Morphological dental trait examination of Ajnala skeletal remains and their possible population affinity

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KEYWORDS

Dental anthropology, Ajnala skeletal assemblage, non-metric traits, population affinity, identification

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ABSTRACT

Objectives: The metric and non-metric features of the fragmented, badly damaged and commingled human remains play a significant role in their identity establishment in forensic anthropology. The main objective of the present study was to assess the population specific attributes of the unknown human dental remains excavated from an abandoned well, found underneath a religious structure at Ajnala (Punjab, India). Written accounts mentioned that Ajnala skeletal remains belonged to 282 Indian origin soldiers of the British army who had revolted against the colonial rulers in 1857, who were killed after capture, and their bodies dumped in an abandoned well.

Materials and Methods: Eleven non-metric dental traits were investigated in a sample of 1527 teeth (1200 dislodged teeth comprising of 300 canines, 300 premolars and 600 molars along with 93 jaw fragments having 327 teeth of different types) collected from this non-scientifically exhumed skeletal assemblage. These selected traits were examined with adequate magnification and lighting, using a flexible arm illuminated magnifier (Lensel Optics Pvt. Ltd., Pune, India), identified and scored in accordance with the descriptions provided in the Arizona State University Dental Anthropology System (ASUDAS).

Results: Eight of the eleven features examined (Carabelli trait, Hypocone absence, Cusp 5, Cusp 6, Tomes root, mesial canine ridge, Y-groove pattern, and four-cusp mandibular second molar) exhibited frequencies that were distinctly higher or lower than the three major continental ancestries.

Discussion: Some amateur historians doubted the authenticity of the written versions and argued that these remains might belong to the non-Indians. Present study results revealed that the studied dental trait frequencies were not similar to any major continental ancestry and were relatively unique in Ajnala teeth like previous Indian studies. While this in itself does not guarantee that these teeth belong to individuals of the Indian subcontinent, it endorses previous scientific analyses and supports the written accounts that the majority of Ajnala teeth were probably Indian in origin. However, the determination of ethnicity from dental morphological features remains debatable and can be used only as suggestive than diagnostic tool owing to possible bias in recording morphological features of teeth. Although determining the racial affinity from teeth is very difficult, caution must be exercised in concluding the racial identity of an individual from the teeth.

INTRODUCTION

Forensic anthropological identification of commingled human remains recovered from diverse contexts is a more challenging and complex process due to material obstacles like poor preservation, severe damage or fragmentation, missing elements, and lastly the inadequate historical records about past armed conflicts, natural or mass disasters which produced such human remains. The expert-mediated retrieval of intact skeletal remains from burial sites like trenches, abandoned wells, *nallahs*, etc., and use of advanced scientific methods and techniques becomes essential for successful identification of disarticulated inter-mixed human remains. Such remains belong either to civilian victims of violent conflict or combatants who sacrificed on behalf of a nation. A multidisciplinary approach is essential to resolve the issue of identification of large commingled assemblages using multiple strategies like osteometric pair-matchings, exclusions and associations, simulations, DNA sequencing strategies.[1] The recovery, segregation, inventory and articulation of commingled human remains from mass burial sites pose a difficult challenge. In case of the present study, skeletal remains resulting from state-sponsored violence, the commingling was further exacerbated by their non-scientific excavation which discouraged the establishment of social identity of the remains and nature of violence committed against the victims. Each commingled assemblage is unique in its history, challenges, and context, and no single identification approach is universally applicable to the diverse situations under which CHR are recovered.[2] Restoring individual identity to remains and repatriation of these badly damaged remains to their relatives for last rites is the ultimate purpose of almost all forensic anthropological analyses. Recovering, reassembling, and naming individuals who died in war or war-related violent conflicts is itself a form of honouring and remembering the victims.[1]

