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RADIOGRAPHICAL STUDIES ON THE DEVELOPMENT OF CHEEK TEETH IN DONKEYS

(With 32 Fig. & 5 Tables)

By

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دراسات اشعاعيه لتطور الضروس فى الحمير

نبيل مسك ، سامية سليم

تم اجراء هذا البحث على عدد ٦٠ رأس مختلفة الاعمار من الحمير تم تقدير العمر بها وتحضيرها للتصوير بالأشعه وكذلك تم استخدام عدد ٥ حيوانات حديثة الولاده تم تصوير أسنانها اشعاعيا من سن يوم وحتى عام كامل ثم تم بعد ذلك تجميع أفلام الأشعه المصوره فى مجموعات لمراحل النمو المختلفه وتم دراسة الآتى عليها :

١ – تحديد وقت ظهور المراحل المختلفه لنمو الأسنان اللبنيه والدائمه .
٢ – توصيف الصور الاشعاعيه للمراحل المختلفه لعمر الأسنان .
٣ – تسجيل أطوال الأسنان اللبنيه من سن الولاده وحتى سقوطها .
٤ – تسجيل أطوال الأسنان اللبنيه من سن الولاده وحتى السن المتقدم .
٥ – تسجيل أطوال أجسام وجذور الأسنان من عمر خمس سنوات وحتى ١٥ سنه .
٦ – السنه الوحشيه ونسبة وجودها وصورتها الاشعاعيه ووقت ظهورها وسقوطها .

وقد تم تسجيل النتائج فى جداول وصور بيانيه وصور اشعاعيه أبيض وأسود وصور ملونه كذلك تم مناقشة هذه النتائج مع المتاح من الأبحاث .

SUMMARY

The current study was carried out on 60 head specimens of donkeys in addition to 5 living animals. Specimens and animal's heads were radiographed and all radiographs were grouped from 1 day old up to 15-year-old and subjected to full study including the following points. Time of radiographic appearance of different stages of development of deciduous and permanent cheek teeth. Radiographic silhouette of the cheek teeth at different stages of development. Length of deciduous cheek teeth from birth to shedding. Length of permanent cheek teeth from birth to senility. Body and root length from age 5 up to 15 years old. Wolf tooth, occurance, radiographic silhouette, and time of eruption and shedding. All results were documented and illustrated in tables and photoes and then discussed with the available literatures.

Keywords: Radiological studies, cheek teeth, Donkey.

INTRODUCTION

Teeth are classified into three general classes according to manner of growth: true teeth, constantly growing teeth and constantly erupting teeth. True teeth occur in carnivores and in the incisors of ruminants. They possess crown, neck, root, grow to adult size and then wear away without further growth or eruption to compensate for wear. Constantly growing teeth are the tushes of swine and the incisors of rodents. These teeth continue to grow through the life of the animal and do not possess a definite root or neck. Constantly erupting teeth are entire teeth of equine and cheek teeth of ruminants. Teeth of this type are complexly layered masses which possess extremely long body, short roots and no definite neck. As the animal ages the tooth sockets gradually fill from below with bone, which slowly pushes the teeth from the socket to compensate for wear *(BONE, 1979)*.

Also teeth are classified into Brachydont and Hypsodont. Brachydont teeth are short, a low-crowned teeth that have a distinct crown, neck and root(s) and stop growing after eruption as in dogs, cats, pigs and incisors of ruminants. Hypsodont teeth have a large crown called the body and small late-forming root(s). These teeth continue to grow for a

variable number of years after birth, which accounts for their unique pattern of wear and for the clinical problems that occur when the wear is abnormal. Hypsodont teeth include that of equine and cheek teeth of ruminants *NICKEL* et al. *(1979) and LAHUNTA* et al. *(1986).*

The study of the cheek teeth in the horse is a well-documented feature of horse evolution *(BAKER, 1971, 1972 & 1979).* The teeth of modern horse have evolved into the structure and form that they now have as a result of the change from browsing habitat to a grazing habitat. The cheek teeth are not included in precise age determinate. Although they may be of some value in indicating a horse's approximate age. Difficulty of access is why they are not used *(BONE, 1979 and LAHUNTA* et al., *1986).*

The fact that the teeth of equines continue to grow for several years after birth gives an indication that they completely different out size. Shape, length and structure at different ages.

Knowledge about the normal radiographic silhouette of the teeth at different ages is meagre in equines specially in donkeys and is considered to be of importance in estimation and diagnosis of diseased and abnormal conditions affecting them. The aim of the present study was designed to describe the normal radiographic silhouette of the cheek teeth at different ages in donkeys.

MATERIAL AND METHODS

The current study was carried out on 60 heads of donkeys of both sex and of different ages. The age of the head specimens were determined *(BONE, 1979).* Specimens were prepared for radiography by separating the mandible from the skull then a median section was performed through it to have a two equal halves. Radiography was performed in lateral projection for the skull and mandible separately.

In addition, five living newly-born donkeys were used in this study. Heads were radiographed periodically from date of birth up to one-year-old animals were sacrificed to be used as specimens of accurate age.

All radiographs were collected in files from one-day-old up to 15-year-oid subjected to full study including the following points:

1- Time of radiographic appearance at different stages of devel-opment of deciduous and permanent cheek teeth.
2- Radiographic silhouette of the cheek teeth at different stages of development.

3- Length of deciduous cheek teeth from birth to shedding.
4- Length of perment cheek teeth from birth to senility.
5- Body and root length from age 5 up to 15 years old. for permanent teeth.
6- Wolf tooth (first premolar tooth occurance, radiographic silhouette, time of eruption and time of shedding.

RESULTS

The constant number of cheek teeth in donkey is 24 composing four dental arcades with six teeth in each arcade. In addition wolf teeth (1 P.M) are found frequenttly in the upper jaw and rarely in the lower jaw. In our study the term cheek teeth will be used to include both premolars and molars except wolf teeth and they will be numbered 1 through 6 (i.e first cheek tooth = P.M2 and fourth cheek tooth = M1).

1- Time of radiographic appearance at different stages of development of deciduous and permanent cheek teeth is illustrated in Table (1 & 2).
2- Radiographic silhouette of cheek teeth at different stages of development (Figs. 1 to 23).

Eruption cyst appears as a radiolucent rounded swelling 10 x 10mm and increased in size gradully until it reached 35 x 35mm then the process of early crown calcification starts within it. The eruption cyst is not attached to the occlusal surface of the mandible. incisive, or maxilla and is related ventrally at the mandible to the mandibular canal but no relation can be observed at the upper jaw with the maxillary duct.

Early crown calcification starts by the appearance of a nearly five finger-like processes of radiodensity. These processes become slightly separate and erect with increaseed radiodensity towards the occlusal surface.

As the process of crown calcification is going on. The eruption cyst becomes elongated in shape and the processes are transformed into calcification columns. The number of which depends on the number of roots formed later on and varies from 2-3 columns.

Radiolucent cystic swellings are observed enveloping the apices of the mandibular and maxillary teeth and remain until roots have been formed completely then disappear.

Eruption cysts of the permanent premolars (1, 2 & 3nd cheek teeth) develop underneath the deciduous teeth. As the process of crown calcification is going on, the roots of deciduous teeth are resorbed and the teeth become so weekly

held in position that the occlusal pressure dislodges them from the mouth after their retention for variable time as capping. At the same time the permanent mandibular teeth increase in length and direct downward towards the ventral line of the horizontal ramus of the mandible leading to the formation of a series of ventral invaginations and the maxillary permanent teeth are directed upwards to occupy a large part of the premaxilla.

