process, the specimen is believed to be that of Asian descent.
- Tax05: slightly pinched ascending ramus, bilobate or square chine shape, a vertical chin profile, Undulation was found, a sloping shape of the sigmoid notch, gonial eversion was everted, the height of the coronoid process was short, and the mandible had a straight inferior border, presenting as a non-rocker jaw. These traits found within the mandible suggest the specimen is European
- Tax06: round and protruding chin shape and profile and a non-pinched ascending ramus, slight undulation found, wide shaped sigmoid notch, gonial angle was vertical, coronoid process was anteriorly projecting and short and a rounded inferior border suggesting a rocker jaw to be present and was scored as African.
- Tax07: round and protruding chin shape and profile along with an ascending ramus that was not pinched, no undulation of the mandible, presented with a wide sloping shaped sigmoid notch, gonial angle was vertical, the coronoid process was short and inferior border was rounded and scored as a rocker jaw. The specimen was determined to be Asian

Sexing:
- Tax01: 29.8mm ascending ramus which was also flexed, Basal and frontal views were square, base was u-shaped, presence of rocking, and slight markings on the gonial; the specimen was scored as female.
- Tax02: It had an ascending ramus measurement of 36.5mm that was flexed. The basal and frontal view were rounded, the basal view was also U-shaped, there was no rocking present and had a gonial eversion that was marked. Th specimen was scored as male.
- Tax03: Straight ramus with a measurement of 31.2mm, There was no rocking present with squared basal and frontal view along with a u-shaped base and gonial eversion was marked; the specimen was scored as male.
- Tax04: With a straight ascending ramus measuring 29.2mm, the specimen had a squared basal and frontal view with a V-shaped base; rocking was also present and gonial eversion had been marked. The specimen presented as female.
- Tax05: This specimen had a straight ramus measured at 30.4mm, base and frontal views were squared, the base was u-shaped, and the jaw did not rock when placed on a flat surface. This specimen had a gonial eversion that was marked. and was scored as male.
- Tax06: This specimen has a ramus that was flexed and 30.3mm, the base and frontal view of the mandible was rounded, base was u-shaped and had rocking present, the markings of the gonial eversion were slight in this case and I believe this specimen to be female.
- Tax07: The ascending ramus was 33.3mm and the ramus was flexed, a rounded basal and frontal view, V-shaped base, along with rocking and there were slight markings on the gonial eversion. The specimen is scored as female.

Aging:
- Tax01: 2-1-2-3, there appeared to have most exposed dentin within the 2 incisors and canine, with lower amounts of exposed dentin within the 2 premolars and first molar. The last of the two molars have no dentin presented with wear of both teeth. This suggests that the mandible is in category E or #YAd. The individual was most likely a young adult 20-35
- Tax02: 2-1-2-2, I mainly focused on the roots and if they were resolved at all and the wear on the left third molar. The molar analyzed had little to no wear, suggesting that the mandible could be of any categories B1, B2, C, and D or #AD and #YAd, suggesting that the specimen was between 16-24 years old.
- Tax03: 2-1-2-3, focused on incisors and canines available, there was no wear and believed to be in the categories B2 and #YAd, estimated at the ages between 16-20 years old
- Tax04: 2-1-2-3, With the minimal wear on the left pre-molar and no wear on the right third molar, that the specimen belonged to category B2 or #YAd. This means that the individual was most likely 20-35 years of age.
- Tax05: 2-1-2-3, Based on dentin presented in the incisor, canine, and premolars, and the wear on the rest of the teeth, this proposes that the specimen is a member of category D or #YAd. This individual is thought to be a young adult between the ages of 20-24
- Tax06: 2-1-1, With the condition of the teeth, having extensive wear and dentin exposed, and roots being resolved, this individual was thought to be in category I or #OAd and presumed to be 50 years of age or older.
- Tax07: 2-1-2-3, all teeth were missing so I focused on root resolving, With the evidence found, I determined that this specimen belonged in
- category I and #OAd. The analysis implied that this specimen was 45 years of age or older, but younger than specimen Tax06.

Conclusion:
Based on my analysis I have determined the possible sex, ancestry, and age of each of the specimens. Specimen Tax01 was mostly likely a European Female between the years of 20-35 years of age. Both specimen Tax02 and Tax03, presented as a European Males, aged 16-20 years of age. The fourth specimen is believed to be an Asian Female from 20-35 years old. Specimen labeled Tax05 is presumed to be a young adult male between 20-24 years of age of European descent. The next, Specimen Tax06, was an African female thought to be 50 years or older. The last specimen, labeled Tax07, was presumed to be an Asian female 45 years or older, but presented younger than Tax06.
Forensic Anthropology aids in the profiling of unknown specimens. In this case, the mandibles were profiled using metric traits of the mandible and non-metric traits of basal views and rocking techniques, aiding in the identification of each of the specimens' sexes. With these specimens, we are unsure of where they come from and who they are. Because of this, Forensic Anthropologists use specific techniques, metrical and non-metrical, to identify specimens and possible discover more about their history and the past context around their death. Though my study strictly focused on mandibular analysis, we also learned that there are many different techniques, metrical and non-metrical, and other skeletal remains, whether it be cranial or post cranial remains, that can be used in profiling and identification of remains.