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**THE TEETH OF THE LOWER JAW
IN DONKEY, BUFFALO AND CAMEL**
(With 2 Tables and 6 Figures)

By

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أسنان الفك السفلي في الحمار ، الجاموسة والجمال

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أجرى هذا البحث بهدف دراسة الصفات التشريحية لأسنان الفك السفلي في الحمار والجاموس والجمال كذلك دراسة علاقة هذه الأسنان بقناة الفك السفلي وعلاقتها أيضاً بالحافة السفلى للفك السفلي . وكانت جميع الحيوانات المستخدمة في البحث من كلا الجنسين وتتراوح أعمارها من ٦ - ٨ سنوات . وقد وجد أن القواطع في الحمار تحترق على سطح أطباتي. وهذا السطح يحل محله حافة حادة في الجاموسة وحافة كليلية في الجمل . وبين البحث في جميع الحيوانات تحت الدراسة أن جذور القواطع متقاربة ولكن درجة التقارب تكون في الجمل أكبر منها في الحمار والجاموسة بالإضافة إلى ذلك تبين أن القواطع تتناقص في الطول من القاطع رقم ١ في إتجاه القاطع رقم ٢ في الحمار وتزداد في نفس الإتجاه في الجمل . أما في الجاموسة فقد وجد أن القواطع الثلاث الأولى لها تقريبا نفس الطول . وأوضح البحث أيضاً أن أسنان الخد تزداد في الطول من الأمام إلى الخلف في الجاموس والجمال . أما في الحمار فقد وجد أن السن الطاحنة الرابعة هي أطول أسنان الخد . وتبين بصفة عامة أن جذور أسنان الخد تنتهي مباشرة فوق قناة الفك السفلي في الجمل وأتنتهي فوق القناة بمسافات مختلفة في الحمار ولكن في الجاموس فإن هذه الجذور تغطي السطح الخارجي للقناة أما جزئياً أو كلياً .

SUMMARY

In donkey the incisors have occlusal surfaces which are represented by sharp edges in buffalo and blunt edges in camel. In all examined species the roots of the incisors are convergent, but the degree of the convergence in camel is more than that in donkey and buffalo. The incisors decrease in length from number 1 to 3 in donkey but increase in camel. In buffalo the first three incisors are nearly equal in length. In buffalo and camel the cheek teeth increase in length and breadth from front to back. In donkey P4 is the longest cheek tooth. In gneral, the cheek teeth terminate proximal to the mandibular canal either directly in camel or by a variable distances in donkey. However, in buffalo the cheek teeth cover the lateral aspect of th canal either partially or completely.

INTRODUCTION

Diseases of the teeth are among the common problems in the clinic such as periodontitis, caries, pulpitis, polyodontitis and fracture of the teeth. In spite of this importance the available literature lack many informations about the anatomy of the teeth especially in donkey, buffalo and camel. Therefore, the aim of this work is to study the anatomical features of the teeth of th lower jaw in the aforementioned animals and also to give a good knowledge for the veterinarian concerning the radiograph of the cheek teeth and their relation with the venteral border of the mandible as well as the mandibular canal.

MATERIAL and METHODS

The present work was carried out on ten heads of donkey (*Equus asinus*) and eight heads of each buffalo (*Bubalus bubalis*) and camel (*Camelus dromedarius*). The examined animals are of both sexes and ranging from 6 to 8 years old. A latero-medial radiographs of one side of the mandible on four specimens of each species were performed. The bones of the mandible covering the vestibular surfaces of the teeth in all specimens were removed to study the relation between the teeth and the mandible as well as the mandibular canal, the teeth then were totally removed from the mandible to complete the other morphological studies.

RESULTS

Dentes incisivi :

The incisors in donkey and camel (Fig. 1) are three on each side which are known respectively, as central (11) intermediate (12) and corner (13) incisors. But that of buffalo are four in number which are named respectively, as central (11), first intermediate (12), second intermediate (13) and corner (14) incisors.

The crowns of the incisors are situated close together in donkey. In buffalo and camel each incisor tooth overlaps partially the tooth medial to it except the central incisors are placed close together at the midline.

The vestibular surface of the crown in donkey is convex in the longitudinal direction and flat in the transverse one. But in buffalo and camel this surface is convex in both directions. The lingual surface in donkey is nearly flat in the longitudinal direction and convex in the transverse one. In buffalo and camel this surface is concave in both directions, but the degree of concavity is more in the latter animal than in the former one.

