MORPHOLOGICAL AND DIGITAL RADIOGRAPHICAL DENTAL ANATOMY OF ADULT BUFFALOES

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ABSTRACT

Gross and radiographic anatomical study of the dental arch of buffalo revealed deeply and firmly anchored 6 incisors, 1 canine, 3 premolars and 3 molar in lower jaw and 3 premolar and 3 molar in the upper jaw. The morphometric and radiographic measurement of the crown length, root length, and total root length of the incisor and cheek tooth were observed. The length of root was 0.8 times than that of the crown for the incisor. The crown length, root length and total tooth length of the maxillary teeth was constantly more than that of the mandibular cheek tooth. The morphometric measurement of the crown length, root length and total tooth length were non-significantly higher than the radiographic measurement except second premolar of lower jaw and first premolar of upper jaw which was significantly differ at ($P \leq 0.05$).

Keyword: buffaloes, *Bubalus bubalis*, crown length, root length, total tooth length, dental anatomy

INTRODUCTION

A large number of clinical studies analyzed the importance of tooth size in the development of occlusion or malocclusion. Because the variability in tooth size, as a consequence of the interrelationship between biological variables, these studies have focused on the size of permanent teeth. Haws (2010) reported that the role of radiology in dentistry continuously expands with the advance of imaging technology. In recent years, with digitization of radiographic image many software applications were coded by different commercial company to execute radiology investigation and manipulate the radiographic images. This provides an alternative of imaging other than conventional radiography.

Lozano *et al.* (2002) observed the development of diagnostic imaging techniques in dentistry has been of fundamental importance. Ingle (2002) reported the application of such techniques in endodontic allows the definition of root canal morphology as well the determination of endodontic working length. Anthony (2014) reported that the oral dental radiology is fundamental to the practice of veterinary dentistry. Radiographs show pathologic lesion or foreign bodies that cannot be identified by any other way and assist the localization of these objects.

St. Clair (1975) reported that the teeth are known to be unique organ made of the most enduring mineralized tissue in the human body.

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Teeth, being the hardest and chemically most stable tissue in the body are an excellent material in the living and non-living populations for anthropological, genetic, odontologic and forensic investigation.

Radiographic determination of tooth length is one of the critical aspects of pulpectomy in primary teeth because minor degrees of resorption may not be obvious radiographically and an underling permanent tooth germ can cause image superimposition. Consequently, the root apex is not clearly identified Mente *et al.* (2002). Hence the present study was undertaken to provide the basic data for bubaline teeth anatomy and its clinical significance.

MATERIALS AND METHODS

Source of specimen

A total number of 10 Cadaver (same size and weight) of adult buffaloes heads were collected from abattoir or from hospital casualty all the measurements were done in the Department of Surgery and Radiology, College of Veterinary Sciences and Animal Husbandry Mathura.

Morphometric measurement

The morphometric measurement of the crown length, root length and total tooth length were measured by using a Vernier calipers to the nearest 0.5 mm, needle point divider and scale.

The measurements included:

1. The crown length (CL): It was recorded from the center of the cervical margin to the highest points of the crown

2. Root length (RL): It was recorded from the center of the cervical margin to the highest points of the root.

3. Total tooth length (TTL): It was measured between the highest points of the crown and root along the center of the cervical margin.

Radiographic measurement

The radiographs of maxilla and mandible (separately) were taken using a portable X ray machine with technique setting of 82 Kvp and 14 mAs using 14 "X17" digital X ray phosphor plate. Image thus captured was digitized using CR system (Konica Regius 110). The X ray cassette was kept below the maxilla and mandible for radiographic images and a minimum of two radiographic projection (view) were made like lateral view and oblique view.

Statistical analysis

All the parameters like crown height, root length, and total tooth length were recorded in centimeters (cm) by using computer software. The data generated by biometrical observations were subjected to statistical analysis (Snedecor and Cochran, 1967) with the help of SPSS 17.0 software.

RESULTS AND DISCUSSION

Gross and radiographic anatomical study of the dental arch of buffalo revealed deeply and firmly anchored 6 incisors, 1 canine, 3 premolars and 3 molar in lower jaw and 3 premolar and 3 molar in the upper jaw. The permanent dental formula of buffalo was incisor 0/3, C=0/1, PM=3/3, M=3/3 as described by Raghavan (1964).