Eruption cysts of the permanent molars (4, 5 & 6th cheek teeth) are formed gradually behind each other as indicated in Table (2). The root apex fourth cheek tooth reaches the ventral line of the horizontal ramus of the mandible leading to its ventral invagination while the other two cheek teeth (5 & 6th) do not reach it during their process of development. The maxillary molars develop upward and most of the paranasal maxillary sinuses.

Root of permanent cheek teeth start to develop after the cheek teeth reach their maximum length at 2-4 years old (late-forming roots). During root development the reserve crown gradually decreased in length and the tooth moved towards the mouth cavity until complete eruption and attrition of the crown and roots were only left inside the maxilla or mandible in 15 years old animal.

The true roots of the maxillary cheek teeth are short when compared with the total length of the teeth. There are three roots. two small lateral roots and one large medial root for each tooth. These roots can be differentiated radiographically. The first upper cheek tooth is directed upward and slightly forward, the second is nearly vertical, the third and subsequent upper cheek teeth incline backwards to and increasing degree. The reserve crown of the fourth to sixth cheek teeth occupy parts of the paranasal maxillary sinuses. Each of the permanent mandibular cheek teeth has two roots with the exception of last tooth which usually has three roots.

Concerning the mandibular canal and its relation to the root apices development of mandibular cheek teeth, it is found that the canal is closely attached to the eruption cyst. When the teeth reach it is full development, the mandibular canal was found crossing the root apices of the teeth but after eruption and attrition of the reserve crown, the canal was observed farawy from the root apices. The relation of the maxillary duct to the maxillary cheek teeth was difficult to be evaluated radiographically.

3- Radiographic length of deciduous cheek teeth from birth to shedding is illustrated in Table (3).

4- Radiographic length of permanent cheek teeth from birth to senility is illustrated in Table (4).
5- Radiographic length of the body and root of permanent cheek teeth from age 5 up to 15 years old is illustrated in Table (5).
6- Wolf teeth (first premolar tooth) occurance, radiographic silhouette, time of eruption and time of shedding.

Maxillary first premolar was first observed at 6 weeks old in both sides and in almost all specimens (more than 90%) and remains up to 9 years old. Eruption cysts cannot be detected. It is a simple conical-shaped have an enlarged crown and narrow root. The maximum total length is 23 mm and width is 7 mm (Fig. 15).

The mandibular first premolar is first observed at 6 months old specimens on both sides. in less than 25% of specimens and remains upto 2 years old. A narrow radiolucent depression, 10 mm length and 2mm width, is observed at the seat of the tooth in some specimens. This radiolucent depression may repressent the eruption cyst (Fig. 3). The tooth appears as a very small flat vestige not more than 10 mm long and 1-2 mm wide.

DISCUSSION

The normal radiographic silhouette of deciduous and permanent cheek teeth is important in many aspects. Delayed eruption of teeth, retention of deciduous teeth, oligodontia, polyodontia, dental tumors, fistulae, dental caries and periodontitis are among the dental affections which constitute the major problems of the oral cavity for which accurate diagnosis and treatment are indicated.

Dental radiography is an important part of oral examination and is used to confirm many abnormal positions or diseases of teeth. In most instances root and reserve crown detail rather than exposed crown detail is needed. This detail is mainly achieved by using lateral and 30° oblique beam. In selected cases, greater detail may be obtained with the use of intraoral dental films *(BAKER, 1971)*.

As with all clinical exercises, experience with the normal radiographic appearance of the teeth at different ages and various stages of development is essential. Morever for the majority of cheek teeth, however, extraction as a treatment for many dental problems is best carried out by trephination and repulsion. The site for trephination is selected from radiographs and anatomical landmarks. It is essential that the

angle of repulsion be correct in both the caudorostral and buccolingual planes *(HARVEY, 1985).*

Newly born donkeys have a full erupting deciduous cheek teeth at one day old. The length of the maxillary deciduous teeth appears longer than the mandibular at fixed age until complete development of the teeth. The length of mandibular cheek teeth becomes lower than the maxillary (Figs. 24, 25 & 25). The upper tooth bud preceeds the lower tooth bud up to 3 weeks in horses *(BAKER, 1970 & 1971).* This explains why the maxillary teeth are longer than the mandibular ones before complete development. As the process of attrition starts the vice versa was observed i.e. the mandibular teeth becomes more longer than the maxillary ones. This may be due to the beginning of the attrition process earlier in the maxillary than mandibular cheek teeth (Fig. 27-32).

The present results indicated that deciduous teeth attain their full development at 6-10 months old after that complete root resorption take place and the process of capping and shedding started at 15 months old in the first deciduous tooth and continued to the second third teeth by one month interval. At 2 years old nearly all deciduous teeth looses their roots and evidently capping the newly formed permanent cheek teeth. The process of shedding extends up to 4 years old in some animals and from our point of view it may depend on the kind of offered food and some individual variations.

The first eruption cyst for permanent cheek teeth develops for the fourth and fifth cheek teeth at 6-7 weeks old. After that the eruption cysts of the first and second cheek teeth are seen at 10-11 months old. At last the eruption cysts of the third and sixth teeth appear 12-15 months old. However. it is interesting to state that the maxillary eruption cyst of the same tooth usually appears earlier than the mandibular one by at least one month. The first permanent cheek tooth attains its maximum length (60-65mm) when the donkey is 3 years old, the second and third attain their maximum length (70-80mm) when the animal is 4 years old. The fourth cheek teeth attains maximum length at 2 years old (70-80mm), the fifth at 3 years old (70-75mm) and sixth at 4 years old (60-65mm).

In horses the length of the first upper cheek tooth is 68mm, the second 83mm, the third 90mm, the fourth 78mm, the fifth 87mm and the last 76mm long *(HARVEY, 1985).* Comparing the results given in horses and our results in donkeys we can conclude that the length of upper cheek teeth in donkey is nearly 10mm less than that of horse. The same author neglects the measurements of the lower cheek teeth which are given in the present study in donkeys.

The cheek teeth complete true longitudinal growth when the horse is 6-7 years old and at that time the length varies between 80- 105mm *(NICKEL et al., 1979)*. This fact indicated that the cheek teeth of donkeys reaches their full length 2-years earlier than horse.

The same general statement observed in the development of deciduous teeth is seen with permanent teeth. The length of maxillary teeth in general is longer than the mandibular teeth until complete true longitudinal growth ceases then vise versa is observed as the process of attrition starts earlier on the maxillary than mandibular.

As longitudinal groth ceases, roots start to devlop which means that they appear at 5 years old and completely develop within one year then nearly have the same length along the whole life. This fact justifies the statement that teeth of equine are hypsodont teeth have an extremely long body and short late-forming roots *(NICKEL et al., 1979)* and *LAHUNTA et al., 1986)*.

In horses the true roots of the maxillary cheek teeth are short when compared with the total length of the teeth. The roots of the lower cheek teeth are relatively shorter than the maxillary ones *(HARVEY, 1985)*. However, the present results indicate that the opposite is true. The length of the maxillary cheek roots is around 10mm while that of the mandibular cheek teeth is around 20mm and reaches up to 35mm at the third lower cheek tooth.

When the length of the crown is compared with the root length (Table 5) we find that the condition differs between the upper and lower cheek teeth and varies according to the animal's age. In 5 years old donkey at the maxillary cheek teeth the crown length is 3-6 times larger than the root length. As the animal become aged the crown decreases and the root slightly increases in length. At 15 years old animal, the crown length becomes 1/3 to equal the root length.

At the mandibular cheek teeth the 5 years old donkey has a crown 2-6 times longer than the root length while at 15 years old the crown length was reduced to 1/6 - 1/2 the root length. This denat that the mandibular cheek teeth have longer roots than the mandibular ones as the animal become aged.

