THE MYLOHYOID BRIDGING: INCIDENCE AND CLINICAL IMPLICATIONS.

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ABSTRACT: The evaluation of non-metrical traits of mandible can be used for the assessment of the existence of parental structures within a community or as taxonomic indicators. The non-metric traits are categorised into three types: foraminal, hyperostotic/ hypoostotic and fusion. In the mandible the mylohyoid bridge is a hyperostotic variant where the mylohyoid groove becomes variably ossified. The occurrence of this trait, independent of sex, is consistent with the assumption that genetic background is relevant to its formation. **AIM & OBJECTIVE:** The study was planned to investigate the incidence and types of mylohyoid bridging in the mandibles of Uttarakhand region. The data may be useful for the anthropologists, and its clinical implications may guide the dental surgeons in nerve block injections. **MATERIAL AND METHOD:** A collection of 69 male and 52 female mandibles (total samples = 121), available in the department of Anatomy at Sri Guru Ram Rai Institute of Medical & Health Sciences, Dehradun, Uttarakhand were used as the material for the study. **ANALYTICAL TEST:** Fisher's exact probability test. **RESULT:** Neither total nor superior and inferior type of mylohyoid bridging was observed in any mandible included in the present study. Only distal-partial, proximal-trace and trace type of bridging was found. Only 9 mandibles showed the presence of mylohyoid bridging (9/121; 7.43%). Bilateral bridging was found in 5 mandibles and 4 had unilateral incidence of mylohyoid bridging [3 (1.24% of the total 242 sides examined) on left side in male mandibles and 1 (0.41%) on right side in female mandible. **CONCLUSION:** The presence of mylohyoid bridging can be used for the assessment of the existence of parental structures within a community or as a taxonomic indicator. Clinically, the entrapment of the nerve to mylohyoid may lead to poorly localized deep pain from the muscles it innervates. Moreover, the nerve may also escape the local anaesthesia which may be overcome by other recent techniques of nerve block. **KEYWORDS:** Non-metrical traits, hyperostotic, taxonomic indicators, mylohyoid bridging.

INTRODUCTION: Mandible is the largest and strongest bone of the facial skeleton and is preferentially preserved in archaeological and paleontological deposits. Furthermore, this bone has provided useful information in studies of sexual dimorphism, geographical variations and evolutionary changes in the morphology.

The expression of non-metric traits is more influenced by the genetic factors as compared to non-genetic factors. Therefore, in anthropological and paleo-anthropological studies, the evaluation of non-metrical traits of mandible can be used for the assessment of the existence of parental structures within a community or as taxonomic indicators. (1) The non-metric traits are categorised into three types: foraminal, hyperostotic/hypostotic and fusion. (2) The hyperostotic traits represent variable ossification of connective tissue, which separates or encloses nerve fibers and vessels. (3) In the mandible the mylohyoid bridge is a hyperostotic variant where the mylohyoid groove becomes variably ossified. (4-6) This variant has been otherwise referred to using several terms such as ponticulus mylohyoideus, canalis mylohyoideus, mylohyoid arch and arcus mylohyoideus. (7-10)

Ossenberg (4) suggests that the precursor of this bridge is a membrane continuous proximally with the sphenomandibular ligament and stretching the ligament of the mylohyoid groove medial to the contained neurovascular structures. According to the investigator, this membrane and its bony variant may be derived from Meckel's cartilage.

Mylohyoid groove, beginning antero-inferior to the mandibular foramen and containing the neurovascular bundle, is normally closed over to become a connective tissue canal, which is the extension of the sphenomandibular ligament attached to the lingula. Either or both parts of this tissue may become partially or completely transformed into bone, forming bridges or an elongated canal, which may extend above the foramen. (11)

Mylohyoid bridging is classified by Hauser and De Stefano (10) according to:

1. Location of bridging

- a) Proximal = in the vicinity of the mandibular foramen.
- b) Distal = approximately at the centre of the mylohyoid groove.
- c) Superior and Inferior = interrupted canal formation, appearing as two separate bridges.

2. Degree of bridging

- a) Trace = formation of two spicules or lipping protruding from the edges of the mylohyoid groove.
- b) Partial bridging.
- c) Total bridging of the mylohyoid groove.

We planned this study to investigate the incidence and types of mylohyoid bridging in the mandibles of Uttarakhand region; at the same time a note was made to its clinical implications along with a comparison to the incidences of mylohyoid bridging in different Indian populations.

MATERIAL AND METHODS: The material for this study consisted of a collection of 69 male and 52 female mandibles (total samples = 121), available in the department of Anatomy at Sri Guru Ram Rai Institute of Medical & Health Sciences, Dehradun, Uttarakhand.

Sex determination of mandibles was done according to the following criteria:

	MALE	FEMALE
1) Gonial eversion	- Marked	Slight/absent
2) Chin	- Square	Pointed/rounded
3) Robustness	- Larger, broader Thicker, heavier	Slender, smaller

All were adult mandibles, the exact ages of which were unknown. Both the medial surfaces of each mandible were inspected for the presence of the bony bridges along the mylohyoid groove.

