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Evaluation of age-related changes in dentition of terrier dogs

Kaveh khazaeel[1*], Farzin Mohandespour[2], Bahman Mosallanejad[3] and Mahdi Pourmahdi Borujeni[4]

[1] Assistant Professor, Department of Basic Sciences, Faculty of Veterinary Medicine, Shahid Chamran University of Ahvaz, Ahvaz, Iran
[2] DVM, Faculty of Veterinary Medicine, Shahid Chamran University of Ahvaz, Ahvaz, Iran
[3] Professor, Department of Clinical Sciences, Faculty of Veterinary Medicine, Shahid Chamran University of Ahvaz, Ahvaz, Iran
[4] Associate Professor, Department of Food Hygiene, Faculty of Veterinary Medicine, Shahid Chamran University of Ahvaz, Ahvaz, Iran

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Abstract

Teeth eruption and wearing, especially incisors and canines, are the most practical parameters used in the clinical and physical examination of the animals. This study aimed to evaluate age-related changes in the dentition of domestic dogs in Ahvaz, Iran, to determine a relationship between arrangement of teeth and age of dogs. The present study was conducted on 173 Terrier dogs referred to the Veterinary Hospital of Shahid Chamran University of Ahvaz, which had a birth certificate. The animals were divided into 7 age groups of 1: 0 - 2, 2: 2 - 8, 3: 8 - 18, 4: 18 - 36, 5:36 - 60, 6:60 - 120 and 7: more than 120 months. The age estimation was presented based on dental profile and compared with the ancestral age. The crown length of incisors and canines were measured in the left maxillary hemi arch using a digital caliper, followed by imaging. In this study, computer and statistical studies were performed on the dental profile, correlation between crown length and age, as well as teeth wearing rate, and dental morphology. A comparison of crown length of incisors in each group showed that teeth I1, I2, and I3 had the minimum to maximum crown lengths, respectively. The correlation of estimated age with ancestral age in the studied dogs was very significant. This study showed that age assessment using teeth is one of the most important practical and true methods for age estimation in dogs.

Key words: Age estimation, Tooth, Teeth arrangement, Teeth wearing, Terrier dogs

Introduction

There are more than 360 different dog breeds around the world today, most of which have been identified by various organizations. Apartment living has attracted a large number of pet cares to small dog breeds. Some of the benefits of keeping small dog breeds include smaller space for maintenance, easier transportation, less barking, and cheaper feeding (due to the amount of food consumed). The most important small breeds are Terrier, Pekingese, Spitz, Miniature pinscher, Miniature poodle, Pomeranian, Affenpinscher, Bichon frise, Chihuahua and Dachshund (Chyan 2018). In the category of Terrier dogs, there are more than 30 breeds that due to mating between different breeds of this category, in many countries, including Iran, there are mainly terrier mix- breeds (Krause-Parello 2008).

In many cases, a veterinarian is asked to determine the age of the animal when visiting in a veterinary clinic. This is

* **Corresponding Author**: Kaveh khazaeel, Assistant Professor, Department of Basic Sciences, Faculty of Veterinary Medicine, Shahid Chamran University of Ahvaz, Ahvaz, Iran, E-mail: k.khazaeil@scu.ac.ir

important in forensic veterinary, dogs without IDs, in stray dogs when buying and selling animals, and in diagnosing certain diseases. Although it is almost impossible to accurately estimate age, especially at older ages, it is possible to estimate approximate age; the only way to estimate an animal's age is knowing its date of birth. In the absence of this information, various parameters of animal growth may be used for age estimation. Teeth eruption and wear are the most practical parameters used in clinical and physical examination of animals for age estimation (Hermanson and Lahunta 2020). The age estimation is mainly based on the characteristics of incisors and canines (Gorrel 2013). To this end, it is important to examine some changes such as the time of deciduous teeth eruption, the change of deciduous teeth and their conversion into permanent teeth, teeth wear and dental morphological changes, and the time of tooth falling out (Kouki et al. 2013). In addition to teeth, the face and appearance of the animal, general moods and behavior, hair color change, and eye changes must also be considered for age estimation (Ettinger, Feldman, and Cote 2017).