The badly damaged, skeletonized and commingled human remains present a serious challenge, whose identification has been attempted by the application of different physical anthropological methods and techniques [3-4]. The identity establishment of an unknown badly damaged skeleton remains requires a collective multi-disciplinary approach involving forensic anthropologists, odontologists, pathologists and DNA scientists. When such human remains are retrieved by forensic anthropologists, or bio-archaeologists, the first step is to establish the identity affiliations (i.e., sex, age, stature, ethnicity) of the remains wherein the experts from diverse scientific disciplines can contribute significantly. Identifying commingled human remains is a sophisticated task that requires significant time, energy, resources, expertise, and application of innovative methods[1]. Individualizing identification of war dead, or victims of violent conflict, natural disaster, or whatever incident of mass fatality, is a complex phenomenon and is a primary objective for forensic anthropological analyses in medicolegal and humanitarian contexts.[1] When a human skeleton or its elements are recovered from the site of mass disasters or are unearthed during archaeological excavation or construction activities (road, canal or building), a forensic anthropologist is generally warranted to identify them, to ascertain the minimum number of individuals, to detect signs of any traumatic or pathological injuries in the bones and teeth or to identify any kind of alteration/damage inflicted to the skeleton(s). Forensic anthropological or archaeological methods play a significant role in biological profiling of unknown human remains retrieved from complex recoveries.

Teeth are the strongest part of human body which have served as crucial evidence in mass fatality incidents to establish the biological identity of severely mutilated bodies or badly damaged skeletal remains.[5,6] Teeth can provide significant information about the cultural practices, dietary behaviour, lifestyle and occupation (such as electrician, carpenter, shoe maker, tailor and musician) of an individual.[7] The teeth of shoe makers, electrician, upholsterers, glass blowers, dress designers/makers and seamstresses have abrasive modifications resulting from holding nails, tacks, needles and glass tube between the teeth. Wind instrument players or musicians develop dental defects.[8-11] The existence of a notch in the incisal edge of a central or central incisor is common in dress makers, seamstresses and electricians whereas grooving may be present in the incisor teeth of carpenters and roof tilers.[12] The radiation damage to teeth in X-ray technicians, radiographers and watch dial painters generally results in radiation caries, gingival recession, periodontitis, alveolar bone damage and causes loosening of teeth and root resorption.[13] Various morphological characteristics of teeth are specifically present in certain population groups and can be used to differentiate ethnicity affiliations of an individual. Dental characteristics include the curves, bulges, cusp pattern, cusp frequency, cusp position, groove pattern, number of roots, number of teeth, bends, furrows, joining (linkage), that appear in various sizes, shapes on the crown and root for assessment of ethnicity.[14] Dental anthropologists have classified human dental variations (non-metric dental traits) into two basic types; the first type features involve major deviations (dental anomalies) from the normal dental blueprint (e.g., extra tooth or fused teeth). The other types of dental variation are minor and more delicate ones that involve variation in secondary cusps, fissure patterns, and supernumerary roots (amongst others).[15] The various unique characteristics/features associated with the human dentition are those which can be visually recorded from the teeth. The dental anomalies can be in the form of the defects, abnormalities of the size, shape, numbers, structure, eruption, or position of the teeth. The structure and shape of teeth and details of their arrangement in the dental arches provides information that can be unique to an individual. Even in identical twins, the slight variations in tooth form and position can enable the twins to be separated on the basis of their dentition.[16] Therefore, dental anomalies are special features of the teeth which are helpful in distinguishing and identifying the sex and ancestry of an individual. Dental anthropologists have been studying the dental variations since the 19th century as they are more common and vary within and between populations, and thus, are largely considered to be useful in evolutionary and forensic contexts.[15]

About the Study Material:
The written accounts mentioned that human cadavers of 282 Indian 'mutineer' soldiers were dumped into an abandoned well at Ajnala (Amritsar, India) and then a religious structure was built over its periphery. About 500 soldiers of the 26th Native Infantry regiment of the British army in India had revolted against colonial rule in July 1857, who were, subsequently captured, killed and their cadavers were intentionally concealed underneath a religious structure at Ajnala.[17-19] The sanitary concerns were cited as the immediate reason for their disposal in a nearby deserted well. It was only in late 2013 that awareness of the remains was created following a chance reading about it in the book written by the British administrator of Amritsar at that time.[17] The most emergent reason advocated for their excavation was to scrutinize the authenticity of the written records about presence of any remains underneath a religious structure in Ajnala. Some amateur historians doubted the truthfulness of the written versions and argued that the said excavated remains might belong to non-Indians.[20] The bundles of severely damaged and commingled human remains were retrieved from the Ajnala well by amateur excavators which presented a tough challenge for their identification owing to their non-scientific excavation. Thousands of human skeletal remains along with the associated personalized items like colonial-era coins, army medals, hand bracelets, iron and copper rings, metalloid arm-bands, gold beads and amulets, etc., dug out from the well sediments corroborated the self-congratulatory but harrowing narrations proclaimed by the author of the book "The Crisis in Punjab: From 10th of May Until Fall of Delhi".[17-18] The application of multiple forensic anthropological methods like osteological, odontological, radiological, and elemental examinations have revealed that the excavated remains belonged to adult males who were non-local to the site, ate mixed diet, and shared a common geographical area during their childhood.[20-24] The main objective of the present investigation was to assess the population affinity of the unknown human dental remains excavated from the Ajnala well based on the frequency distribution of some selected morphological dental traits. The estimated trait frequencies were compared with the published global and Indian data to make the ancestry estimations about the Ajnala victims.