According to our investigation, the cheek teeth can play a good role in precise age determination up to 15 years old. Lateral or oblique radiographic projections may be sufficient to determine the stage of development and the length of different tooth segment which facillitates age determination.

The rate of dental attrition in horse is 3mm/year. The rate of attrition in donkey may be less than in horse so that the ages up to 40 years may be reached *(BAKER, 1979)*. Our observations indicated that the tooth looses nearly 60mm from the crown length within 10 years i.e 6mm/year which means more rate of dental attrition than horses. However this point needs further studies.

Occasionally, a rudimentary upper PMI is present. It is erupted when the animal is still young and is not replaced. It is also present in the lower jaw but does not erupt *(Nickel et al., 1979)*. It is usual to include the vestigial first premolar in the upper jaw in the dental formula, but it can also be found in the lower jaw, thus increasing the total number by two *(Harvey, 1985)*. Our results indicate that wolf tooth is present in most specimens in the upper jaw and considerably rare in the lower jaw. It is more developed in the maxillary than mandibular raw however it is still a vestigial conical-shaped tooth at the upper jaw and flat remnants at the lower. Also our results indicate that the tooth appears early in life and remains upto 9 years old upper jaw and 2 years old in the lower jaw.

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LEGENDS OF FIGURES

Fig. 1: Lateral radiograph of a 6-week-old specimen of the mandibule showing 1st, 2nd and 3th D.C.T. and the eruption syst of the 4th P.C.T. in early crown calcification.

Fig. 2: Lateral radiograph of a 6-week-old specimen of the maxillary jaw showing 1st, 2nd and 3th D.C.T. and the eruption cyst of the 4th P.C.T. in early crown calcification.

Fig. 3: Lateral radiograph of a 7-month-old specimen of the mandibular jaw showing 1st, 2nd and 3th D.C.T. the 4th P.C.T. with complete crown calcification and before eruption and the eruption cyst of the 5th P.C.T.

Fig. 4: Lateral radiograph of a 7-month-old specimen of the maxillary jaw showing the 1st, 3th D.C.T. with variable degrees of root resorption, the eruption cyst of the 1st and 2nd P.C.T., the 2th P.C.T. with complete crown calcification at the time of eruption, and the eruption cyst of the 5th P.C.T.

Fig. 5: Lateral radiograph of a 9-month-old specimen of the mandibule showing 1st, 2nd and 3th D.C.T., the 4th P.C.T. at time of eruption with complete crown calcification, and the eruption of the 5th P.C.T.

Fig. 6: Lateral radiograph of a 9-moth-old specimen of the mandibule showing 1st, 2nd and 3th D.C.T., 4th P.C.T. after eruption with complete crown calcification, and the 5th P.C.T. in early crown calcification and before eruption.

Fig. 7: Lateral radiograph of a 15-month-old specimen of the mandibule showing the 1st, and 2nd D.C.T. with mid-root resorption and the 3th one with early root resorption, 1st and 2nd P.C.T. with mid-crown calcification, the 3th P.C.T. in a form of eruption cyst, the 2th P.C.T. after eruption and complete crown calcification, the 5th P.C.T. before eruption and mid-crown calcification and the eruption cyst of the 6th P.C.T.

Fig. 8: Lateral radiograph of a 18-month-old specimen of the mandible showing 1st, 2nd and 3th D.C.T. in a form of dental capping with complete root resorption specially the first and second teeth, the 1st, 2nd and 3th P.C.T. with complete crown calcification, the 4th P.C.T. with mid-root formation and full eruption, the 5th P.C.T. with complete crown calcification and full eruption and

the eruption cyst of the 6th P.C.T. Note that roots of the 1st and 2nd P.C.T. extend to the venrral horizontal border of the mandibular ramus resulting in its invagination.

Fig. 9: Lateral radiograph of a 2-year-old specimen of the maxillary arcade showing, capping of the 1st, 2nd and 3th D.C.T. with complete root resoption, complete crown calcification of the 1st, 2nd and 3th P.C.T., 4th and 5th P.C.T. in complete crown calification and complete and mid root formation respectively, and the 6th P.C.T. in mid-crown calification and before eruption.

Fig. 10: Lateral radiograph of a 4-year-old specimen of the mandibular arcade showing full development of all cheek teeth with full eruption and variable stages of roote formation.

Fig. 12: Lateral radiograph of a 5-year-old specimen of the mandibular arcade showing full teeth development with complete root formation.

Fig. 13: Lateral radiograph of a 5-year-old specimen of the maxillary arcade showing complete teeth development with complete root formation. Note that the reserve crown was decreased in length. Radiographically two roots are visualized but actually 3 roots are present.

Fig. 14: Lateral radiograph of a 8-year-old specimen of the mandibular arcade showing a noticable reduction in the length of the reserve crown and elongation of the roots.

Fig. 15: Lateral radiograph of a 8-year-old specimen of the maxillary arcade showing complete disappearance of the reserve crown with severe reduction of teeth length.

Fig. 16: Lateral radiograph of a 15-year-old specimen of the mandibular arcade showing complete disappearance of the reserve crown, servere attrition of the crown and presence of a clear will developed double roots except for the 6th one triple root.

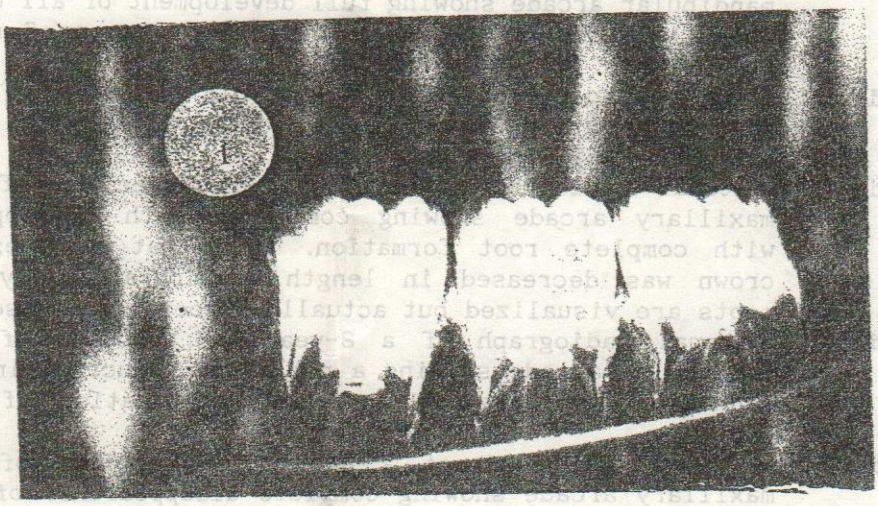
Fig. 17: Lateral radiograph of a 15-year-old specimen of the maxillary arcade showing complete disapearance of the reserve crown and severe attrition of the crown and presence a will developed but shorter roote than the mandibular cheek teeth.