Regardless of the high importance of the dog as a pet in advanced societies, which provides the need to obtain birth certificates for the animal from birth, different forms of skulls in dogs, racial diversity, lifestyles and different diets may also be some factors influencing the small number of documented reports of dental age estimation in dogs. However, veterinary anatomy references provide a suitable description of tooth changes at different ages of dogs that need to be compared and evaluated between different males and females in different regions and races. Among the population of dogs referred to Ahvaz Veterinary Hospital, considering that Terrier dogs have the highest frequency among small breed dogs, the present study was conducted to investigate age-related changes in the teeth of this breed with emphasis on changes in incisors and canines. Given that, there are no significant resources in this regard, it is necessary to conduct a study in this field that can be available to veterinarians, veterinary students and other interested parties.

The present study aimed to evaluate age-related changes in dentition of terrier dogs to obtain correlation between dental morphology and teeth arrangement with age, and for the first time to investigate the correlation between crown length and age of dogs, considering gender and studying its effect statistically.

Materials and Methods

Study animals

The present study was conducted on 173 Terrier dogs referred to the Veterinary Hospital of Shahid Chamran University of Ahvaz, which were mesencephalon. Results based on dental changes were presented in seven age groups of 0 to 2, 2 to 8, 8 to 18, 18 to 36, 36 to 60, 60 to 120 and more than 120 (10 years) months.

It should be noted that the review of small animal files revealed that Terrier dogs and their mixed breeds were the most common in the past year. In order to carry out this project, an attempt was made to investigate an equal number of males and females as much as possible. In this study, 97 males and 76 females were studied. After obtaining the consent of the owner of the animal, in the initial examination after taking history, the dogs that have a birth certificate and whose owners are sure of the age of their animal were selected. Moreover, the animals that had the same method of keeping and similar diets and had no specific disease were screened and selected from all the referred dogs. The dental examination was then performed in accordance with the ethical principles of working with animals. Work on the samples was carried out by regarding the ethical considerations of working with animals and based on the approval of the ethics committee of Shahid Chamran University

of Ahvaz with the code of ethics: EE / 97.24.3.49903 / scu.ac.ir.

Methods for verifying the studied samples

In each case, the dog breed was verified according to the documents recorded in the birth certificate, and the age of the animal was recorded based on the same documents. As mentioned earlier, only dogs with an approved birth certificate and age based on birth date were selected for review.

The studies were performed by at least two people blindly and finally, dental age estimation was performed based on the average analysis, presented and compared with ancestral age (animal birth time) and the mentioned dental specifications were entered in the information registration form. Notable features include deciduous teeth eruption, replacement of deciduous with permanent teeth, teeth arrangement status in terms of abnormal spaces between contact surfaces and teeth falling out, morphology of incisors and canines for wear status of incisor cusps, tooth color, calculus on the vestibular surface of the canines and the rate of its progress and the rate of wear progress of incisors and canines. Also, the crown length of incisors and canines were measured in the left maxillary hemi arch using a digital caliper (Guang Lu Company, China).

Statistical analysis

The collected data were analyzed descriptively and analytically by SPSS version16 software and statistical tests such as correlation analysis, regression analysis, two-way analysis of variance, one-way analysis of variance, LSD test, independent samples t-test and Chi-square tests.

Results

In this study, 173 Terrier dog breeds were evaluated in 7 age groups that were in the age range of 7 days to 15 years. The number of dogs examined in each group is given in Table 1.

Table 1: Number of dogs studied in each age group

Age groups	Number	Mean age ± standard deviation (months)
First (under 2 months)	16 males - 8 females	1.48 ±0.46
Second (from 2 months to less than 8 months)	15 males - 10 females	4.08 ±1.79
Third (from 8 months to less than 18 months)	10 males - 14 females	12.88 ±3.3
Fourth (from 18 months to less than 36 months)	15 males - 10 females	26.35 ±5.58
Fifth (from 36 months to less than 60 months)	15 males - 10 females	46.91±7.38
Sixth (from 60 months to less than 120 months)	12 males - 13 females	79.64± 16.48
Seventh (over 120 months)	14 males - 11 females	139.68 ±16.93
Total	173	44.86 ±47.66

The eruption time of central, middle and lateral incisors

This index was assessed only in the first and second groups (according to the eruption time of the teeth), because all incisors were permanent in the dogs of the next groups.

The first group: In this age group, the deciduous incisors have grown or are growing after 3 weeks.

Concerning the deciduous incisors in this group, first the canines start growing simultaneously from both the maxilla and mandible, and then the incisors start from

the maxilla and then from the mandible. Thus, first the central incisors and then the middle and lateral incisors grew. In the present study, 94% of dogs in the first group had all deciduous teeth.