Incisor

A total of 6 simple incisors were embedded in the lower jaw. The dental pad was present against

these incisors in the upper jaw are in agreement with St. Clair (1975) in for cattle and Archana *et al.* (2000) for yak. The morphometric mean of the crown length, root length and total tooth length were 1.98±0.01, 2.4±0.11 and 4.42±0.23 cm (Figure 7) where as the mean values for the radiographic measurement were 2.05±0.09, 2.35±0.15 and 4.49±0.24 cm (Table 2, Figure 8). There was non-significant difference between the morphometric and radiographic measurements. In the buffalo, the roots were rounded and curved and 0.82 times as long as crown in the present study whereas in Ox it was one and half times as long as crown St. Clair (1975) and in Yak 2 times Archana *et al*. (2000). Thus the incisor of buffaloes is less deeply and firmly anchored in the alveolus than cattle. So root does not fit tightly in the alveolus allowed the tooth a small movement similar observation was made by St. Clair (1975) in ox. In buffaloes the root of Incisor was straight and gradually increasing curvature was noticed as the corner incisor was approached similar observations were made by St. Clair (1975). In contrast in Yak Archana *et al.* (2000) reported that the root of the incisors appeared curved. There curvature increased from I_1 to I_3. The root of the corner incisor looked almost straight. The shovel shaped crowns were marked by a distinct neck and round blunt pointed root embedded in to the respective alveoli similar to Archana *et al.* (2000) in Yak and St. Clair (1975) in ox. The medial edge of each tooth was slightly overlapped at the lingual surface of the tooth. The teeth decreased in size from number one to four and alveoli became shallower. Similar observations were made by St. Clair (1975) in ox.

Cheek tooth (premolar and molar)

The total 6 cheek tooth (3 premolar and 3 molar) occurred on either side in the upper jaw (maxilla) or lower jaw (mandible).

Crown length

In the upper jaw, the morphometric mean value of the crown length of the premolar (PM) and molar (M) were PM_1 1.73±0.09, PM_2 2.05±0.1, PM_3 2.17±0.10, M_1 2.43±0.14, M_2 2.44±0.08 and M_3 2.38±0.08 cm respectively while radiographic mean±SE for the same was PM_1 2.05±0.23, PM_2 2.34±0.40, PM_3 2.49±0.38, M_1 2.83±0.46, M_2 2.82±0.23 and M_3 2.76±0.21 cm respectively. There was non-significant difference between the morphometric and radiographic mean value of crown length in the upper jaw (Table 1, Figure 1 and Figure 2).

Whereas in the lower jaw the morphometric mean value of crown length were PM_1 1.27±0.10, PM_2 1.59±0.07, MP_3 1.88±0.14, M_1 1.83±0.12, M_2 2.01±0.13 and M_3 2.04±0.14 while radiographic mean value for the same was PM_1 1.51±0.11, PM_2 1.91±0.08, PM_3 2.18±0.16, M_1 2.14±0.12, M_2 2.27±0.14 and M_3 2.32±0.15 cm respectively. There was non-significant difference between the morphometric and radiographic mean value of the crown length except PM_2 which differed significantly at ($P \leq 0.05$, Table 2). The crown length of upper jaw and lower jaw was gradually increased from PM_1 to M_1 while crown length of the M_2 and M_3 almost similar. A similar observation was made by St. Clair (1975) in ox.

Root length

In the upper jaw the morphometric mean value of the root length of the premolar and molar were PM_1 2.89±0.22, PM_2 2.93±0.18, PM_3 3.16±0.17, M_1 3.49±0.20, M_2 3.66±0.22 and M_3 4.02±0.21 while radiographic mean value for the same were PM_1 2.54±0.69, PM_2 2.69±0.54, PM_3 3.06±0.64, M_1 3.23±0.83, M_2 3.41±0.83 and M_3

Table 1. Morphometric and radiographic measurement of different tooth in the upper Jaw of buffaloes.