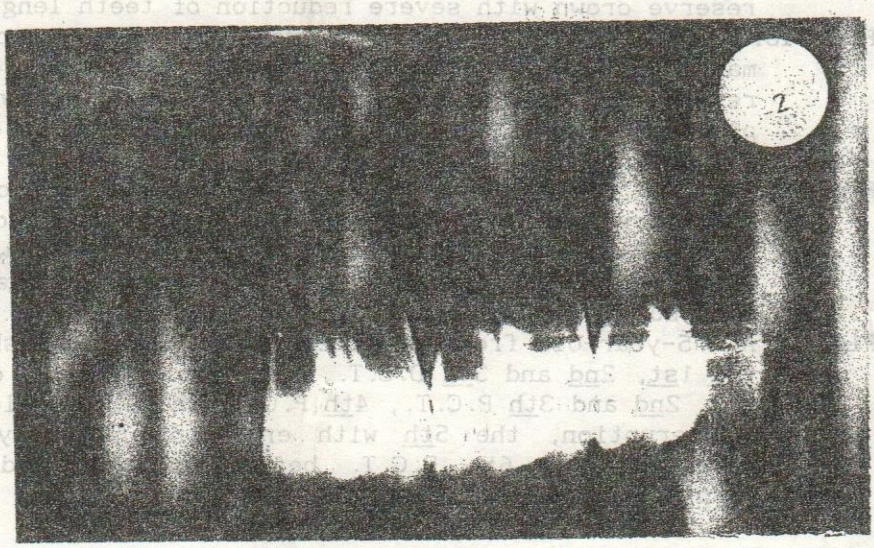
Fig. 18: A 2.5-year-old fresh specimen of the mandibule showing the 1st, 2nd and 3th D.C.T., the eruption cysts of the 1st, 2nd and 3th P.C.T., 4th P.C.T. in full development and eruption, the 5th with eruption and early root formation and 6th P.C.T. before eruption and with complete crown calcification.

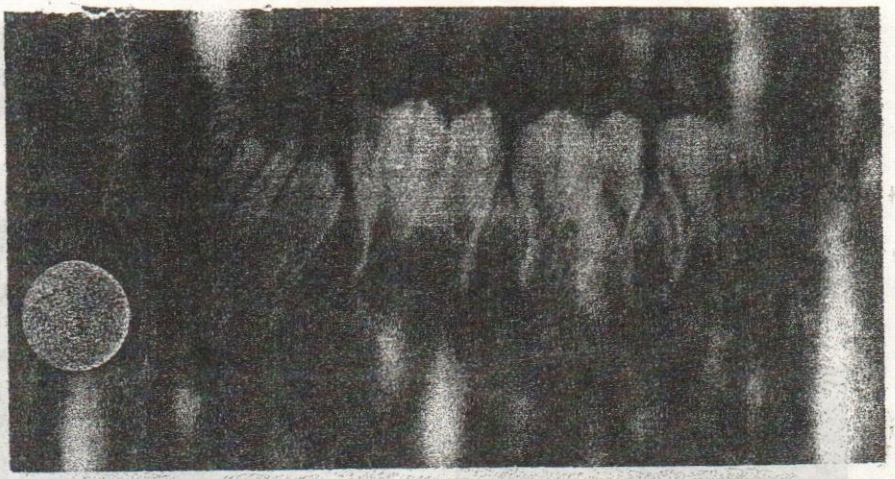
Fig. 19: A 2.5-year-old dried specimen of the mandibular arcade showing the same features as in fig. 18 Note that the 1st D.C.T. shed out.

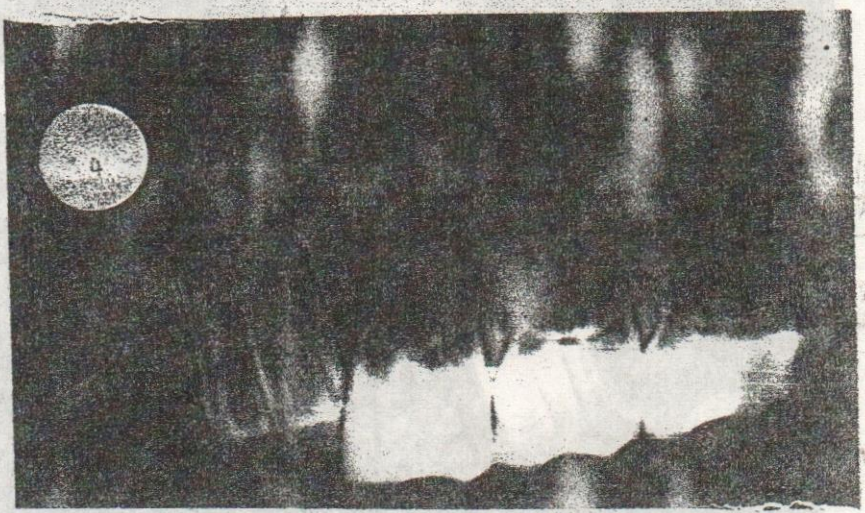
Fig. 20 & 21: A 4-year-old fresh specimens of the mandibular and maxillary cheek teeth. Note complete development of the teeth and full eruption.

Fig. 22 & 23: A 15-year-old dried specimens of the mandibular and maxillary cheek teeth. Note complete disappearnce of the reserve crown and complete development of the teeth roots.