Fisher's exact probability test was applied to the sex related incidences of mylohyoid bridging in the test samples, with the level of significance set at $p < 0.05$. Data obtained from the mandibles were evaluated using GraphPad Prism version 5.00 for Windows, GraphPad Software, San Diego California USA, www.graphpad.com.

A comparison of the present results was made with the incidences of mylohyoid bridging reported by earlier authors in different Indian populations.

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RESULTS: Altogether 121 mandibles were examined for the presence of mylohyoid bridging on both the sides, out of which 101 mandibles were dentulous and rest were edentulous.

According to the classification cited above, neither total nor superior and inferior type of mylohyoid bridging was observed in any mandible included in the present study. Only distal-partial (fig. 1), proximal-trace (fig. 2) and trace (fig. 3) type of bridging was found. The proximal type is just the extension of the sphenomandibular ligament, as is apparent by the ossified backward projection of the lingula (fig. 4).

Only 9 mandibles showed the presence of mylohyoid bridging (9/121; 7.43%) (table.1). Bilateral bridging was found in 5 mandibles and 4 had unilateral incidence of mylohyoid bridging [3 (1.24% of the total 242 sides examined) on left side in male mandibles and 1 (0.41%) on right side in female mandible (fig. 5)].

FIGURE 5: Side distribution of incidences of mylohyoid bridging in male and female mandibles.

Sex	Presence	Absence	Row Total	Percentage
males	06	63	69	8.69%
females	03	49	52	5.76%
Column Total	09	112	121	7.43%

Table 1: The incidence of mylohyoid bridging according to sex

In respect to the incidence of mylohyoid bridging in relation to sex, the results indicated that the difference between male and female mandibles is statistically not significant as $P < .05$.

DISCUSSION: The mylohyoid bridge, a hyperostotic variant is formed under some genetic background and is one of the useful genetic markers for researching populational relationships. (12) However, certain reports disagree to this concept. (13) Mechanical forces too are believed to take part in the formation of mylohyoid bridging. (14)

The results of the present study indicate that the incidence of mylohyoid bridging did not show any sex difference. The occurrence of the trait, independent of sex, is consistent with the assumption that genetic background is relevant to its formation. (12) Though, slight male predominance in the incidence was noted by Ossenberg (9) and Dodo (15) while Sawyer et al. (5) distinctly reported a predominance of females in Euro-Americans. However, non-metrical traits, on the whole did not diverge (or very little if at all) on the account of sex as reported by several researchers. (16-18)

Contrary to the results of K. Narayana et al. (19), mylohyoid bridge seems to be expressed more on the left side than on the right in the present study. Though, there was statistically no significant difference ($P < .05$) between frequencies on sides.

Total bridging of the mylohyoid groove is rarely found as indicated by the results of this study, although this trait has been reported in some mandibles in earlier studies. (20) The incidence reported by Kaul, S.S. and Pathak, R.K. (6) in north Indian sample (2.98–7.14%) and Narayana, K. (19) in Indians (pooled) coincides with the results of the present study (table. 2). However, the total incidence of 7.43% as found in this study is less than that in another study on north Indians (8.63%). (20) Differences in the incidence of mylohyoid bridging may be due to variations related to era, climate, diet, geography, or race, as non-metrical variants are known to depend on these factors. (21, 22)

Population	Incidence of mylohyoid bridging	Percentage	Reference no.
North Indians		8.63	20
North east Indians		2.98–7.14	6
South Indians		6.39	Manjunath, K.Y. (23)
Indians		7.20	19
Uttarakhand population		7.43	Present study

Table 2: Percentage incidences of mylohyoid bridging in various Indian populations.

As the mylohyoid nerve passes through the tunnel formed by the mylohyoid bridge, it may be unusually entrapped against the bone, imparting poorly localized deep pain from the muscles it innervates. Chronic compression of the nerve results in muscular paresis. This symptom would be subclinical unless the nerve entrapment is bilateral; then swallowing difficulties may ensue. (24) Due to the variability in location of branching and the potential barriers formed by both the pterygomandibular fascia and the sphenomandibular ligament, the nerve to the mylohyoid may escape anaesthesia in an inferior alveolar nerve block. (25) The failed local anaesthesia may be overcome either by high block (Gow- Gates or Akinosi techniques) or by lingual infiltration. (26) The Gow-Gates and Akinosi methods are best reserved for those cases where the conventional block methods fail.

In conclusion, the total type of mylohyoid bridging is not commonly found in the mandibles of Uttarakhand region. The relevance of genetic background in its formation confers that this trait can be used for the assessment of the existence of parental structures within a community or as a taxonomic indicator. Clinically, the unusual entrapment of the nerve to mylohyoid against the bone may lead to poorly localized deep pain from the muscles it innervates. Moreover, the nerve may also escape the local anaesthesia which may be overcome by other recent techniques of nerve block.