In group 2, some incisors (such as I3) were falling out and permanent teeth had been grown.

In this group, both deciduous and permanent canines were observed together in a hemi arch in 9% of the samples that were about 5 to 7 months old.

The reduction in the frequency of deciduous central teeth (dI1) between the first and second groups was statistically significant ($p<0.001$).

The reduction in the frequency of deciduous middle teeth (dI2) between the first and second groups was statistically significant ($p<0.001$).

The reduction in the frequency of deciduous corner teeth (dI3) between the first and second groups was statistically significant ($p<0.001$).

The crown length of teeth and examination of correlation with gender and age

Table 2 shows the mean ± standard deviation of the crown length of permanent incisors and canines in the studied dogs.

Table 2: Mean ± standard deviation of crown length (mm) of permanent incisors and canines

Group \ Teeth	Gender	I1	I2	I3	C
Group 2	Male	3.04 ± 1.28	3.95 ± 0.35	40.62 ± 3.06	47.72 ± 2.40
	Female	6.23 ± 7.40	3.29 ± 0.97	20.35 ± 23.63	30.5 ± 24.75
	Total	4.21 ± 4.66	3.65 ± 0.76	32.51 ± 17.37	41.98 ± 14.32
Group 3	Male	4.43 ± 0.58	4.63 ±0.47	4.84 ± 0.44	10.57 ± 2.10
	Female	4.48 ± 0.41	4.60 ± 0.39	4.83 ± 0.35	11.03 ± 3.34
	Total	4.64 ± 0.47	4.61 ± 0.40	4.83 ± 0.38	10.84 ± 2.84
Group 4	Male	4.97 ± 0.49	5.11 ± 0.52	5.53 ± 0.51	12.42 ± 1.26
	Female	4.95 ± 0.49	5.36 ± 0.42	5.67 ± 0.53	11.69 ± 3.94
	Total	4.86 ± 0.48	5.21 ± 0.49	5.59 ± 0.51	12.13 ± 2.62
Group 5	Male	5.56 ± 0.26	5.87 ± 0.24	6.21 ± 0.25	13.00 ± 1.14
	Female	5.45 ± 0.56	5.80 ± 0.47	6.18 ± 0.49	13.29 ± 1.36
	Total	5.52 ± 0.40	5.84 ± 0.34	6.20 ± 0.36	13.11 ± 1.21
Group 6	Male	5.84 ± 0.87	6.20 ± 0.77	6.51 ± 0.73	13.45 ± 4.05
	Female	6.56 ± 0.42	6.83 ± 0.43	7.12 ± 0.42	14.31 ± 1.18
	Total	6.21 ± 0.75	6.53 ± 0.69	6.83 ± 0.66	13.90 ± 2.90
Group 7	Male	6.49 ± 1.29	6.95 ± 1.05	7.31 ± 1.04	13.87 ± 1.40
	Female	6.82 ± 1.08	7.11 ± 0.99	7.44 ± 0.90	13.92 ± 1.88
	Total	6.64 ± 1.14	7.02 ± 1.02	7.37 ± 0.96	13.89 ± 1.59

The statistical study on the crown length of permanent incisors and canines

In the statistical study on the crown length of central, middle, and corner incisors and canines, the two-way ANOVA showed the results as follows:

In the central incisor (I1): Age is the influential factor in the crown length of this tooth ($p<0.001$), but gender and the interaction of gender and age have no effect on this ($p>0.05$).

In the middle incisor (I2): Age is the influential factor in the crown length of this tooth ($p<0.001$), but gender and the interaction of gender and age have no effect on this ($p >0.05$). In the corner incisor (I3): All three parameters of gender, age and the interaction of gender and age are effective in the crown length of this tooth ($p <0.001$).

In the canines (C): All three parameters of gender, age group, and the interaction of age and gender affected this factor ($p<0.001$).

The crown length of the central incisor (I1):

The age group 2 was significantly different from age groups 5 ($P<0.05$), 6, and 7 in terms of crown length ($p<0.001$).

There was a significant difference in the crown length between age group 3 and age group 5 ($p<0.05$) and age groups 6 and 7 ($p<0.001$).

Age group 4 had a significant difference in the crown length with the age groups 6 and 7 ($p<0.01$).

The crown length of the middle incisor (I2):

All age groups had a significant difference in the crown length ($P<0.001$).

The crown length of the lateral incisor (I3):

There was a significant difference in the crown length only between the age group 2 and the other groups ($P<0.001$).