MATERIAL AND METHODS

A total of eleven morphological non-metric dental traits were investigated in a total sample of 1527 teeth (1200 dislodged teeth comprising of 300 canines, 300 premolars and 600 molars along with 93 jaw fragments having 327 teeth of different types) collected from the Ajnala site skeletal assemblage (Figure 1 and 2). Each tooth and jaw fragment was cleaned of any extraneous material like soft tissue, tartar/calculus; rinsed with distilled water, cleaned and dried, before attempting the morphological trait analysis. In spite of this, tenacious debris, calculus and tooth wear precluded assessment of several teeth, reducing the sample further. The dental non-metric traits were examined and analyzed by first author (AA) with adequate magnification and lighting, using a flexible arm illuminated magnifier (Lensel Optics Pvt. Ltd., Pune, India), identified and scored in accordance with the descriptions provided in the Arizona State University Dental Anthropology System (ASUDAS) referring to Turner et al. (1991)[25] as well as Scott and Turner (1997).[15] Some traits were also examined by the corresponding author, and negligible inter-observer error was noticed. Accordingly, the ordinal scale was converted to a nominal scale to categorize the non-metric trait for each assessed tooth as being present or absent.[15]

Figure 1. Abandonded well unearthered beneath a religious structure at Ajnala

Figure 2. Fragmented, badly damaged and commingled human skeletal remains exhumed from Ajnala well

The description for each morphological characteristic examined is as under:

1) *Cusp of Carabelli:* The Carabelli cusp is an additional tubercle on the first maxillary molars. It is situated at the mesio-palatal site of the tooth (anthropologically, on the 'protocone') (Figure 3).
2) *Three-cusp upper second molar*: The upper second molar usually has four cusps, but one of the cusps (the distolingual/distopalatal cusp, anthropologically referred to as the 'hypocone') may be missing, resulting in a three-cusp feature (Figure 4).
3) *Four-cusp lower first molar:* The lower first molar usually has five cusps, however, when the distal cusp is missing, it results in the four cusp trait (Figure 5).
4) *Four-cusp lower second molar*: The lower second molar usually has four cusps, however, the distal cusp is present at times, it results in five cusps (Figure 6). In such cases, the tooth is graded as 'absent' for the four-cusp feature.
5) *Cusp 5 or distal accessory tubercle*: It is also referred to as the 'distal accessory tubercle' as the trait is seen as an occlusal tubercle on the distal marginal ridge of the upper first molar (Figure 7).
6) *Cusp 6:* This feature is characterised by the presence of an additional cusp

between the distal and distolingual cusps of the lower first molar.

7) *Cusp 7*: This feature is characterised by the presence of an additional wedge-shaped cusp between the mesiolingual and distolingual cusps of the lower first molar (Figure 8).
8) *Y-groove pattern*: When the mesiolingual and distobuccal cusps of the lower molar are in contact at the central fossa, the resultant groove pattern is referred to as the Y-pattern, which is usually observed on lower second molars.
9) *Mesial canine ridge*: This is a non-metric dental trait characterised by the coalescence of a large cingulum with the mesial marginal ridge of upper canine teeth.
10) *Tomes root*: This is characterised by the presence of an additional root on the lower first premolar, with the tooth exhibiting a buccal and lingual root (Figure 9).
11) *Three-rooted lower first molar*: This is characterised by the presence of an additional root on the lingual surface of the distal root of lower first molar.