Crown length			Root length		Total tooth length		
Sr. No	**Teeth name**	**Morphometric**	**Radiographic**	**Morphometric**	**Radiographic**	**Morphometric**	**Radiographic**
1	C.I	……	……..	……	……	…….....	…….
2	PM1	1.73±0.09	2.05±0.23	2.89±0.22	2.54±0.69	4.61±0.24	4.59±0.74
3	PM2	2.05±0.11	2.34±0.40	2.93±0.18	2.69±0.54	4.98±0.19	5.03±0.55
4	PM3	2.17±0.10	2.49±0.38	3.16±0.17	3.06±0.64	5.38±0.20	5.55±0.74
5	M1	2.43±0.14	2.83±0.46	3.49±0.20	3.23±0.83	5.93±0.18	6.12±0.80
6	M2	2.44±0.08	2.82±0.23	3.66±0.22	3.41±0.83	6.09±0.21	6.23±0.79
7	M3	2.38±0.08	2.76±0.21	4.02±0.21	3.52±0.80	6.40±0.20	6.28±0.73

* Morphometric and radiographic value differ significantly at 0.05 % level of significance.

Table 2. Morphometric and radiographic measurement of different tooth in the lower Jaw of buffaloes

Crown length				Root length		Total tooth length	
Sr. No	**Teeth name**	**Morphometric**	**Radiographic**	**Morphometric**	**Radiographic**	**Morphometric**	**Radiographic**
1	C.I	1.98±0.11	2.05±0.09	2.4±0.11	2.35±0.15	4.42±0.23	4.49±0.24
2	PM1	1.27±0.10	1.51±0.11	2.20±0.11	1.81±0.12*	3.46±0.16	3.32±0.17
3	PM2	1.59±0.07	1.91±0.08*	2.59±0.15	2.41±0.14	4.18±0.16	4.32±0.15
4	PM3	1.88±0.14	2.18±0.16	2.99±0.09	2.79±0.10	4.87±0.18	4.97±0.18
5	M1	1.83±0.12	2.14±0.12	3.48±0.14	3.25±0.17	5.30±0.20	5.39±0.23
6	M2	2.01±0.13	2.27±0.14	3.79±0.17	3.74±0.27	5.79±0.23	6.03±0.32
7	M3	2.04±0.14	2.32±0.15	4.29±0.26	4.22±0.32	6.32±0.29	6.47±0.33

* Morphometric and radiographic value differ significantly at 0.05 % level of significance.

Figure 1. Morphometric measurement of crown length of upper jaw.

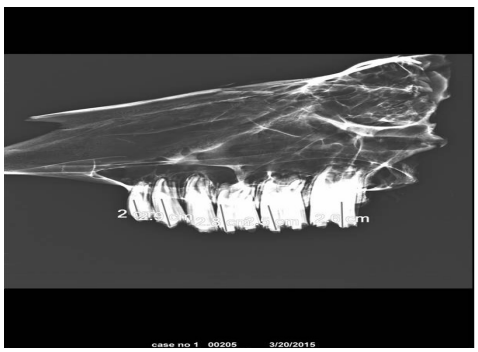

Figure 2. Radiographic measurement of crown length of cheek tooth in upper jaw.

Figure 3. Morphometric measurement of root length of cheek tooth in upper jaw.

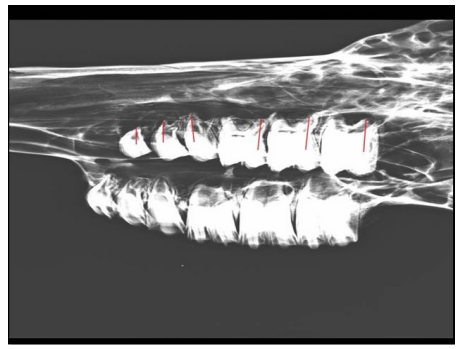

Figure 4. Radiographic measurement of root length of cheek tooth in upper jaw.

Figure 5. Morphomertic measurement of root length of cheek tooth lower jaw.

Figure 6. Radiographic measurement of root length of cheek tooth in lower jaw.

Figure 7. Morphomertic measurement of total tooth length of incisor in lower jaw.

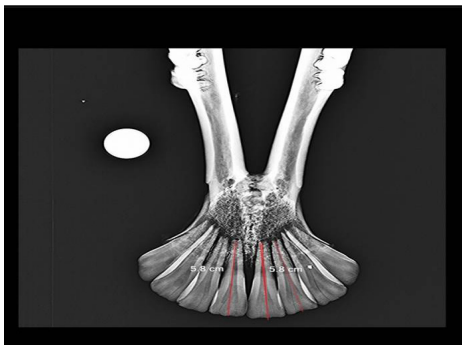

Figure 8. Radiographic measurement of total tooth length of incisor in lower jaw.

Figure 9. Morphometric measurement of total tooth length of cheek tooth in upper jaw.