The crown length of tooth canines (C):

Age group 2 had a significant difference in the crown length with all other age groups ($P<0.001$). There was a significant difference in the crown length between age group 3 and age group 5 ($p<0.05$) and age groups 6 and 7 ($p<0.01$).

The equations between age and crown length:

Crown length of central incisor × 9.23 + 0.39 = age ($p<0.001$, $r=0.65$) (strong)

Crown length of middle incisor × 29.73 - 113.27 = age ($p<0.001$, $r=0.89$) (very strong)

Crown length of corner incisor × -0.9 + 63.09 = age ($p>0.05$, $r = 0.41$) (moderate)

Crown length of canines × -0.51 + 66.13 = age ($p >0.05$, $r = 0.28$) (poor)

The prevalence of tooth wearing (presence or absence of wearing) on incisors and canines

Tooth wearing was observed from the third age group onwards. This wearing starts with the mandibular central incisors. The first sign is wearing or tear of the dental cusp. Continuation of wearing after mandibular central incisors with age, respectively, is the mandibular middle incisor, the maxillary central incisor, the maxillary middle incisor and the mandibular lateral incisor, and then the maxillary lateral incisor. However, this order was certainly not 100% for the samples.

The statistical study on the prevalence and severity of tooth wearing

In the central incisor wear (I1): There was a significant difference between age groups 1 and 2 ($p<0.001$). In the middle incisor wear (I2): There was a significant difference in the prevalence of wear between groups ($P<0.001$).

In the lateral incisor wear (I3): There was a significant difference in the prevalence wear between groups 1 and 2($P<0.01$).

The gingival recession

One of the observations of the present study was the gingival recession with age, which was observed from age group 5 onwards and increased with age. The prevalence of gingival recession was 56% in the fifth age group, 80% in the sixth age group, and 100% in the seventh age group, and this difference was statistically significant ($p <0.001$). Given the prevalence of this process in female dogs (76.5%) and male dogs (80.5%), it is logical that there was no significant difference between the sexes ($P>0.05$).

The dental calculus

By clinical examination recorded images, the prevalence of dental calculus in studied dogs was presented in all age groups.

Table 3 shows the percentage of dental calculus in all age groups.

Table 3: Prevalence of dental calculus in groups 1 to 7

Age groups	Calculus (percentage)
1	0
2	20
3	4.2
4	52
5	68
6	84
7	96

This increase and difference are statistically significant ($p<0.001$).

Dental calculus was observed in 50% of female dogs and 44.3% of male dogs; this difference was not significant ($P>0.05$).

The teeth inclination

In the present study, the teeth, especially mandibular incisors, were inclined and angled outwards from about 8 years of age onwards in some specimens. Teeth inclination was observed in 72% of age group 6 and 100% in age group 7; this difference was significant ($P<0.01$). Teeth inclination was observed in 91.7% of female dogs and 80.8% of male dogs; this difference was not significant ($P>0.05$).

The teeth falling out

The teeth falling out were observed in the sixth (16%) and seventh (52%) age groups, and this increase was statistically significant ($p <0.01$). The teeth falling out occurred in 42.3% of male dogs and in 25% of female dogs, and this difference was not statistically significant ($P>0.05$).

The teeth irregularities

Any common dental irregularities such as diastema, malocclusions and even tooth inclination were investigated in this study, which increased with age in the dogs of age group 6 and above.

The correlation of estimated dental age with ancestral age

Figure 1 shows the correlation of estimated dental age with ancestral age based on month in the dogs studied.