The incisors of the donkey have occlusal surfaces which contain infundibula. However, in buffalo and camel these surfaces are replaced by a sharp edges in the former and blunt edges in the latter animal. Consequently the infundibula are not present in buffalo and camel.

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In all examined animals the roots of the incisors are single and directed caudally. In buffalo and camel they are nearly quadrilateral at their proximal half, rounded at the distal half and tapered towards their extremities. In donkey the roots are flattened mediolaterally.

The diastema in buffalo, donkey and camel measures 11.7, 8.2 and 4.7 cm respectively. Therefore the diastema is the longest in buffalo.

Table (1) and Fig. (5) indicate that the longest incisor tooth in donkey is the corner and in camel is the central. The incisors decrease in length from number 1 to 3 in donkey while increase in the same direction in camel. In buffalo the first three incisors are nearly equal in length and the fourth tooth is the shortest one. The length of the incisor teeth in camel, buffalo and donkey ranging between 5.8-8.2, 5.5-6.3 and 4.2-4.9 cm respectively. This result shows that the incisors of camel are longer than that of donkey and buffalo.

The ratio between the breadth of all the incisors at the crowns and at the roots is nearly 2:1 in donkey as well as buffalo and 3:1 in camel. This result explains that the roots of the incisors in all species under investigation are convergent, but the degree of convergence is more in camel than in donkey and buffalo. This is due to that the roots of the incisors are closely situated in camel and separated by small spaces in donkey and buffalo.

Canines :

The canines (Fig. 1) are present in donkey and camel but absent in buffalo. In camel they are present in both sexes but more developed in male than in female animals. In donkey the canines are developed in male and rudimentary in female animals.

In both donkey and camel the canine is a simple tooth without infundibulum. It lies about 2.5 cm rostral to the mental foramen in donkey and 3.5 rostral to the rostral mental foramen in camel. The root of the canine in donkey is rounded and strongly curved to direct caudally. In camel the root is nearly flattened mediolaterally and directed caudomedially.

The canine tooth divides the diastema into two unequal parts; a short rostral and a long caudal. In both animals the rostral part is located between the corners and the canines and about 0.8 cm in length. The caudal part in donkey is present between the canines and second premolars and is 7.4 cm in length, however, in camel it lies between the canines and the first premolars and is 3.9 cm in length.

The total length of the canines in donkey is 3.3 cm with 1.4 cm crown length and 1.9 cm root length. In camel the total length is 5.0 cm with 1.1 cm crown length and 3.9 cm root length. It is found that the canines are shorter than the incisors in both donkey and camel.

Dentes premolares and molares :

In donkey and buffalo (Figs. 1-4) the first premolar is absent, therefore the premolars are three in number; P2, P3 and P4. The camel (Figs. 1,4) has two premolars; P1 and P4 because the P2 and P3 are absent. But in one out of eight examined cases of camel a remnant of the P3 was observed. The number of the molar teeth in all investigated species is three; M1, M2 and M3.

The first premolar in camel is a simple tooth and is generally the smallest one in the lower jaw. It lies directly caudal to the rostral mental foramen and is separated from the rostrally located canines by 3.9 cm and from the caudally situated P4 by 7.3 cm. The first premolar is similar in shape to the canine but smaller than it.

The occlusal surface of the cheek teeth in donkey is oblique, sloping upward and inward from the vestibular border, thus the lingual border is prominent. This feature is only observed in the molars of camel and buffalo.

In donkey the occlusal surfaces of the cheek teeth are rectangular in outline except that of the P2 and M3. The surfaces of the latter teeth are nearly triangular in shape and the base is directed caudally in P2 and rostrally in M3. In case of camel the occlusal surfaces of the molars are irregular, that of P1 is pointed and of P4 is nearly triangular in shape with caudally directed base. The cheek teeth in buffalo have an irregular occlusal surfaces except P2 shows a mediolaterally flattened surface.

In donkey each cheek tooth has two infundibula except M3 three. In camel and buffalo each molar tooth has two infundibula except M3 in the former animal possesses an additional small infundibulum. In the premolars of buffalo and P1 in camel the infundibula are not found but P4 in the latter animal shows a small infundibulum.

In donkey and buffalo each cheek tooth has two roots except M3 three. A similar condition is found in camel except P1 has only one root. The roots of molars in all examined species are directed ventrally and caudally in a gradually increasing obliquity. But the direction of the roots of the premolars differs in the different examined species. In donkey the roots of P2 are vertically directed but that of P3 and P4 are directed ventrally and slightly caudally. In buffalo the roots of the P2 and P3 are directed ventrally and rostrally but that of P4 are directed ventrally and slightly caudally. In camel the root of P1 is directed ventrally and caudally and those of P4 are directed vertically.