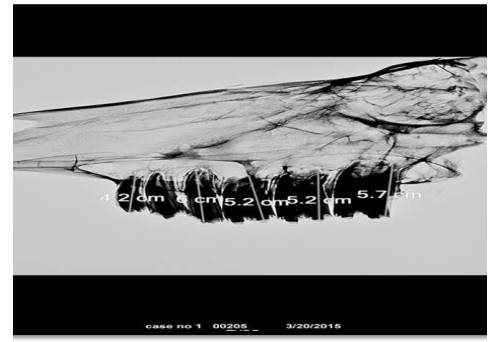

Figure 10. Radiographic measurement of total tooth length of cheek tooth in upper jaw.

Figure 11. Morphometric measurement of total tooth length of cheek tooth in lower jaw.

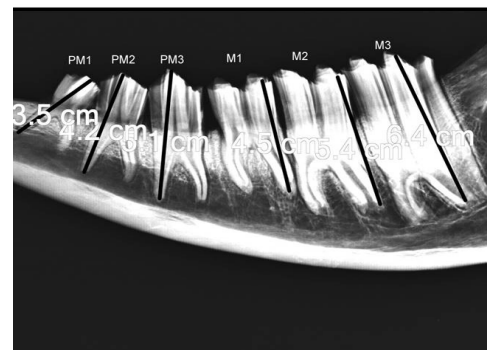

Figure 12. Radiographic measurement of total tooth length of cheek tooth in lower jaw.

3.52±0.80 cm respectively. The morphometric values of root length were higher than the radiographic mean value (Table 1, Figure 3 and Figure 4).

In the lower jaw, the morphometric mean values of the root length of the Premolar and Molar were PM_1 2.20±0.11, PM_2 2.59±0.15, PM_3 2.99±0.09 cm, M_1 3.48±0.14, M_2 3.79±0.17 and M_3 4.29±0.26, while radiographic mean value was PM_1 1.81±0.12, PM_2 2.41±0.14, PM_3 2.79±0.10 M_1 3.25±0.17, M_2 3.74±0.27 and M_3 4.22±0.32cm respectively. The morphometric mean value of root length of PM_1 was significantly higher than the radiographic mean values. (Table 2, Figure 5 and Figure 6).

Total tooth length

The morphometric mean value of total tooth length in the upper jaw were PM_1 4.61±0.24, PM_2 4.98±0.19, PM_3 5.38±0.20 and M_1 6.40±0.20, M_2 6.09±0.21, M_3 6.40±0.20 while radiographic mean value were PM_1 4.59±0.74, PM_2 5.03±0.55, PM_3 5.55±0.74 and M_1 6.12±0.80, M_2 6.23±0.79, M_3 6.28±0.73cm respectively. The morphometric mean values of total tooth length were non-significantly higher than the radiographic mean values. A similar observation was made by (St Clair, 1975) in ox. (Table 1, Figure 9 and Figure 10).

In the lower jaw, the morphometric mean values of total tooth length were PM_1 3.46±0.16, PM_2 4.18±0.16, PM_3 4.87±0.18 and M_1 5.30±0.20, M_2 5.79±0.23, M_3 6.32±0.29, while radiographic mean value were PM_1 3.32±0.17, PM_2 4.32±0.15, PM_3 4.97±0.18 and M_1 5.39±0.23, M_2 6.03±0.32, M_3 6.47±0.33 cm respectively. The morphometric values of total tooth length were non-significantly higher than radiographic mean values (Table 2, Figure 11 and Figure 12).

The PM_1 was smallest and PM_3 largest. The crown length of the upper molar was higher than premolar, the upper premolar and molar were resemble with lower one except they were narrow. In the upper jaw all the cheek tooth were embedded in the corresponding alveoli of the maxilla and in the lower jaw the root of the cheek tooth were embedded in the corresponding alveoli of the mandible. All the cheek tooth were snuggly fitted in the mandibular alveoli and surrounded by closely knitted meshes of the cancellous tissue.

The result showed no significant difference between the morphometric and radiographic mean suggesting that the morphometric measurement was effective in the assessment of tooth measurements. In cadaver specimens and radiographic measurements can be employed in clinical conditions for making comparisons. Admitting as clinically acceptable a 0.5 mm discrepancy between the morphometric and radiographic estimated measurement and it was could be due to radiographic magnification bias, positioning errors and directions.

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