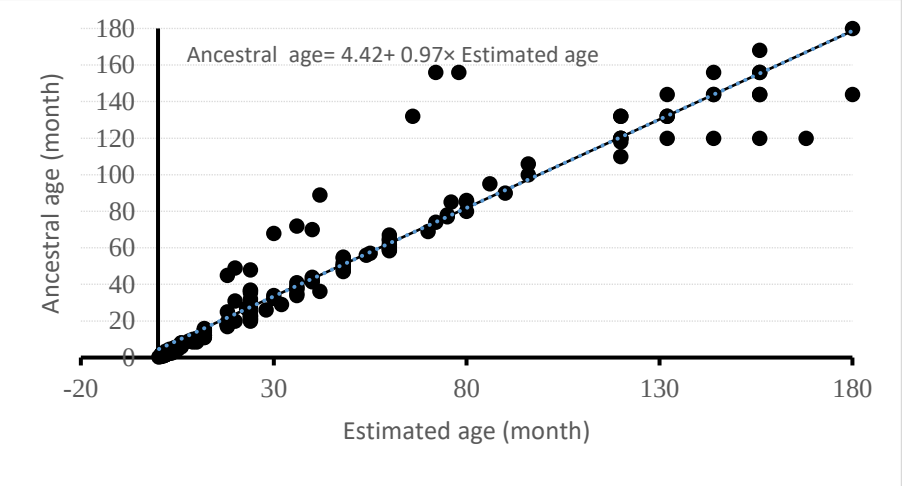

Figure 1: Correlation of estimated dental age with ancestral age in months

As shown in Figure 1, the correlation coefficient of estimated age with ancestral age was very strong and significant in the studied dogs ($r = 0.95$, $p<0.001$). This correlation coefficient in the first to seventh groups was moderate ($r = 0.05$, $p = 0.01$), very strong ($r = 0.86$, $p = 0.001$), very strong ($r = 0.91$, $p <0.001$), strong ($p = 0.64$, $p = 001$), strong ($p = 0.61$, $p = 0.001$), strong ($r = 0.751$, $p<001$) and poor and insignificant ($r = 0.31$, $p>0.05$), respectively.

Figure 1 shows an equation between estimated dental age and ancestral age in the dogs studied.

Profile of age changes observed in incisor and canine teeth

The first age group (between day zero and <2 months)

No teeth are seen until the first 3 weeks of life.

The deciduous teeth begin to grow from the first 3 weeks onwards.

The deciduous teeth have fully grown from week 3 to week 6. The complete deciduous teeth arrangement is visible at the end of this time period.

The deciduous teeth begin to fall out to replace permanent teeth from week 6 to week 8 (figure 2).

Figure 2: The onset of deciduous teeth falling out to replace permanent teeth in an 8-weeks-old Terrier dog

The second age group (between 2 and 8 months)

The replacement of incisors begins at 2 to 3 months old (figure 3).

The replacement of permanent incisors is completed from 3 to 5.5 months of age.

The eruption of permanent canines can be seen from 5 to 7 months old. In this period, both deciduous and permanent canines can be found together (figure 4).

The complete permanent teeth are observed from 7 to 8 months old. The complete permanent teeth arrangement can be seen at this age in a dog.

Figure 3: Permanent central incisor newly erupted in a 3-months-old Terrier dog

Figure 4: The presence of both deciduous and permanent canines in a 6 months old Terrier dog

The third age group (between 8 and 18 months)

The full arrangement of the teeth did not change during this time, but the onset and then the progression of central incisor wear, especially in the mandible, was observed to indicate the beginning of wearing (figure 5).

Figure 5: The onset of incisor wearing in a 14-months-old Terrier dog

The fourth age group (between 18 and 36 months)

The mandibular central incisor wearing was completed, and signs of mandibular middle incisor wearing were observed between 18 and 24 months.

The mandibular middle incisor wearing was completed from 24 to 36 months (figure 6). The signs of maxillary central incisor wearing were observed in some cases.

Figure 6: Signs of complete wearing of the lower central incisor in a 28-months-old Terrier dog

The fifth age group (between 36 and 60 months)

The maxillary central incisor wearing had been completed and signs of maxillary middle incisor wearing were observed from 36 to 48 months old (figure 7).

Completion of wearing can be seen in the middle incisor of the maxilla from 48 to 60 months old. The onset of wearing is visible on the mandibular corner incisor and then on the maxillary side as well as the canines.

Figure 7: Full wearing signs in the maxillary central incisor in a 48-months-old Terrier dog

The sixth age group (between 60 and 120 months)

Observations were different and scattered in this age group, and could not be categorized as in previous groups. In general, this age period with increasing age was associated, respectively, increasing factors such as the progress of wearing in all teeth, gingival recessions, dental calculus (figure 8) and teeth inclination to the outside of the oral cavity in incisors as well as teeth falling out.

Figure 8: Canine wearing and calculus greatly seen in an 8-years-old Terrier dog

The seventh age group (120 months and older)

The main change in this final period, from the 10 years old to the death time of the animal, is the teeth falling out, especially the incisors (figure 9). In this case, no specific order was observed in the present study. The amount of dental calculus had also reached its peak at this age.