The research outline of present study was duly approved by the Institutional Ethics Committee of the Panjab University, Chandigarh (India), vide letter nos. PUIEC/2018/99/A/09//01 dated: January 28, 2018 and PUIEC/201/41/20//05 dated: August 18, 2016

Figure 3. Carabelli trait on an upper right first molar is at least Grade 5 as per the ASUDAS and hence Carabelli cusp (arrow) is considered 'present'

Figure 4. The upper right second molar has three cusps only, with the hypocone missing

Figure 5. In this lower jaw specimen, the four-cusp lower molar is 'present' in the right first and second molar since the distal cusp is absent in both

Figure 6. The four-cusp lower molar feature is 'absent' in the lower left first and second molar of this jaw specimen since the distal cusp (arrows) is present

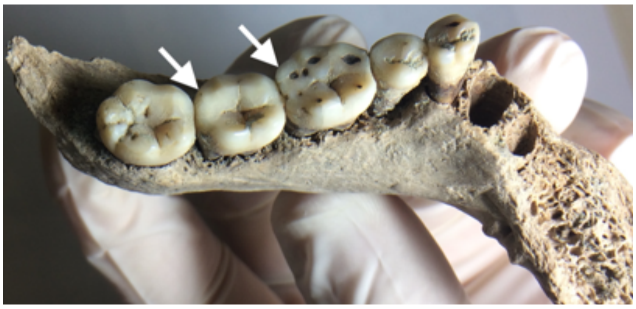


Figure 7. Cusp 5 (arrow) or the 'distal accessory tubercle' on an upper first molar

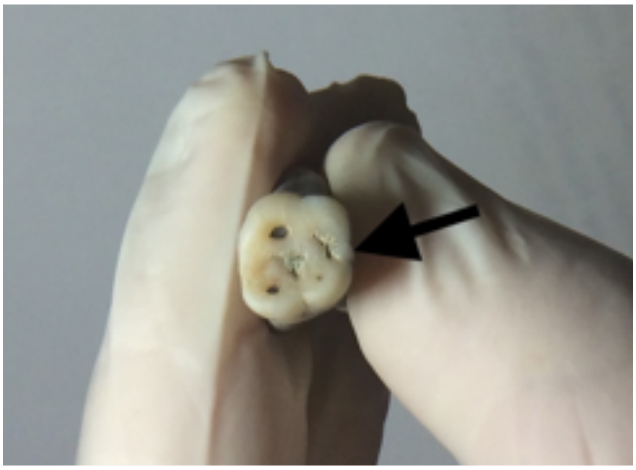


Figure 8. Cusp 7 (arrow) viewed between the two lingual cusps of a lower first molar

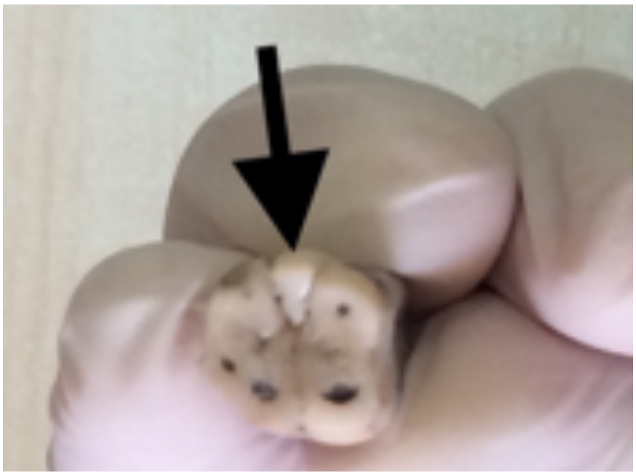
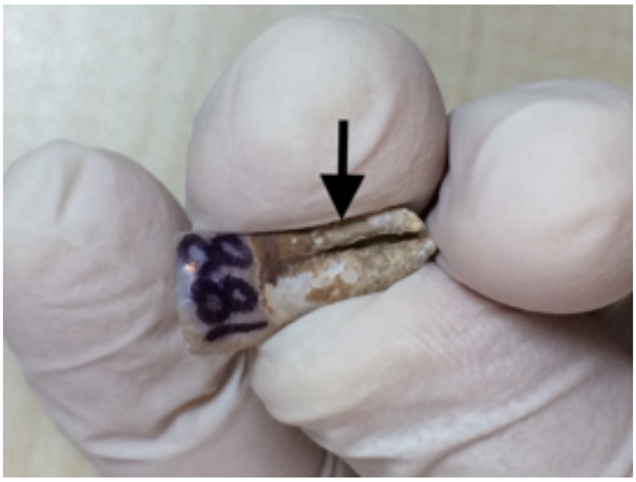