Concerning the termination of the roots of the cheek teeth in relation to the mandibular canal. It is found that in donkey all the cheek teeth are terminated proximal to the canal by a variable distances; 1.0, 1.1, 0.5, 1.0, 1.5 and 2.6 cm for the P2, P3, P4, M1, M2 and M3 respectively. In buffalo, except P2, the roots of the cheek teeth cover the lateral aspect of the mandibular canal either partially in case of P3 and molars or completely in case of P4 (Fig. 3). The P2 in buffalo

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ends directly proximal to the canal. in camel (Fig. 4) all the cheek teeth terminate directly proximal to the mandibular canal except the P4 ends about 0.5 cm proximal to the canal.

From the clinical point of view, the distances between the termination of the roots of the cheek teeth and the ventral border of the mandible (Table 2) is important especially during the extirpation of the teeth. It is observed that these distances in donkey are relatively larger than in camel and buffalo and are ranging between 2.4-5.0, 0.3-0.8 and 0.4-1.4 cm respectively.

In buffalo and camel the cheek teeth increase in length and breadth from front to back as shown in Table (2) and Figs. (5, 6). The longest and the broadest tooth in both animals is M3, but the shortest and the narrowest tooth in buffalo is P2 and in camel is P1. In general, the cheek teeth in buffalo are longer but narrower than the corresponding ones of camel. In donkey the longest cheek tooth is P4 and the shortest is P3.

Table (1)

Showing some measurements on the incisors in the different examined animals (in cm).

The name of the animal	Donkey			Buffalo				Camel		
The name of the tooth	I1	I2	I3	I1	I2	I3	I4	I1	I1	I3
Total length	4.2	4.6	4.9	6.3	6.2	6.3	5.5	8.2	7.4	5.8
Crown length	2.0	2.1	2.3	3.3	3.2	2.8	2.2	3.0	2.5	1.8
Root length	2.2	2.5	2.6	3.0	3.0	3.5	3.3	5.2	4.9	4.0
Breadth at:										
A- The crown	0.9	1.1	0.9	1.9	2.0	2.0	1.9	1.9	1.9	1.4
B- The neck	0.6	0.7	1.1	0.9	1.1	1.2	1.2	1.5	1.4	1.7
C- The root	0.2	0.2	0.4	0.6	0.6	0.6	0.5	0.3	0.4	0.3
Thickness at:										
A- The crown	1.0	1.0	0.9	0.3	0.3	0.3	0.3	0.4	0.4	0.3
B- The neck	1.1	1.1	1.0	0.9	1.1	0.9	0.9	1.2	1.2	0.8
C- The root	0.7	0.6	0.6	0.7	0.6	0.6	0.5	0.7	0.7	0.5
Breadth of all incisors										
A- At the crowns	2.9			6.2				3.9		
B- At the roots	1.5			3.0				1.3		

Table (2): Showing some measurements on the cheek teeth in the different examined animals (in cm).