Figure 9: Maxillary central incisor (I1) falling out and inclination of teeth seen in 14 years old Terrier dog

Discussion

The age-related expectations about adaptability, strength, mobility, and stress tolerance can vary widely between young and old animals. The age of the patient affects the thought processes associated with each aspect of the treatment protocol, including how the animals are restrained, the detection of the diagnostic differences, the treatment methods considered, and the anesthesia and medication doses selected. The age also affects adaptability and hopes for an animal's survival as well as the decision to euthanize. In the present study, the age estimation profile was presented based on the observed changes in the dog's teeth in different age categories, which can be used to estimate the age of the dogs.

This study was conducted on 173 Terrier dogs in 7 age groups in the range of 7 days to 15 years old. In the first group of dogs aged less than 2 months and in the second group of dogs aged 2 to 8 months, the study showed that deciduous incisors had been grown or were growing in the first group after 3 weeks old. Moreover, the deciduous incisors in this group began to grow, first from the maxilla and then from the mandible. Thus, first the central incisors and then the middle and corner incisors had been grown. In the first group, 94% of the dogs had all deciduous teeth. In the second group, some incisors were falling out and the permanent teeth had been grown. In this group, in 9% of the samples aged 6 to 7 months, both deciduous and permanent canines were observed together in a hemi arch. The results also showed that the crown length of incisors and canines differed significantly in different age groups. In this study, the prevalence of wearing on incisors between different age groups was significantly different but no difference was observed in the prevalence of wearing on canines between different groups. Also, the prevalence of wearing in groups 1, 2 and 3 was different from groups 4, 5, and 6. In other words, the prevalence of wearing increases with age, although there was no difference between the prevalence of wearing in groups 4, 5, and 6. Another parameter examined in the present study was the gingival recession, which was observed in the fourth age group. In present study, the correlation coefficient of estimated age with ancestral age in the studied dogs was very strong and significant.

Dogs are diphyodont, including two sets of teeth; the deciduous teeth are fallen out and a set of permanent teeth is replaced. Puppies have 28 deciduous teeth and adult dogs have 42 permanent teeth. Most deciduous teeth begin to calcify during the last 2-3 weeks of pregnancy, whose crown is formed up to three weeks, and the root calcification is completed up to seven weeks (Rashed 2015).

Despite the proper explanation of dog dental age estimation in the sources of veterinary anatomy (Hermanson and Lahunta 2020; Nickel et al. 1979; Lahunta and Habel 1986) .

The available literature review revealed that the dog dental profile evaluation has not received much attention so far for age estimation in comparison with ancestral age of the animal, and the explanation of dental changes at certain ages in dogs has been sufficient (Carney et al. 2016).

examined the diameter of dental pulp in a raccoon dog and noted a decrease in both

males and females by 2.5 years of age. Another study noted a nonlinear correlation between age and dimensions of dental pulp in coyote(Jean et al. 1986) .(Harris 1978) reported the presence of cementum annuli as a feature of age estimation in red foxes, although the growth rate of this structure varied in different fox populations.

Numerous studies have been conducted in humans, who have brachydont teeth, and the introduction of new diagnostic and imaging technologies has led to more recent studies. Bosmans et al. (2005), employed dental panoramic radiography to calculate age and showed that the dental age estimation in all mandibular teeth did not differ significantly from ancestral age.

Dog incisors have sharp protrusions called spurs, the attrition and wearing of which are the basis for age estimation(Barton 1939). In the present study, deciduous teeth are observed after 3 weeks old.

Shabestari et al. (1967), examined eruption and falling out of deciduous teeth and the emergence of permanent teeth in 106 Beagle dogs. Accordingly, deciduous teeth began to appear approximately 3 weeks after birth and were completed by the end of the fifth week. The canines erupt first and then incisors and molars. The deciduous teeth began to fall out approximately on day 110, and the first incisor appeared with the permanent maxillary molar. The last permanent tooth to appear was the third molar, which appeared around on day 175; this study had results similar to the present study.

The tooth color and the presence of dental calculus in dogs with better keeping conditions were less common. The reason could be the type of food used. In this study, it was found that the prevalence of calculus and discoloration of teeth in dogs consuming standard commercial dry foods is far less than dogs consuming human table plate waste or cooked meat and poultry.

The tooth color is affected by several intrinsic structures and extrinsic factors. The basic tooth color is influenced by the thickness and structural properties of the enamel, which affects the dispersion and absorption of light inside the enamel. Due to the relatively transparent nature of tooth enamel, the structural properties and color of the underlying dentin play a major role in the overall tooth color (Boy, Crossley, and Steenkamp 2016).