Figure 9. Tomes root seen on a lower first premolar



RESULTS

Out of 125 maxillary first molars assessed, 44 (35.2%) exhibited the Carabelli cusp (≥ Grade 5, as observed in the ASU plaques) (Figure 3). Three-cusp upper second molars were observed in 40 out of 122 (32.8%) upper second molars (Figure 4). Four-cusp lower first molar was a feature in the 10 out of 172 (5.8%) teeth assessed in the present investigation (Figure 5). Four-cusp lower second molar trait was observed in 156 out of 192 (81.3%) teeth (i.e., 36 of the mandibular second molars exhibited the distal cusp and, thereby, five cusps) (Figure 5). The distal accessory tubercle or Cusp 5 was observed in 4.2% (5/120) of the maxillary first molars (Figure 7). Cusp 6 was observed in 3 out of 173 (1.7%) mandibular first molars assessed in present study, while 'Cusp 7' was observed in 14 out of 173 (8.1%) teeth (Figure 8). The Y-groove pattern was observed in 6 out of 192 (3.1%) lower second molars. Out of the 122 upper canine teeth available, wear and debris on the lingual/palatal surface allowed the assessment of 46 tooth specimens of which 14 (30.4%) exhibited the mesial canine ridge. Of the 293 premolars, 34 were mandibular first premolar of which only 2 (5.9%) exhibited the Tomes Root (Figure 9). Three-rooted lower first molar trait was observed in 2 out of the 122 (1.6%) teeth.

DISCUSSION

Identification of the deceased becomes crucial from ethical, legal, social and sometimes political perspectives. Victim identification from the decomposed, skeletonized, incinerated and disintegrated body parts play an important role in forensic death investigations when the traditional methods of visual recognition or dactylography fail to do so. If a human body is found completely or partially skeletonized, identification of victim becomes an uphill task and in such situations, the forensic anthropological and odontological methods play a decisive role in identification.[26] Forensic odontologists glean information from the teeth to decide about their peri-mortem fate, age, sex, dietary status, migration history, geographical affiliations, pathological or traumatic conditions, ancestry etc.[27-28] Attributing population affinity to unknown remains can play a crucial role in establishing their biological identity. The main aim of the present analysis was to estimate the population affinity of the Ajnala skeletal remains from non-metric dental traits to authenticate (endorse or refute) the written versions about geographical affiliations of the victims.[17-19] For this purpose, eleven morphological/non-metric dental features were assessed in the randomly selected dislodged and jaw-located teeth collected from Ajnala skeletal collection.

The frequency distribution of the studied non-metric traits in different teeth types of the Ajnala dental sample and their comparisons with other major continental ancestries has been presented in Table 1. In the present analysis, Carabelli Cusp (≥ grade 5 in the ASU plaques) was present in 35.2% first maxillary molars (Figure 3). The prevalence of this trait was higher than the data available for three major continental ancestries namely, Western Eurasians (22.6%), Sub-Saharan Africans (14.5%), and North-eastern Asians (14%).[15] Angadi and Acharya (2008)[28]—who also used ASU plaques—reported a similarly higher frequency of this non-metric dental trait (26%) in a sample of 100 subjects from India, predominantly from the southern and western regions of the country. While this appears closer to the frequency of Western Eurasians, it is recognizably higher, akin to the present investigation. It is also plausible that the frequency is inherently different here because the sample originates from India. In fact, Carabelli trait is shown to occur in approx. 48% of subjects in another study from India which looked at populations from the southern and south-eastern regions of that country.[29] A study that looked at root traits in a heterogeneous group of South-western Indians observed that the frequency of dental traits for this population "were not similar to any specific geographic subdivision".[30] In fact, they observed the Tomes root in 5% of the mandibular first premolars from their sample, which is near identical to the 5.9% observed in the present investigation (Figure 9). This frequency was lower (and different) than that reported for three major continental ancestries i.e., Western Eurasians (7.3%), Sub-Saharan Africans (6.8%), and North-eastern Asians (8.8%).[15] However, we acknowledge that the Tomes root frequency reported in the current investigation (n = 34) and in Yeli and Acharya (2013) (n = 40) is based on a small sample.