The name of the animal	Donkey									Buffalo									Camel															
The name of the tooth	F2	P3	F4	H1	F2	H3	F2	P3	F4	H1	H2	H3	F1	P4	H1	H2	H3	F2	P3	F4	H1	H2	H3	F1	P4	H1	H2	H3	F1	P4	H1	H2	H3	
Total length	4.8	4.5	5.9	5.2	5.4	5.0	4.0	5.0	6.3	6.3	7.4	7.9	3.2	4.6	5.7	5.9	6.3	4.8	4.5	5.9	5.2	5.4	5.0	3.2	4.6	5.7	5.9	6.3	3.2	4.6	5.7	5.9	6.3	
Crown length	1.0	1.1	1.8	1.5	1.5	1.5	2.0	2.1	2.3	2.6	2.2	2.4	0.7	2.3	2.5	2.3	2.7	1.0	1.1	1.8	1.5	1.5	1.5	0.7	2.3	2.5	2.3	2.7	0.7	2.3	2.5	2.3	2.7	
Root length	3.8	3.4	4.1	3.6	3.9	3.5	2.0	2.9	4.0	3.7	5.2	5.5	2.5	2.3	3.2	3.6	3.6	3.8	3.4	4.1	3.6	3.9	3.5	2.5	2.3	3.2	3.6	3.6	3.8	3.4	4.1	3.6	3.9	3.5
Distance between root and V.B. of mandible	2.7	3.0	2.4	2.8	4.0	5.0	1.1	0.9	0.4	1.4	0.9	0.6	0.3	1.3	0.9	0.8	0.3	2.7	3.0	2.4	2.8	4.0	5.0	1.1	0.9	0.4	1.4	0.9	0.6	0.3	1.3	0.9	0.8	0.3
Distance between roots of the same tooth	0.9	0.8	0.8	1.0	0.9	0.7	0.8	0.1	1.1	0.6	1.2	1.2	-	1.2	1.0	1.4	2.4	0.9	0.8	0.8	1.0	0.9	0.7	0.8	0.1	1.1	0.6	1.2	1.2	-	1.2	1.0	1.4	2.4
Breadth at:																																		
A- The crown	2.3	2.3	2.0	1.8	1.9	3.0	1.2	1.9	2.0	2.4	2.6	3.6	0.3	2.0	2.3	3.3	4.3	2.3	2.3	2.0	1.8	1.9	3.0	1.2	1.9	2.0	2.4	2.6	3.6	0.3	2.0	2.3	3.3	4.3
B- The neck	1.5	1.7	1.8	1.7	1.8	2.5	1.4	1.9	1.9	2.2	2.4	3.5	0.9	1.8	2.7	2.9	4.3	1.5	1.7	1.8	1.7	1.8	2.5	1.4	1.9	1.9	2.2	2.4	3.5	0.9	1.8	2.7	2.9	4.3
C- The root	1.8	1.8	1.8	1.7	1.5	2.3	1.3	2.0	1.9	1.9	2.5	3.1	1.1	2.1	2.3	2.8	3.9	1.8	1.8	1.8	1.7	1.5	2.3	1.3	2.0	1.9	1.9	2.5	3.1	1.1	2.1	2.3	2.8	3.9
Thickness at:																																		
A- The crown	1.3	1.5	1.5	1.4	1.4	1.2	0.6	0.9	1.0	1.3	1.4	1.4	0.4	1.2	1.7	1.7	1.7	1.3	1.5	1.5	1.4	1.4	1.2	0.6	0.9	1.0	1.3	1.4	1.4	0.4	1.2	1.7	1.7	1.7
B- The neck	1.3	1.3	1.5	1.4	1.3	1.0	0.6	1.0	1.3	1.5	1.6	1.5	1.0	1.1	1.7	1.9	1.8	1.3	1.3	1.5	1.4	1.3	1.0	0.6	1.0	1.3	1.5	1.6	1.5	1.0	1.1	1.7	1.9	1.8
C- The root	0.9	0.9	1.0	0.8	0.7	0.8	0.4	0.6	0.6	0.7	1.2	1.2	1.2	0.5	0.6	0.9	1.1	0.9	0.9	1.0	0.8	0.7	0.8	0.4	0.6	0.6	0.7	1.2	1.2	1.2	0.5	0.6	0.9	1.1
Number of the roots	2	2	2	2	2	3	2	2	2	2	2	3	1	2	2	2	3	2	2	2	2	2	3	2	2	2	2	2	3	1	2	2	2	3
Breadth of all ch.th.																																		
A- At the crowns	13.1									13.8									12.2*															
B- At the roots	15.4									17.2									14.7															

V.B. of the mandible = Ventral border of the mandible.

Breadth of all Ch.Th. = Breadth of all cheek teeth.

(*) The breadth of all cheek teeth except P1 in camel.

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Fig. (1): Photograph of the incisors in donkey(A), camel(B) and buffalo(c). (Dorsal view).

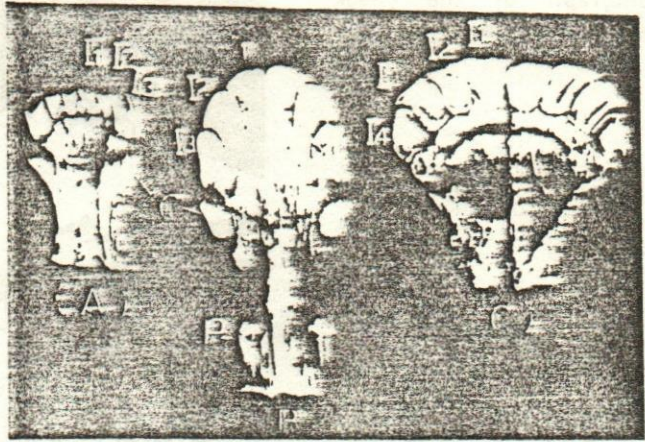


Fig. (2): Lateromedial radiograph of the cheek teeth in the donkey.