In this study, the analysis of the central, middle and lateral incisors, as well as the canines showed that the crown length of teeth from small to large size were central incisor, middle incisor, lateral incisor, and then canines, respectively. In fact, the biggest tooth was the canines, and the lateral incisor was the biggest tooth among the incisors; the age was a factor affecting the size of all teeth. In addition to being due to the growth of teeth, this factor can also be caused by increasing gingival recession with age (Harris 1978).

In terms of the correlation between crown length and age, an equation was obtained for each tooth, and there was a strong correlation between age and crown length of the middle incisor.

(Kershaw et al. 2005) used the ratio of pulp chamber to tooth width for the age estimation of adult wild dogs. Morgan and Miyabayashi examined age-related changes in permanent teeth of Beagle dogs using radiography. One of the factors studied was the size of the root canal (Kershaw et al. 2005; Morgan and Miyabayashi 1991).

In the present study, the dogs over than 7 years old showed signs of tooth irregularities, dental calculus, yellow plaque and tooth inclination. The highest rates of gingival infection or periodontal disease were observed in the seventh age group (10 years and older). Cases such as lack of pattern instructions for dental hygiene, poor nutrition, non-compliance with the principles of wound management in case of oral injuries can be the reasons for such observations in the present study.

The teeth inclination was seen in the samples older than 8 years old, so that the

teeth were inclined and angled outwards especially mandibular incisors.

In the dogs with no evidence of plaque, tartar, gingivitis, or periodontal disease, there is no change in the appearance of the gums and hard tooth structures in the age of the dog as a factor in age estimation of dogs. The plaque is usually attached daily to the tooth crown unless removed mechanically or chemically. Calcium and phosphorus in saliva mineralize the plaque, and tartar is formed. It is common to find plaque and tartar on the healthy teeth of old dogs (Bellows et al. 2015).

Landon et al. (1998), examined age estimation techniques in brown wolves using changes such as the tooth wear, the time of pulp chamber closure in the canines and cementum annuli. They stated that age estimation based on tooth decay is a relatively simple method for approximately correct age estimation in puppies and older animals up to 4 years of age. The use of dental caries has the advantage that it can be used in live animals.

In the present study, the analysis of tooth wearing showed that not all teeth of the first age group, which were deciduous, showed wearing until the time of falling out. In the second age group, no wear was observed due to the newly eruption of permanent teeth. In the third age group, on average, a mild to moderate amount of permanent central incisor was worn, but the rest of the teeth did not show wear. In the fourth age group, the central incisors had significant wear. The wear reached the mandibular middle incisors, and some wearing was seen in the maxillary central incisors. In the fifth age group, all teeth more or less showed wearing. In the sixth and seventh age groups, the wearing of all teeth was complete.

Barton (1939), examined the age estimation in dogs and found that the teeth were clean, white and full in the first year, the mandibular canines begin to wear at 15 months of age, the sharpness of mandibular canines disappears between the ages of 18 months and 2 years, the sharpness of maxillary canines begin to wear between the ages of 2.5 years to 3 years, and the sharpness of maxillary canines disappears and the teeth start to turn yellow as well as the tartar is often seen on the base of canines at the age of 4 years. All incisors are clearly worn at 5 years of age. However, it should be noted that the type of food and care of the dog's teeth can affect the amount of wear. The age can be estimated based on tooth wear and other signs, such as tooth darkening, after the age of 5 years. The color of canines tends to be green and moss-like at the age of 6 years.

The reason for this discrepancy with the present study is probably due to the type of nutrition and breed differences. The standard diet, which often includes commercial dry foods, can be more effective because of the stiffness and dryness. It is logical that breed differences affect the type and order of teeth eruption and wearing.

The study of age estimation in humans based on the amount of tooth wear was conducted in a study in 2000. The results showed that the degree of tooth wear with age in men and women had a significant correlation. They also stated that their system designed based on teeth wear is a reliable system for age estimation(Kim et al. 2000).

Smuts et al. (1978), described a system based on the appearance and disappearance of deciduous teeth and the emergence of permanent teeth as well as permanent teeth wear in African lion. They stated that the maxillary and mandibular central incisors begin to appear between the ages of 7 and 14 days, all permanent teeth appear between the ages of 18 months to 2 years, the wear occurs in the incisors and canines at the ages of 5 to 6 years old, and all teeth show signs of wear between the ages of 7 and 9 years. Wearing is seen in all teeth, along with fractures of the canines, incisors, and molars between the ages of 10 to 14 years.