With regards to the three-rooted mandibular first molar, the 1.6% frequency in the present investigation is in between the frequencies for Western Eurasian (0.7%), Sub-Saharan African (2.3%), and North-eastern Asian (20.4%).[15] Yeli and Acharya (2013) found a relatively high 9.3% frequency for the three-rooted first molar trait in a sample of 144 South-western Indian subjects. Therefore, it is likely that Indians may exhibit a frequency for this trait that is in between the frequency of major world populations.

Three-cusp upper second molar (Hypocone *absence*—Figure 4) was observed in 32.8% of the Ajnala teeth is similar to that in Angadi and Acharya (2008)[28], who reported 34% of upper second molars exhibited hypocone absence in their aforementioned Indian sample (n = 100). Again, this frequency is different (and higher) than that has been reported for Western Eurasians (17%), Sub-Saharan Africans (6.7%), and North-eastern Asians (12.7%).[15]

The 5.8% incidence of four cusp lower first molar (Figure 5) in the teeth assessed here is lower than Western Eurasian (9.3%) but higher than Sub-Saharan African (1%) and North-eastern Asian (0.2%) [15]. While this is in between the frequencies of three major human subdivisions and different to them, Angadi and Acharya (2008)[28] reported it in a relatively high 11% of the Indian dentitions. The same trait's frequency of 81.3% in mandibular second molars (Figure 5) compare well with the findings of 90% in the Indian sample of Angadi and Acharya (2008)[28], both of which are higher than for Western Eurasians (72.5%), Sub-Saharan Africans (23.6%), and North-eastern Asians (20.3%).[15]

'Cusp 5' (Figure 7) was observed only in 4.2% of maxillary first molars considered in the present investigation, which is recognizably lower than the frequency data available for Western Eurasians (17.8%), Sub-Saharan Africans (26.7%), and North-eastern Asians (23.6%).[15]

'Cusp 6' was observed in 1.7% of mandibular first molars assessed in the current analysis. This frequency, again, is much lower than the frequency in three major continental ancestries, where it was reported to be present in 9.6% Western Eurasians, 18.8% Sub-Saharan Africans, and 40.1% North-eastern Asians.[15]

'Cusp 7' (Figure 8) was observed in 8.1% mandibular first molars and this frequency falls in between the frequency data available for Western Eurasians (6.9%), Sub-Saharan Africans (28.7%), and North-eastern Asians (6.3%)[15], although the trait frequency observed herein is comparable to Western Eurasians and North-eastern Asians.

Table 1. Frequency distribution (%) of different non-metric features in Ajnala skeletal remains and their comparison with three sub-divisions of humankind

Sr. No.	Dental Trait	Location and definition of feature	Present sample	Western Eurasians	Sub-Saharan Africans	North east Asians
1	Cusp of Carabelli	A tubercle on mesiolingual or lingual aspect of upper 1st molar	35.2	22.6	14.5	14.0
2	Three-cusp upper 2nd Molar	Distolingual cusp (hypocone) missing on upper 2nd molar	32.8	17	6.7	12.7
3	Four-Cusp Lower 1st Molar	Lower 1st Molar	5.8	9.3	1.0	0.2
4	Five-Cusp Lower 2nd Molar	Lower 2nd Molar	81.3	72.5	23.6	20.3
5	Distal accessory tubercle (Cusp 5)	An occlusal tubercle on the distal marginal ridge of upper 1st molar	4.2	17.8	26.7	23.6
6	Cusp 6	Additional cusp between distal and distolingual cusps of lower 1st molar	1.7	9.6	18.8	40.1
7	Cusp 7 (Wedge-shaped)	Additional cusp between mesiolingual and distobuccal cusps on lower 1st molar	8.1	6.9	28.7	6.3
8	Y-groove pattern	Lower 2nd molar (mesiolingual and distobuccal cusps are in contact at central fossa)	3.1	26.6	48.4	14.6
9	Mesial canine ridge	Upper canine characterized by coalescence of a large cingulum with mesial marginal ridge	30.4	4.2	17.6	2.8
10	Tomes root	Additional root on lower first premolar with the tooth having a buccal and lingual root	5.9	7.3	6.8	8.8
11.	Three-rooted lower 1st Molar	Additional root on lingual surface of distal root of lower 1st molar	1.6	0.7	2.3	20.4
12.	Taurodontism					
13.	Shovelling					
14.	Premolar Tuber-apex					
15.	Dilaceration					
16.	Tuberculum Dentale in maxillary canines					
17.	Multiple lingual cusp					