Fig. (3): Lateromedial radiograph of the cheek teeth in the buffalo.

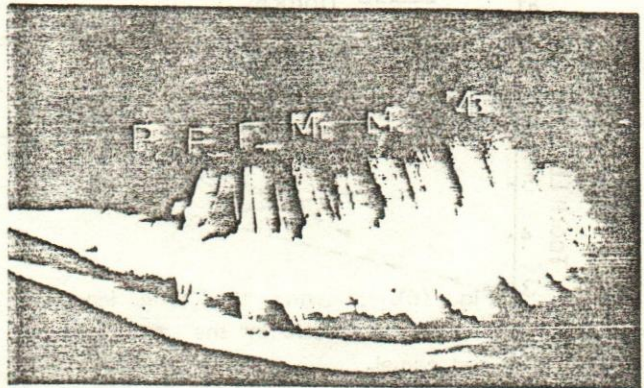
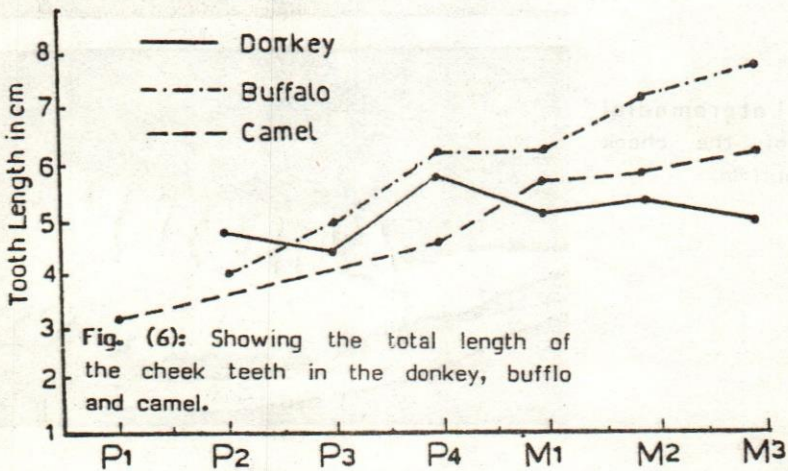
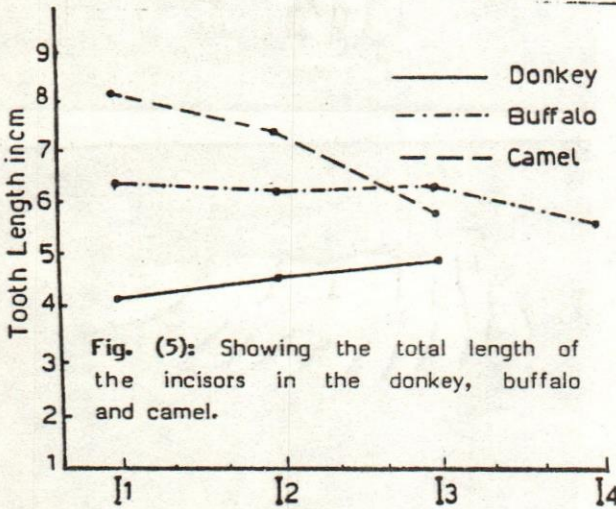
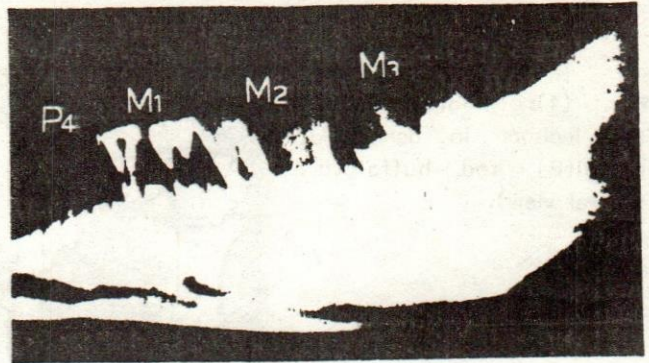


Fig. (4): Lateromedial radiograph of the cheek teeth in the camel.



