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Gross morphological study on teeth of Mehsana buffalo (*Bubalus bubalis*): The incisor teeth

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Abstract

The present study on gross morphology of incisor teeth was carried out on 12 skulls of Mehsana buffalo. Among these, 6 skulls had all deciduous incisors and other 6 had all permanent incisors. All incisors were observed for gross morphological features in intact skull and after sculpturing them from the skulls. There were four pairs of incisors placed obliquely in the body of mandible. In the upper jaw, incisors were found to be absent. The incisors consisted a crown, a neck and a root. All incisor teeth of buffalo were found to be brachydont type. The crown of permanent incisors was shovel shaped with slight lateral extension. The labial surface was convex, smooth and extended more distally. Both these surfaces united dorsally and formed sharp incisor border. The crown tapered towards the root and formed the distinct neck. The root was thicker and cylindrically tapering. The crowns of first to third incisors were almost similar in size. The first incisor was relatively straight. The curvature of root increased towards lateral side from second to fourth incisor. All the four deciduous incisors were almost similar in resemblance but smaller than respective permanent ones. The roots were relatively thinner and much longer in the deciduous incisors. The lateral curvature increased from first to fourth incisors. The crown size was decreased from first to fourth. In young animals, the deciduous incisors were crowded and their crowns were found overlapped.

Keywords: Incisors, permanent, deciduous, buffalo, gross morphology

1. Introduction

Amongst, all the domestic animals, the ruminants play an important role in the world economy. In India, buffalo farming is an important component of the livestock industry and contributes more than 50 million tons of milk and 1.43 million tons of meat in addition to high valued hides, bones and draft power for agricultural operations (CCARI, 2024) [1]. In comparison to other herbivores, domestic ruminants have a distinct digestive tract which is especially well adapted for conversion of grass to animal protein (St. Clair, 1975) [2]. The teeth are accessory digestive organ. Since teeth are the hardest and most chemically stable tissue in the animal body, they are important materials for anthropological, genetic, odontologic, and forensic investigations on both living and non-living population (Sten, 2004; Singh, 2017) [3, 4]. Under classification, the dentition of domestic ruminants is considered as thecodont, heterodont, and diphyodont type. The teeth of domestic animals develop differently in each region of the mouth according to their use and are grouped into incisors, canines, premolars and molars (Nickel *et al.*, 1986; Singh, 2017; Koing and Liebich, 2020) [4, 5, 6]. The basic permanent dental formula of primitive placental mammals is: 2 (I-0/4, C-1/1, P-4/4, M-3/3) = 44 (Young, 1962) [7]. In contrast to other herbivores, the domestic ruminants do not present incisors in their upper jaw, instead they have dental pad. Incisor eruption occurs in a distinct pattern over time and provides information about the approximate age of domestic ruminants (St. Clair, 1975; Nickel *et al.*, 1986; Singh, 2017; Koing and Liebich, 2020) [2, 4, 5, 6]. The incisors in domestic ruminants are normally designated from medial to lateral as first or central (I-1), second or first intermediate (I-2), third or second intermediate (I-3), fourth or corner incisors (I-4) (Koing and Liebich, 2020) [5]. Extensive research has been conducted on the dentition of major domestic ruminants and well documented in standard veterinary anatomy books (Raghavan, 1964; St. Clair, 1975; Nickel *et al.*, 1986; Singh, 2017; Koing and Liebich,

2020) [2, 4, 5, 6, 8], though very scanty literature is available on buffalo teeth (Fuller, 1959; Rollinson, 1974; Patel *et al.*, 2009; Singh *et al.*, 2017) [9, 10, 11, 12]. Hence, the present study has been planned to elucidate the gross morphologic facts of incisors in Mehsana buffalo.

2. Materials and Methods

The present gross morphologic study on incisor teeth was carried out on 12 skulls of female Mehsana buffaloes, collected from surrounding villages. Among these, six skulls of young animals had complete set of deciduous incisors and other six skulls of adult animals had complete set of permanent incisors. First, all incisors were observed for gross morphological features in intact skull. Afterward, incisive portion of mandibles of these skulls were sculptured by chisel, hammer, and electric saw machine to open alveolar sockets of incisors. The complete set of deciduous and permanent incisor teeth of each mandible was removed from alveolar sockets and arranged in serial order. The incisors, in the present study, were designated from medial to lateral as first, second, third, fourth incisors; and symbolized as I-1, I-2, I-3, I-4 and Di-1, Di-2, Di-3, Di-4 for permanent and deciduous dentitions, respectively. Each incisor tooth was examined for detail gross morphological features.

3. Results

Each deciduous and permanent incisor tooth of 12 Mehsana buffalo was gross morphologically observed in its entirety. The Mehsana buffalo had total eight incisors, four incisors in each left and right quadrant of lower jaw in permanent and deciduous dentition.