Y-groove pattern trait was observed in 3.1% of mandibular second molars, which is again much lower than the Western Eurasians (26.6%), Sub-Saharan Africans (48.4%), and North-eastern Asians (14.6%) as per the compilation of Scott and Turner (1997).[15]
Lastly, the mesial canine ridge was observed in 30.4% maxillary canines considered here. This frequency was much higher than the three major continental ancestries, namely Western Eurasians (4.2%), Sub-Saharan Africans (17.6%), and North-eastern Asians (2.8%).[15] It is likely that the low number of maxillary canines assessed in our investigation (n = 46) impacted the results and the actual frequency could be lower and comparable to other human subdivisions since findings in another study from India (n = 1042) show that its frequency is 14.3% (which it must be noted is towards the higher end of the spectrum of incidence amongst the three major continental ancestries).
Out of eleven features evaluated, eight exhibited frequencies which were recognizably or distinctly higher or lower than three major continental ancestries namely Western Eurasian, Sub-Saharan African and North-eastern Asians. Three features namely Cusp 7, four cusp lower first molar and three-rooted lower first molar show frequencies which were in between the frequencies of the three major continental ancestries and relatively close to at least one of the them. Two of the non-metric traits with 'distinct' frequency were based on a relatively small sample size (Tomes root of mandibular first premolar and the mesial canine ridge). Still, six out of eleven features—accounting for a majority of the non-metric traits applied herein—that were assessed on relatively large sample size exhibited distinctiveness in their frequencies.
The non-metric dental features of the Ajnala teeth samples could be compared with only a limited number of Indian studies that previously made use of the ASUDAS; some of the recent Indian research that utilized ASUDAS [31-33] comprise of non-Indians and therefore the authors here relied on the studies headed by Acharya and colleagues[29, 30] and another.[29]
A previous work undertaken on a skeletal collection in Denmark showed that relatively accurate population categorization was possible.[34] We believe that the findings herein have parallels to that work wherein a blinded analysis of a skeletal collection (of known provenances in that study) revealed that population attribution was largely accurate and showed expected dental non-metric traits. In fact, those authors found that the results for the dental non-metric traits followed the anticipated frequencies, in general.[34]
From the non-metric dental traits examined in the current sample for estimating their population affinity, it can be concluded that trait frequencies were relatively unique. This in itself does not guarantee that these teeth belong to individuals of the Indian subcontinent but it endorses the findings from previous research that allude to Indians exhibiting a relatively unique frequency for non-metric dental traits.
The results of our analysis in turn are in agreement with written records which mentioned that the remains belong to the Indian-origin soldiers killed in 1857 whose cadavers were dumped into the said disused well at Ajnala,[17-19] Preliminary dental health status [22, 35], odontometrics [36], elemental analysis [21], radiocarbon dating [23] and radiological ageing [22, 24] and molecular[37] results have corroborated that the excavated teeth belonged to adult individuals most likely killed in 1857.

CONCLUSIONS

Bones and teeth have been increasingly used to determine the biological profile of individual(s) as they retain crucial markers of human form and identity after death. Teeth protect invaluable information to answer forensic anthropological queries of provenance, biological identity, taphonomic/traumatic insults, estimation of dietary practices and subsistence patterns, paleopathology, etc. In the present investigation, out of eleven dental features evaluated for which population frequency data existed for comparison, eight traits (comprising almost three-quarters of the assessed features) exhibited frequencies recognizably higher or lower than three major continental ancestries. Although results of two of the features may be undermined by a relatively small sample size, the non-metric dental traits examined in this sample, by and large, have frequencies that are relatively unique. While this per se does not imply that these remains positively belong to the Indian subcontinent, it reaffirms the findings from previous research that allude to Indians exhibiting a relatively unique frequency for non-metric dental traits compared to other major continental ancestries.[28, 30] The present investigation's observations also endorse the previous scientific analyses with these remains that the majority of Ajnala teeth were probably Indian in origin to support the written accounts.[17-19]

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