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DISCUSSION

According to that reported in cattle by McLEOD (1958), SISSON/GROSSMAN (1963), RAGHAVAN/KACHROO (1964) and NICKEL/SCHUMMER/SEIFERLE (1973) the incisors are eight in number similar to that reported in buffalo. However, SENGAR/SINGH (1970) in the latter animal, EL-HAGRI (1967) as well as CLAIR (1975) in cattle stated that the incisors are six in number, considering the corners of the incisors as canines.

The present study shows that only in donkey the incisors have occlusal surfaces which contain infundibula. These surfaces are replaced by sharp edges in buffalo and blunt edges in camel. In this respect SISSON/GROSSMAN (1963), EL-HAGRI (1967) and CLAIR (1975) mentioned that the presence of the infundibula on the crown are peculiarities of the incisors of equines.

The present work indicates that the incisors decrease in length from number 1 to 3 in donkey but increase in the same direction in camel. In this connection CLAIR (1975) stated that in cattle the incisors decrease in size from number 1 to 4. In agreement with that given by IBRAHIM (1983) the central incisor tooth is the longest one among the other incisors. In donkey the corner is the longest incisor tooth, and in buffalo the first three incisors are nearly equal in length.

Corresponding to that recorded in horse by EL-HAGRI (1967) the roots of the incisors are convergent in all the examined species. In comparison between the ratio of the breadth of all the incisors at the crowns and roots (in donkey and buffalo 2:1 and in camel 3:1) it is clear that the degree of convergence of the roots in the camel is more than that of donkey and buffalo. This is due to that the roots of the incisors are closely situated in the camel and separated by small spaces in the donkey and buffalo.

The canine in donkey and camel divides the diastema into two unequal parts, a condition which is also reported in horse by SISSON/GROSSMAN (1963). On the other hand IBRAHIM (1983) in camel mentioned that the canine erupts nearly in the middle of the diastema.

The premolars in camel are generally two in number (P1 and P4) as that mentioned by LEESE (1927) and IBRAHIM (1983). While in one out of eight examined cases a remnant of the P3 was demonstrated.

In all investigated species the third molar tooth has three roots, a similar result was also reported in horse by SISSON/GROSSMAN (1963). However, this tooth has two roots in the latter animal and cattle as mentioned by NICKEL *et al.* (1973) and BERG (1982). But EL-HAGRI (1967) stated that in horse the third molar tooth has only one root.

In agreement with that recorded in horse (SISSON/GROSSMAN, 1963 and EL-HAGRI, 1967) the occlusal surfaces of the cheek teeth in donkey is oblique, sloping

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upward and inward from the vestibular border. This feature is only observed in the molars of buffalo and camel.

The present findings show that in buffalo and camel the cheek teeth increase in length and breadth from front to back. In agreement with this result SISSON/GROSSMAN (1963) and NICKEL *et al.* (1973) stated that in horse the cheek teeth increase in size from before backward.

SÜNGER/HERTSCH (1981) reported that in donkey the P4 and M2 are the strongest teeth in both upper and lower jaws. The present work indicates also that in the same animal the P4 is the longest tooth of the lower jaw and is followed by M2.

In donkey, the cheek teeth ranging between 4.8-5.9 cm in length and 1.2-1.5 cm in thickness. In horse the length of these teeth is about 8-10.5 cm (NICKEL *et al.*, 1973) and the thickness averaging 1.8 cm (CLAIR, 1975). In comparison between the finding in donkey and that recorded in horse, it is clear that the cheek teeth in donkey are shorter and narrower than those in horse.

Concerning the extraction of the teeth, O'CONNOR (1965) reported that the teeth are extracted by leverage parallel to the direction of their roots. Moreover, HARVEY (1985) in cattle mentioned that the traction should follow alignment with the tooth. Therefore, the present work describes the direction of the roots of the teeth to help the practitioner during the extirpation of the teeth. It can be concluded that in all examined species the molars are raised dorsally and rostrally during extraction, but the direction of the traction of the premolars depends upon the species of the studied animals.

HARVEY (1985) stated that in horse the extraction of the majority of the cheek teeth is best carried out by trephination and repulsion. He added that the site of trephination is selected from the radiographs and the anatomical landmarks. In this respect HICKMAN/WALKER (1980) pointed up that, it is essential to trephine exactly over the root. In the present study the distances between the roots of the cheek teeth and the ventral border of the mandible as well as the mandibular canal are measured. These measurements give a suitable sites for the trephination and repulsion of the cheek teeth in the different investigated species, consequently the operations become more successful and safe.

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