3.1 Permanent incisor teeth

From dorsoventral view, lingual faces of permanent incisors were visible. In this view, all four pairs of permanent incisors were placed obliquely in the incisive portion of mandible and formed curved crescent shaped arrangement. In the upper jaw, there were no incisors, instead there was dental pad. Each incisor consisted relatively shorter crown, longer root and distinct neck. The crown of all incisors was projected above the alveolar socket and found externally covered with enamel; whereas root found relatively loose within their alveolar sockets and found externally covered with cementum. The crowns of all permanent incisors were spatula shaped. The labial surface was convex, smooth and extended more distally towards root. The lingual surface was found slightly concave with small ridges. Both, lingual and labial surfaces met rostro-dorsally and formed sharp shovel shaped incisor border. The lingual surface of crown near the incisor border cameformed occlusal surface against dental pad. Because of continuous attrition of enamel at occlusal surface, dentin found exposed. The crowns of first to third incisors were almost similar in size. The fourth incisor had relatively smaller crown than first, second and third permanent incisors. The crown of permanent incisors tapered towards the root and formed the distinct neck. The permanent incisors had only a single, simple, thicker and cylindrically tapering, cone-shaped root. From dorsoventral view, the root of first incisor was observed relatively straight. The curvature of root increased towards lateral side from second to fourth incisors. The overall size of permanent incisors decreased from first to fourth incisors (Fig. 1-B & 2-B). It was observed that morphological features of fourth incisor, which was canine of primitive placental mammals, were almost similar to first three incisors and it was also found evolutionary migrated mesially and placed

very close to the third incisors in mandible. All the permanent incisor teeth of buffalo were simple and did not show units, infundibulum and complex enamel folds; and were of brachydont type.

3.2 Deciduous incisor teeth

All the four deciduous incisors were almost similar in resemblance but found smaller than respective permanent ones. The crowns of all deciduous incisors were asymmetrical spatula shaped with slight lateral extension. The roots were relatively thinner and much longer in deciduous than permanent incisors. The lateral curvature of root increased from first to fourth deciduous incisors. The crown size of deciduous incisors was observed decreasing from first to fourth (Fig. 1-A & 2-A). The deciduous incisors of young animals were found to be packed and appeared overlapping on to the lingual surface of their mesial neighbour tooth.

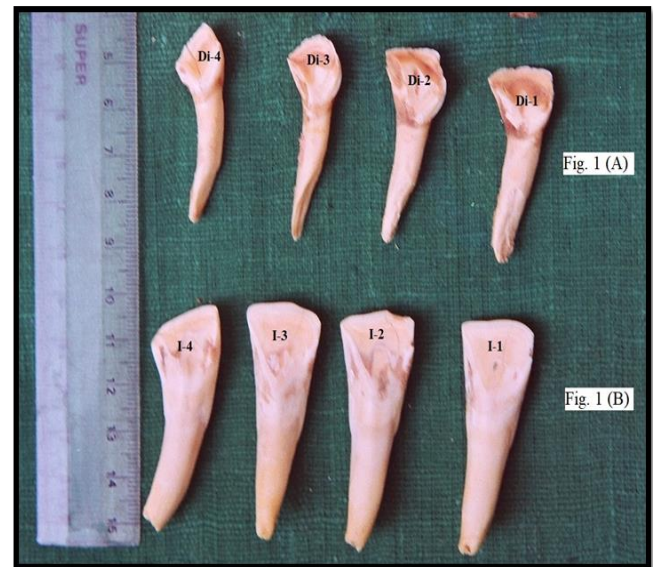


Fig 1: Photograph of isolated all four right Deciduous (A) and Permanent (B) incisors of Mehsana buffalo (Lingual View) showing gross morphology and comparison. Di = Deciduous incisor; P = Permanent incisor



Fig 2: Photograph of isolated all four right Deciduous (A) and Permanent (B) incisors of Mehsana buffalo (Labial View) showing gross morphology and comparison. Di = Deciduous incisor; P = Permanent incisor

4. Discussion

In the present study, skulls of Mehsana buffalo had total eight incisors; four incisors in each quadrant of lower jaw. The canine of primitive placental mammals, in the present study on Mehsana buffalo, found evolutionary migrated very close to the incisor position and took morphological shape and function like other incisors. Hence, the authors suggest to consider this tooth as fourth incisor which corroborated to the description for incisors in other domestic ruminants (St. Clair, 1975; Nickel *et al.*, 1986; Koing and Liebich, 2020; Singh, 2017) [2, 4, 5, 6]. In agreement to present findings, Rollinson (1974) [10] for all species of domestic water buffalo; Fuller (1959) [9] for American wild buffalo (*Bison bison*) mentioned all four anterior teeth as incisors in dental formulae. In contrary, St. Clair (1975) [2] had considered fourth incisor as canine in dental formulae of domestic ruminants; however, he described fourth incisor along with incisor group because of similar functional anatomy. The gross morphological features of deciduous and permanent incisors of Mehsana buffalo observed in the present study were in close accordance to the earlier report on incisors of buffalo (Singh, 2017) [4]. The present gross morphological findings on incisors of buffalo were essentially similar to those of cattle (Garlic, 1954; Brown, *et al.*, 1960, Nickel *et al.*, 1986; St. Clair, 1975; Singh, 2017; Koing and Liebich, 2020) [2, 4, 5, 6, 13, 14]. Supporting to the present observations, Fuller (1959) [9] and Rollinson (1974) [10] stated that morphological features of buffalo teeth were at par with of cattle. Rollinson (1975) [10] opined that teeth of domestic water buffalo are strongly developed than those of ox.

5. Conclusions

There were four pairs of incisors placed obliquely in the body of mandible. The incisors consisted of a crown, a neck and a root. All incisor teeth of buffalo were brachydont type. The permanent incisors had shovel shaped crown and tapering cylindrical root. The first incisor was relatively straight. The curvature of roots increased towards lateral side from second to fourth incisors. All the four deciduous incisors were almost similar in resemblance but smaller than respective permanent ones. The roots were relatively thinner and much longer in deciduous incisors. The lateral curvature increased from first to fourth incisors. The basic gross morphological information generated on incisors of Mehsana buffalo will be useful for veterinary clinical practice and further research regarding involvement of method of age determination from wearing pattern of incisors in Mehsana buffalo.

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7. Conflict of Interest

Not available

8. Financial Support

Not available

8. References

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