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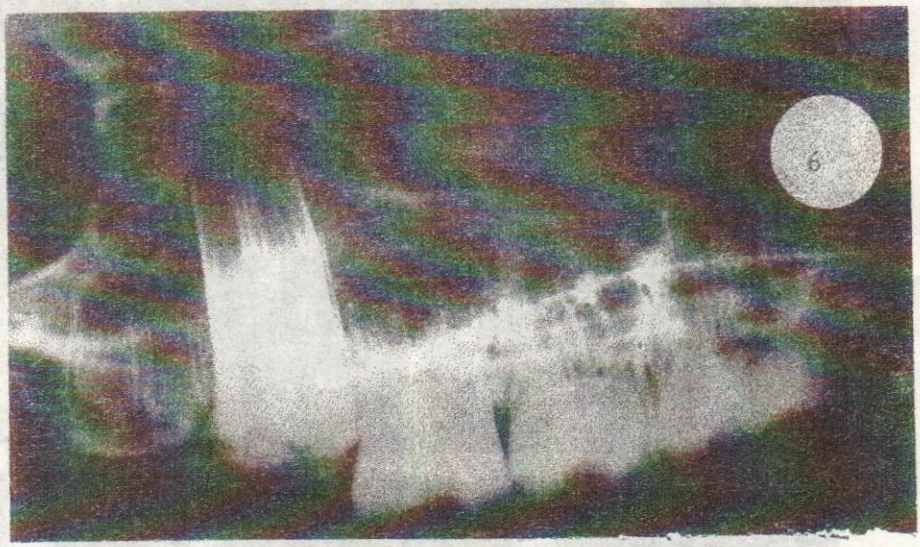
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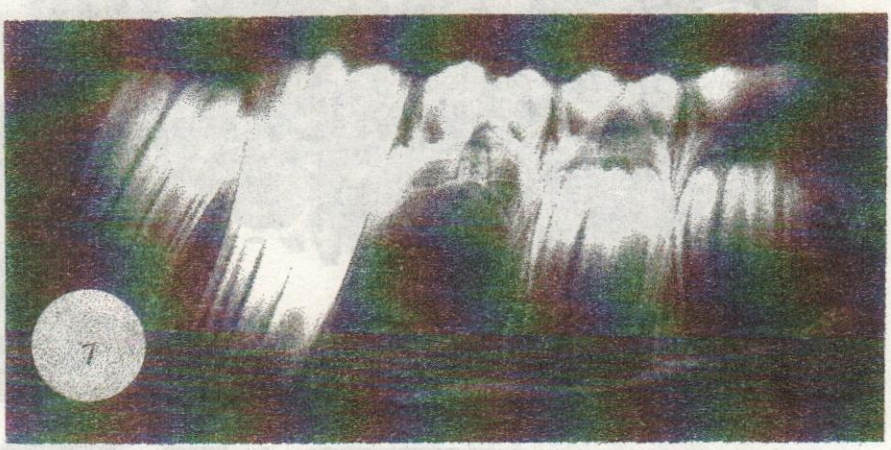
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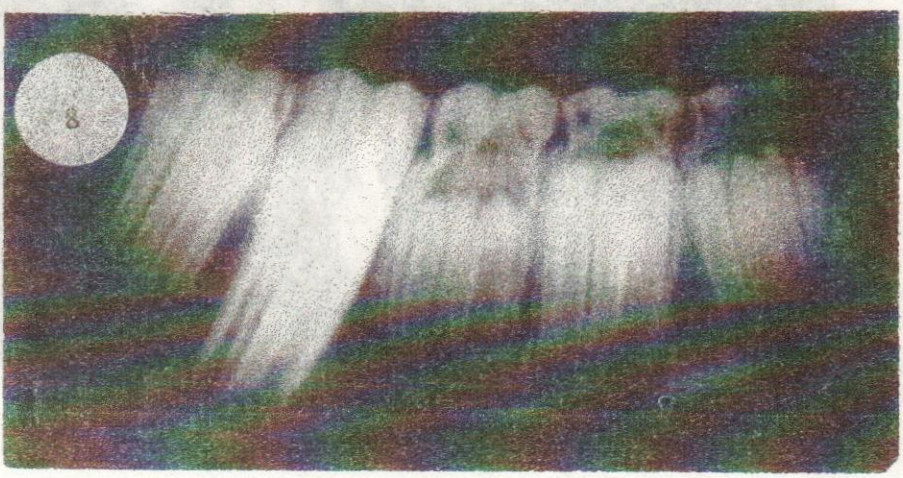
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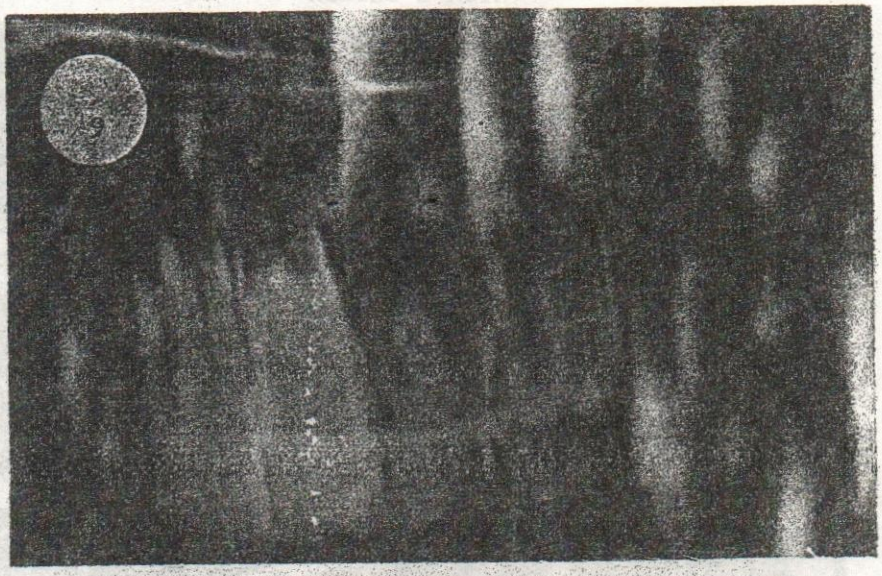
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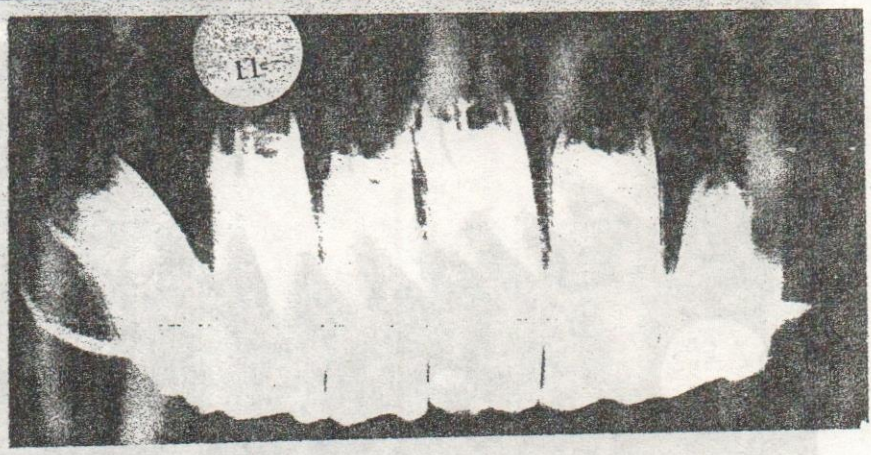
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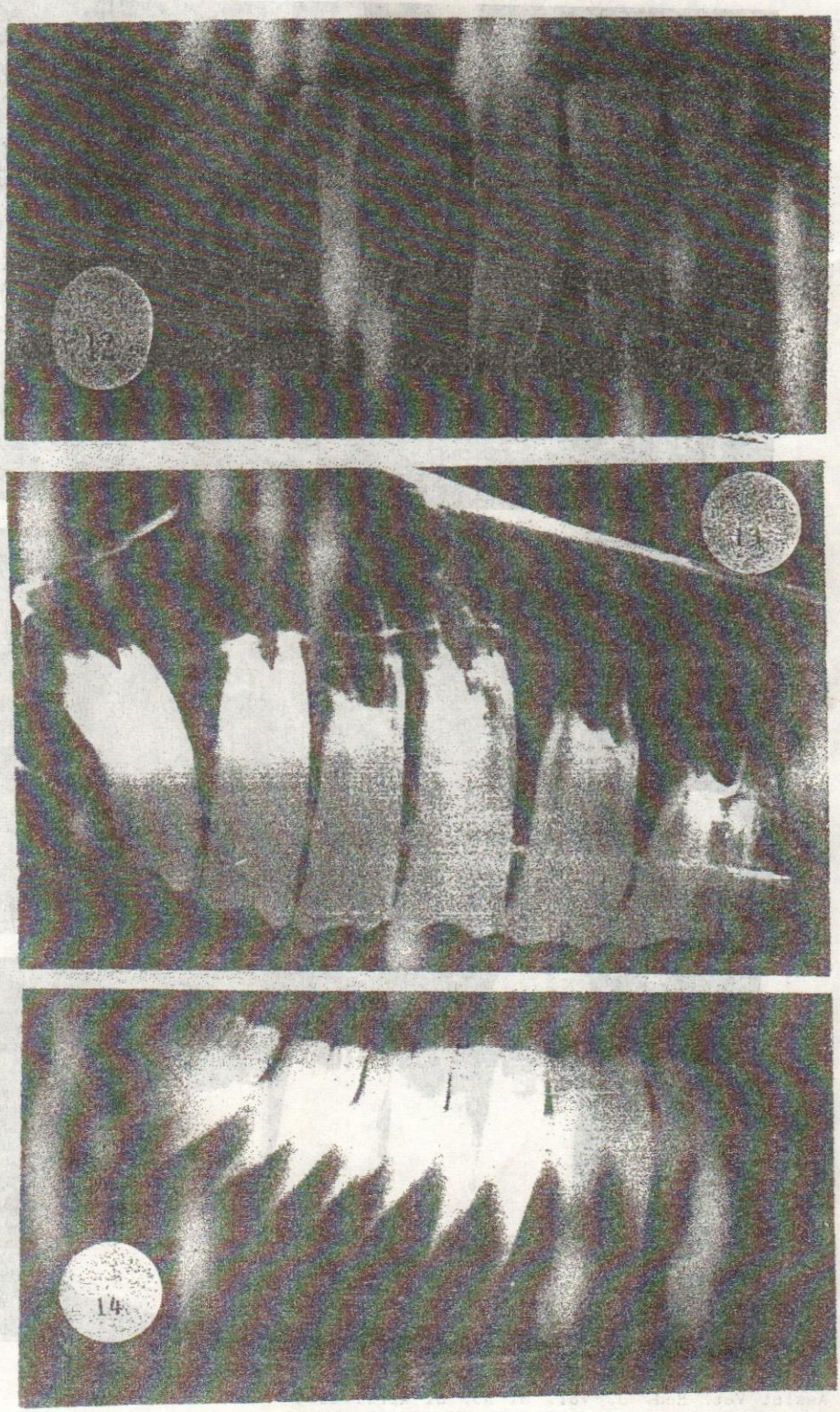
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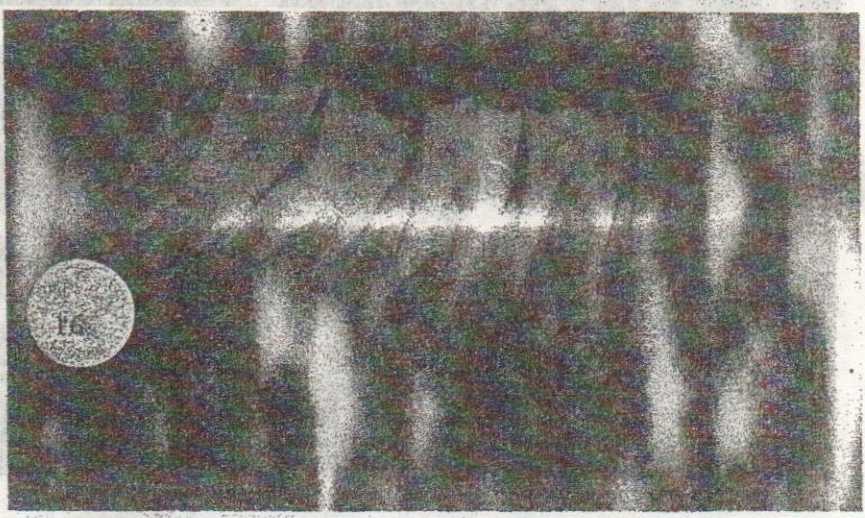
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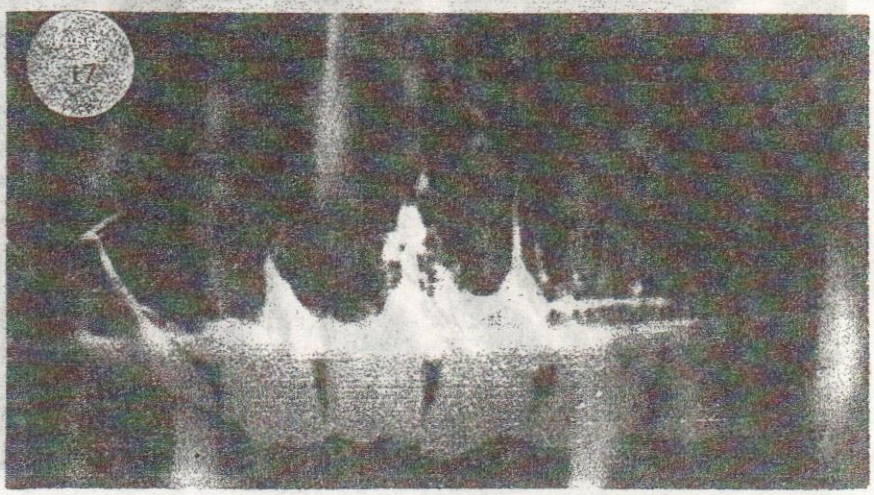
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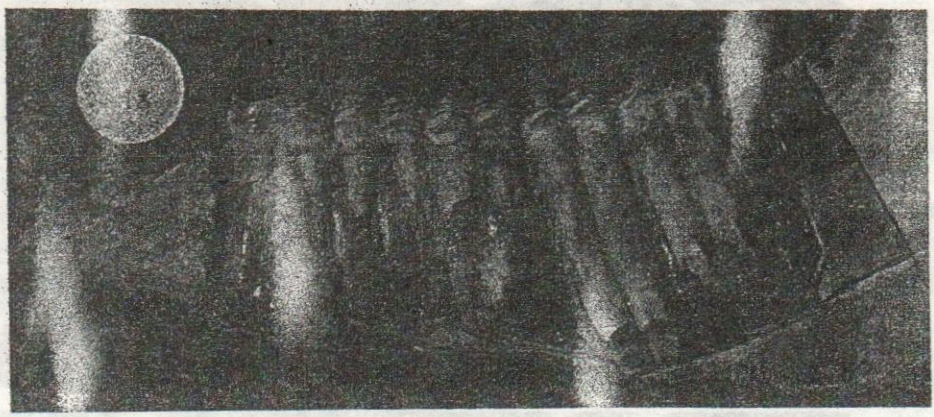