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REFERENCES

1. Kaur J., Choudhry R., Raheja S., Dhisra N.C. Non metric traits of the skull and their role in anthropological studies. *J. Morphol. Sci.* 2012; 29 (4): 189-194.
2. Griffin, Mark C. Morphological variation of the late pre-contact and contact period guala [PhD thesis]. West Lafayette, Indiana: Purdue University; 1993 [cited August, 1993]. Available from: <http://docs.lib.purdue.edu/dissertations/AAI9403700>.
3. Kulkarni Vasudha. Study of Metrical and Non metrical traits of skull of south Indian population [M.D. thesis]. Bangalore, Karnataka: Rajiv Gandhi University of Health Sciences; 2010 [cited April, 2010]. Available from: [http://119.82.96.198:8080/jspui/bitstream/123456789/5706/1/Kulkarni Vasudha.pdf](http://119.82.96.198:8080/jspui/bitstream/123456789/5706/1/Kulkarni%20Vasudha.pdf).
4. Ossenberg N.S. The mylohyoid bridge: an anomalous derivative of Meckel's cartilage. *Journal of Dental Research.* 1974; 53: 77-82.
5. Sawyer D.R., Allison M.J., Elzay R.P., and Pezzia A. The mylohyoid bridge of Pre-Columbian Peruvians. *American Journal of Physical Anthropology.* 1978; 48: 9-16.
6. Kaul S.S., Pathak R.K. The mylohyoid bridge in four population samples from India, with observations on its suitability as a genetic marker. *American Journal of Physical Anthropology.* 1984; 65: 213-218.
7. Hasebe K. Canalis mylohyoideus. *Tohoku Igaku Zasshi.* 1916; 1: 224.
8. Laughlin W.S., Jorgensen J.B. Isolate variation in Greenlandic Eskimo crania. *Acta Genetica et Statistica Medica.* 1956; 6: 3-12.
9. Ossenberg N.S. Discontinuous Morphological Variation in the Human Cranium [PhD thesis]. Ottawa: National Library of Canada, University of Toronto. 1969. Available from: Smithsonian Institution Libraries.
10. Hauser G., De Stefano G. F. Epigenetic Variants of the Human Skull. *Schweizerbart, Stuttgart;* 1989.
11. Scheuer L., Black S., Christie A. Developmental juvenile osteology. London: Academic Press; 2000. P. 599.
12. Kentaro Jidoi, Takashi Nara, and Yukio Dodo. Bony Bridging of the Mylohyoid Groove of the Human Mandible. *Anthropological Science.* 2000; 108 (4): 345-370.

13. Lundy J.K. The mylohyoid bridge in the Khoisan of Southern Africa and its unsuitability as a mongoloid genetic marker. *American Journal of Physical Anthropology*. 1980; 53: 43–48.
14. Trinkaus E. Bilateral asymmetry of human skeletal non-metric traits. *American Journal of Physical Anthropology*. 1978; 49: 315–318.
15. Dodo Y. Non-metrical cranial traits in the Hokkaido Ainu and the northern Japanese of recent times. *Journal of the Anthropological Society of Nippon*. 1974; 82: 31–51.
16. Berry A.C., Berry R.J. Epigenetic variation in the human cranium. *J. Anat.* 1967; 101: 361–379.
17. Corruccini R. An examination of the meaning of cranial discrete traits for human skeletal biological studies. *American Journal of Physical Anthropology*. 1974; 40: 425–446.
18. Hanihara T., Ishida H., Dodo Y. Characterization of biological diversity through analysis of discrete cranial traits. *American Journal of Physical Anthropology*. 2003; 121: 241–251.
19. Narayana K., Narayan P., Ashwin K., Prabhu L.V. Incidence, types and clinical implications of a non-metrical variant - mylohyoid bridging in human mandibles. *Folia Morphol.* 2007; 66 (1): 20–24.
20. Gopinathan K., Chhabra S., Dhall U. Mylohyoid bridging in north Indian population. *J Anat Soc India*. 1995; 44: 110–125.
21. Hanihara T., Ishida H. Frequency variations of discrete cranial traits in major human populations. III. Hyperostotic variations. *J Anat.* 2001; 199: 251–272.
22. Turan-Ozdemir S., Sendemir E. Incidence of mylohyoid bridging in 13th century Byzantine mandibles. *Anat Sci Int.* 2006; 81: 126–129.
23. Manjunath K.Y. Mylohyoid bridging in south Indian mandibles. *Indian J Dental Res.* 2003; 14: 206–209.
24. Loughner B.A., Larkin L.H., Mahan P.E. Nerve entrapment in the lateral pterygoid muscle. *Oral Surg Oral Med Oral Pathol.* 1990; 69: 299–306.
25. Pamela Stein, Jennifer Brueckner, Matthew Milliner. Sensory innervation of mandibular teeth by the nerve to the mylohyoid: Implications in local anesthesia. *Clinical Anatomy*. 2007; 20 (6): 591–595.
26. Meechan J. G. How to overcome failed local anaesthesia. *British Dental Journal*. 1999; 186 (1): 15–20.

FIGURE.1: Distal-partial type of mylohyoid bridging with probe passing through the tunnel.

FIGURE.2: Proximal-trace type of mylohyoid bridging.

FIGURE.3: Trace type of mylohyoid bridging.

FIGURE.4: Ossified backward projection of the lingula.

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