(Shimoinaba and Oi 2015) examined the correlation between age and tooth wear in bears. They stated that there was a correlation between tooth wearing and age in the black bear and that the age of the bear could be estimated based on the estimated tooth wear. The highest correlation between age and tooth wearing was in the maxillary and the mandibular first and second molars.

Gonçalves et al. (2016), measured the external hole of the pulp chamber, the maximum root length and the maximum surface length of the mandibular first and second incisors, and introduced a way for age estimation in wild boar. They stated that their age estimation model showed a high percentage of deviation (61%).

McFarlin et al. (2018), proposed a method for age estimation in mountain gorillas based on incisor decay. They stated that age was significantly correlated with incisor size, but most importantly the greatest correlation was seen for the size of the first maxillary incisor.

This study showed that age assessment using teeth is one of the most important practical and true methods for age estimation in dogs.

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Conflict of interest

No conflict of interest is associated with this work.

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ارزیابی تغییرات وابسته به سن در دندان‌های سگ‌های تریر

کاوه خزائیل[۱*]، فرزین مهندس‌پور [۲]، بهمن مصلی‌نژاد [۳] و مهدی پورمهدی‌بروجنی[۴]

[۱] استادیار گروه علوم پایه، دانشکده دامپزشکی، دانشگاه شهید چمران اهواز، اهواز، ایران
[۲] دانش‌آموخته‌ی دکترای عمومی دامپزشکی، دانشکده دامپزشکی، دانشگاه شهید چمران اهواز، اهواز، ایران
[۳] استاد گروه علوم درمانگاهی، دانشکده دامپزشکی، دانشگاه شهید چمران اهواز، اهواز، ایران
[۴] دانشیار گروه بهداشت مواد غذایی، دانشکده دامپزشکی، دانشگاه شهید چمران اهواز، اهواز، ایران

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چکیده

رویش و ساییدگی دندان‌ها، به خصوص دندان‌های ثنایا و دندان نیش، عملی‌ترین پارامترهایی هستند که در معاینات بالینی و فیزیکی حیوانات استفاده می‌شوند. این مطالعه با هدف بررسی تغییرات وابسته به سن در دندان‌های سگ‌های اهلی در اهواز، ایران، برای تعیین رابطه بین آرایش دندان‌ها و سن سگ‌ها انجام شد. مطالعه حاضر بر روی ۱۷۳ سگ تریر مراجعه شده به بیمارستان دامپزشکی دانشگاه شهید چمران اهواز که دارای شناسنامه بودند انجام شد. حیوانات به ۷ گروه سنی ۱: ۰ – ۲ ، ۲: ۲ – ۸ ، ۳: ۸ – ۱۸ ، ۴: ۱۸ – ۳۶ ، ۵:۳۶ – ۶۰ ، ۶:۶۰ – ۱۲۰ و ۷: بیش از ۱۲۰ ماهه‌ها تقسیم شدند. تخمین سن براساس پروفایل دندانی و مقایسه با سن شناسنامه‌ای ارائه شد. طول تاج دندان‌های ثنایایی و دندان نیش با استفاده از یک کولیس دیجیتال در نیم قوس فک بالا سمت چپ اندازه‌گیری و سپس تصویربرداری شد. در این پژوهش، مطالعات رایانه‌ای و آماری بر روی پروفایل دندانی، ارتباط بین طول تاج و سن، و همچنین میزان ساییدگی دندان و مورفولوژی دندان انجام شد. مقایسه طول تاج دندان‌های ثنایا در هر گروه نشان داد که دندان‌های I1، I2 و I3 به ترتیب دارای حداقل تا حداکثر طول تاج هستند. همبستگی سن تخمینی با سن شناسنامه‌ای در سگ‌های مورد مطالعه بسیار معنی‌دار بود. این مطالعه نشان داد که ارزیابی سن با استفاده از دندان یکی از مهم‌ترین روش‌های عملی و واقعی برای تخمین سن در سگ‌ها است.

کلمات کلیدی: تخمین سن، دندان، آرایش دندانی، ساییدگی دندان، سگ‌های تریر

*نویسنده مسئول : کاوه خزائیل، استادیار گروه علوم پایه، دانشکده دامپزشکی، دانشگاه شهید چمران اهواز، اهواز، ایران
E-mail: k.khazaeil@scu.ac.ir