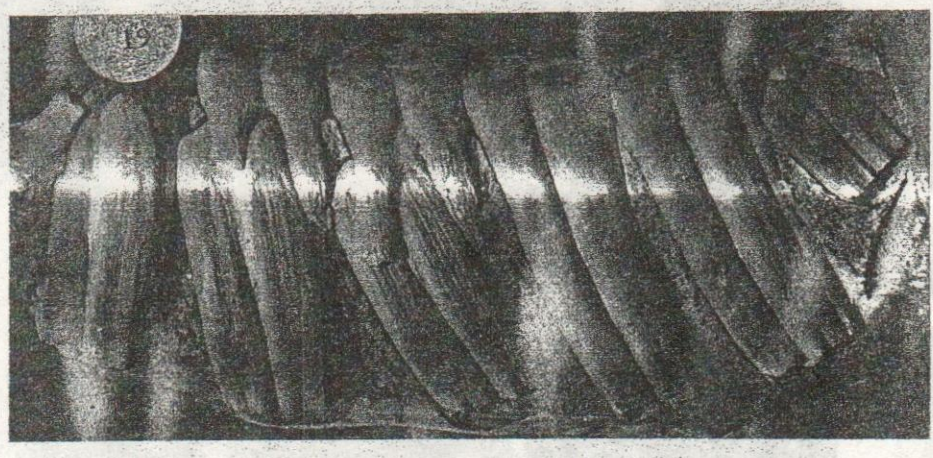
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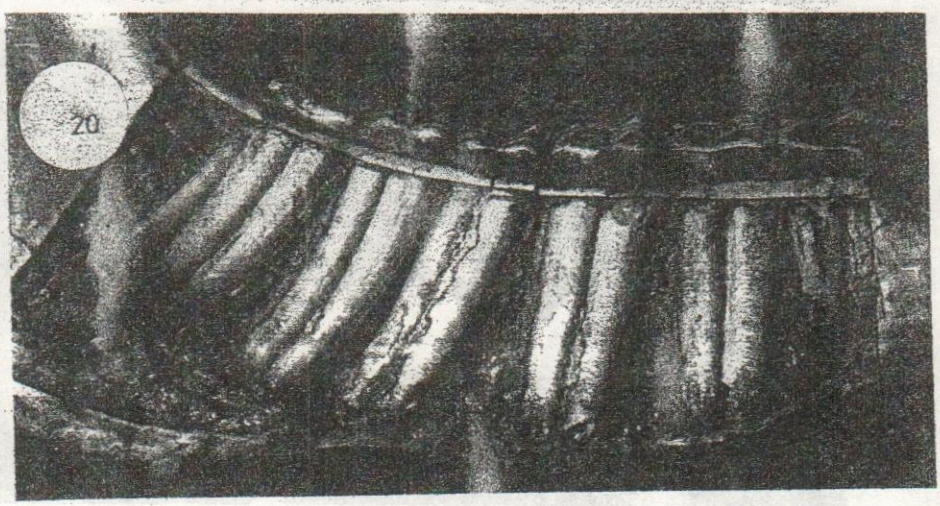
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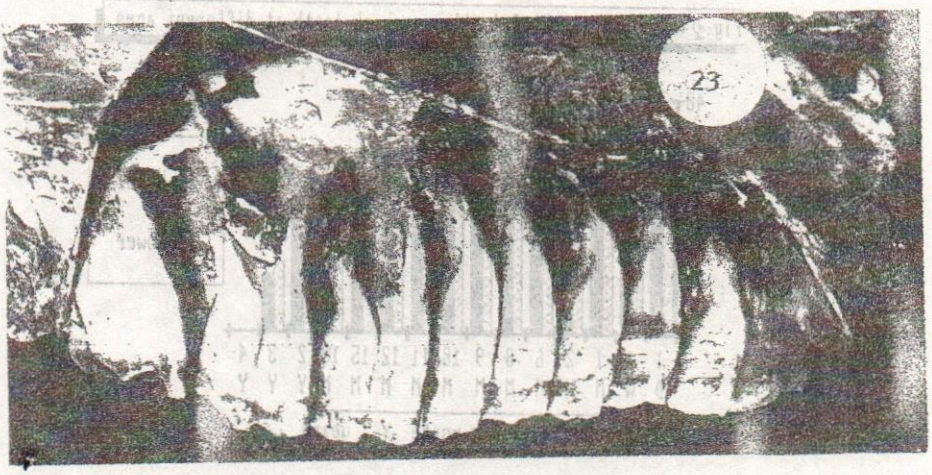
23

Fig. (3): Length of first deciduous cheek teeth at different ages.

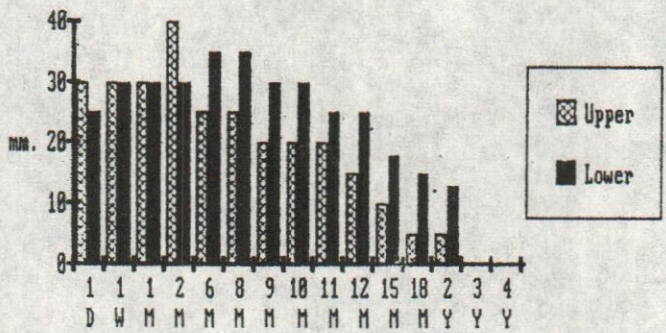

Fig. (4): Length of second deciduous cheek teeth at different ages.

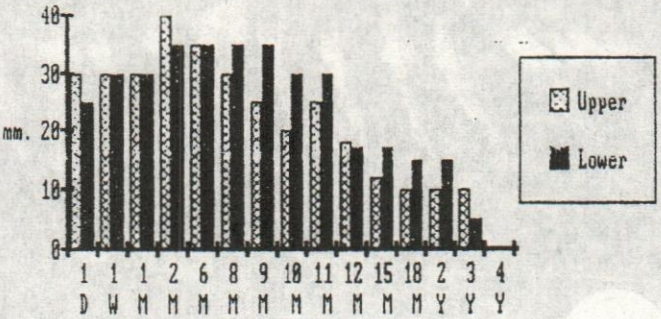

Fig. (5): Length of third deciduous cheek teeth at different ages.

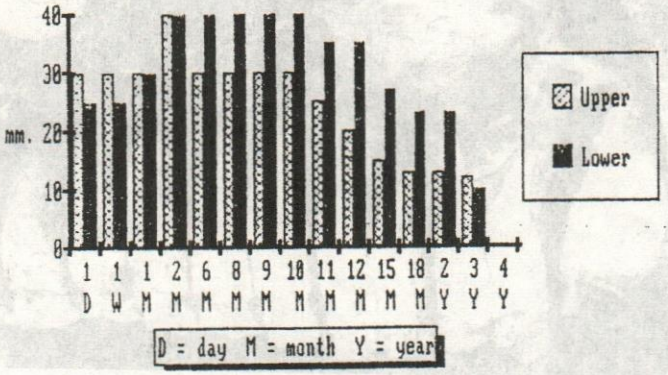

Fig.(7): Length of first permanent cheek teeth at different ages.

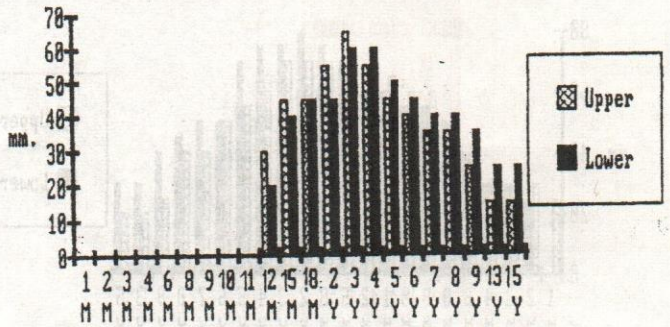

Fig.(8): Length of second permanent cheek teeth at different ages.

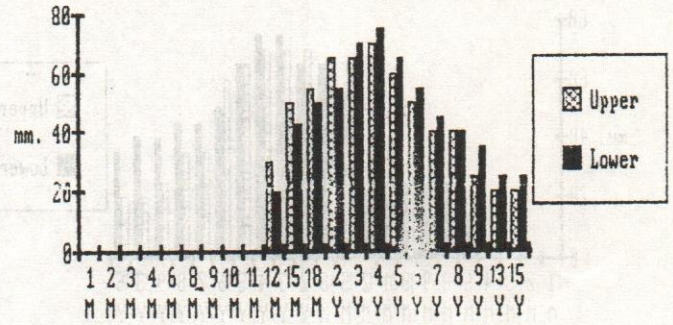

Fig.(9): Length of third permanent cheek teeth at different ages.

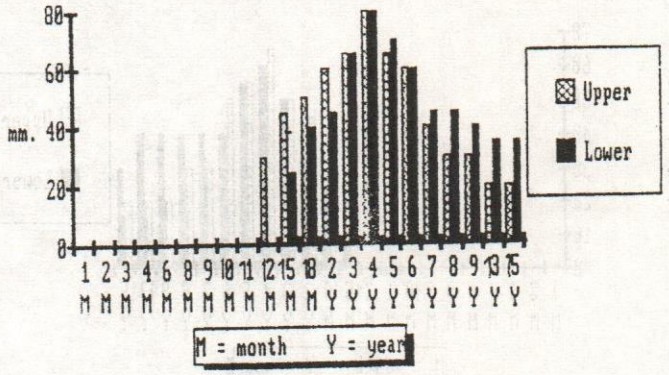

Fig. (4): Length of fourth permanent cheek teeth at different ages.

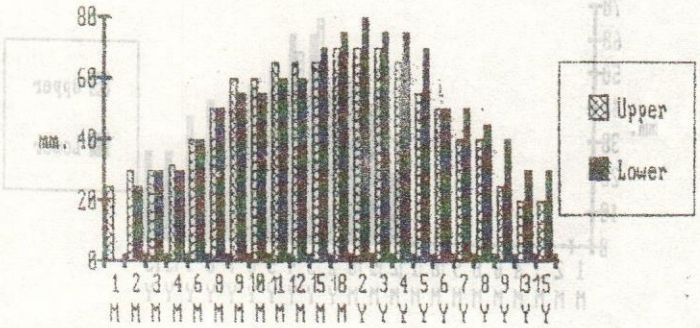

Fig. (5): Length of fifth permanent cheek teeth at different ages.

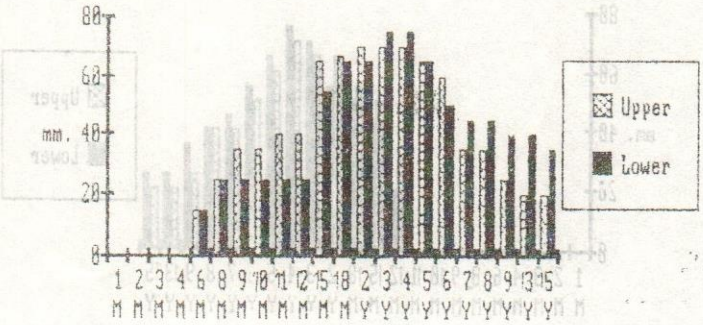

Fig. (6): Length of sixth permanent cheek teeth at different ages.

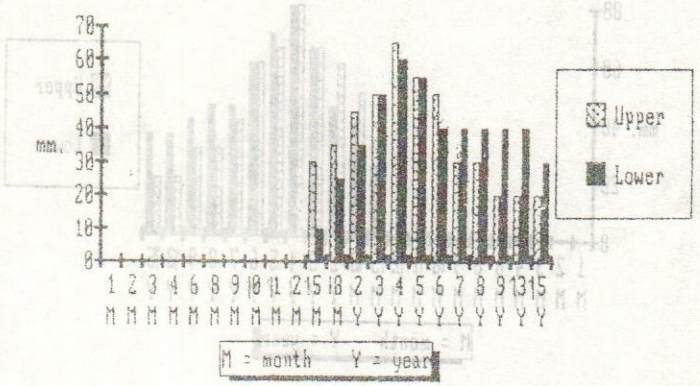

Table (1):Time of radiographic appearance of different stages of development of deciduous cheek teeth in donkeys.

Stage of development	1st cheek teeth		2nd cheek teeth		3rd cheek teeth	
	Upper	Lower	Upper	Lower	Upper	Lower
Appearance of eruption cyst	Before birth					
Early, mid & complete crown calcification						
Eruption time						
Early root formation						
Mid root formation	1m	1m	1m	1m	1m	1m
Complete root formation	6m	6m	6m	6m	6m	6m
Full tooth development	6m	8m	6m	10m	6m	10m
Early root resorption	10m	11m	11m	12m	12m	13m
Mid root resorption	12m	13m	13m	14m	14m	15m
Complete root resorption	15m	16m	16m	17m	17m	18m
Capping and shedding	2 – 4 years					

m = months.

Table (2): Time of radiographic appearance of different stages of development of permanent cheek teeth in donkeys.

Age	1st C.T		2nd C.T		3rd C.T		4th C.T		5th C.T		6th C.T	
	U	L	U	L	U	L	U	L	U	L	U	L
Appearance of eruption cyst	10[m]	11[m]	10[m]	11[m]	12[m]	15[m]	6[w]	7[w]	6[m]	7[m]	12[m]	15[m]
Early crown calcification	11[m]	12[m]	12[m]	13[m]	13[m]	16[m]	7[w]	8[w]	8[m]	9[m]	18[m]	24[m]
Mid crown calcification	12[m]	13[m]	13[m]	14[m]	14[m]	18[m]	5[m]	6[m]	13[m]	15[m]	24[m]	30[m]
Complete crown calcification	15[m]	18[m]	15[m]	18[m]	15[m]	20[m]	9[m]	10[m]	15[m]	18[m]	30[m]	30[m]
Eruption time from the bone	18[m]	24[m]	24[m]	27[m]	27[m]	30[m]	9[m]	10[m]	15[m]	18[m]	30[m]	36[m]
Early root formation	39[m]	42[m]	45[m]	48[m]	48[m]	45[m]	9[m]	11[m]	15[m]	18[m]	30[m]	36[m]
Mid root formation	45[m]	48[m]	48[m]	51[m]	51[m]	54[m]	13[m]	15[m]	18[m]	24[m]	36[m]	42[m]
Complete root formation	48[m]	54[m]	54[m]	54[m]	54[m]	57[m]	15[m]	18[m]	24[m]	30[m]	42[m]	48[m]
Full tooth development	48[m]	54[m]	54[m]	54[m]	54[m]	57[m]	24[m]	24[m]	36[m]	42[m]	42[m]	48[m]

[w] = weeks.

[m] = months.

Table (3): Radiographic length (mm) of deciduous cheek teeth at different ages in donkeys.

Age	1st cheek teeth		2nd cheek teeth		3rd cheek teeth	
	Upper	Lower	Upper	Lower	Upper	Lower
1 day	30	25	30	25	30	25
1 week	30	30	30	30	30	25
1 month	30	30	30	30	30	30
2 months	40	30	40	35	40	40
6 months	25	35	35	35	30	40
8 months	25	35	30	35	30	40
9 months	20	30	25	35	30	40
10 months	20	30	20	30	30	40
11 months	20	25	25	30	25	35
12 months	15	25	18	30	20	35
15 months	10	18	12	17	15	27
18 months	5	15	10	15	13	23
2 years	5	13	10	15	13	23
3 years	shed	shed	10	5	12	10
4 years	shed	shed	shed	shed	shed	shed

Table (4):Radiographic length (mm) of permanent cheek teeth at different ages in donkeys.

Age	1st C.T		2nd C.T		3rd C.T		4th C.T		5th C.T		6th C.T	
	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower
1.5 month	--	--	--	--	--	--	25*	--	--	--	--	--
2 months	--	--	--	--	--	--	30*	25*	--	--	--	--
3 months	--	--	--	--	--	--	30*	30*	--	--	--	--
4 months	--	--	--	--	--	--	32*	30*	--	--	--	--
6 months	--	--	--	--	--	--	40	40	15*	15*	--	--
8 months	--	--	--	--	--	--	50	50	25*	25*	--	--
9 months	--	--	--	--	--	--	60	55	35	25*	--	--
10 months	10*	--	10*	--	--	--	60	55	35	25*	--	--
11 months	20*	10*	20*	10*	--	--	65	60	40	25*	--	--
12 months	30*	20*	30*	20*	30*	--	65	60	40	25*	10*	--
15 months	45	40*	50	43*	45	25*	65	70	65	55	30*	10*
18 months	45	45	55	50	50	40	70	75	67	65	35	25*
2 years	55	45	65	55	60	45	70	80	70	65	45	35
3 years	65	60	65	70	65	65	70	75	70	75	50	50
4 years	55	60	70	75	80	80	65	75	70	75	65	60
5 years	45	50	60	65	65	70	55	70	65	65	55	55
6 years	40	45	50	55	60	60	50	50	60	50	50	40
7 years	35	40	40	45	40	45	40	50	35	45	30	40
8 years	35	40	40	40	30	45	40	45	35	45	30	40
9 years	25	35	25	35	30	40	25	40	25	40	20	40
13 years	15	25	20	25	-20	35	20	30	20	40	20	40
15 years	15	25	20	25	20	35	20	30	20	35	20	30

* Eruption cyst.

Table (5):The Radiographic length of (mm) body and root of permanent cheek teeth from age 5 up to 15 years old in donkeys.

Age Year		1st C.T		2nd C.T		3rd C.T		4th C.T		5th C.T		6th C.T	
		Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower
5	Body	35	35	50	40	60	60	45	50	60	50	55	55
	Root	10	15	10	15	10	10	10	20	10	15	0	0
6	Body	30	25	40	25	50	40	40	30	50	35	45	40
	Root	10	20	10	20	10	20	10	20	10	15	5	0
7	Body	25	20	30	30	30	15	30	30	20	25	25	30
	Root	10	20	10	15	10	30	10	20	10	20	5	10
8	Body	25	20	30	15	20	10	30	25	25	15	25	20
	Root	10	20	10	25	10	35	10	20	10	30	5	20
9	Body	15	15	15	10	20	15	15	20	15	10	15	20
	Root	10	20	10	25	10	35	10	20	10	30	5	20
13	Body	5	5	10	5	5	5	10	10	10	10	15	15
	Root	10	20	10	20	15	30	10	20	10	30	5	25
15	Body	5	5	10	5	5	5	10	10	10	5	10	10
	Root	10	20	10	20	15	30	10	20	10	30	10	20