

# Occlusal Issues: Identification, Advice, and Therapy

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Malocclusion may contribute to less than optimal oral health and it is the responsibility of the veterinarian to advise clients when oral health is in jeopardy. Additionally, many breeding programs are nondescript and lack in composition. In the show ring, where winners often win by small margins, winners win big. To successfully and consistently breed winners, one must pay close attention to detail. There is more to breeding a winner who will beget winners than meets the eye. Not all veterinarians are interested in nurturing show ring clientele, either because they are unfamiliar with the nuances of breed standards or uncomfortable in recognizing structural oral abnormalities. The immediate medical goal is comfort and good health. The long-term goal is that of counseling clients on how to breed better animals so that their offspring can have good oral health without our professional intervention.

## Genetics

The genetic pattern for malocclusion in man is determined by a combination of dominant and recessive genes with incomplete penetrance and in animals as a polygenic trait.<sup>1</sup> This means that a given trait may not be seen in every generation, and the details of the hereditary pattern for jaw relationships are very complex. The determination of a dog or cat's occlusion, as well, is not governed by simple Mendelian genetics. Many genes determine the shape, size and exact location of each tooth, as well as the shape and size of each of the facial and jaw bones in which they are seated. Polygenic traits such as these are much more difficult to control than single-allele problems. If a condition is a result of a recessive trait, it is best to cull both parents, as only 25% of the offspring will be clean. We do not have as much information on the genetics of bad bites as we would like. The necessary pool of needed information resides among those who breed dogs purposefully. In order to gain more knowledge, it will be necessary for breed clubs to establish as a priority the gathering of lineage information scientifically, including registration numbers (*to avoid report duplications*), and to seek aid in compilation of competent hereditary data so that statistical tables can be constructed, possibly at one or more veterinary colleges.

Some oral structural conditions can be caused by both acquired and genetic circumstances. Some conditions can appear as a developmental problem, a congenital problem, or an acquired problem, all of which are not genetic in nature. Some conditions, on the other hand, known specifically to be genetically heritable are:

1. Missing teeth<sup>1</sup>
2. Supernumerary (extra) teeth<sup>1</sup>
3. Misalignment of teeth and oral structure<sup>1</sup>
4. Scissors Bite
5. Class I, II, and III malocclusions (Level Bite, Reverse Scissors Bite,
6. Underjet/Underbite)<sup>1</sup>
7. Anterior Cross-bite<sup>1</sup>
8. Posterior Cross-bite<sup>1</sup>
9. Wry Mouth<sup>1</sup>
10. Base Narrow Mandibular Canines, and Narrow Mandibles<sup>1</sup>
11. Head shape is known to be genetically influenced<sup>2</sup>
12. Spear/lance canines (Shetland Sheepdogs)<sup>1,3</sup>
13. Tight Lip Syndrome in the Chinese Shar Pei<sup>1,3,4</sup>
14. Amelogenesis imperfecta (one type of incomplete enamel development) in humans, has been documented to have 12 modes of genetic transmission.

## Normal and abnormal bites in dogs

As of April, 2012, of the 171 American Kennel Club breeds, 42% (71 breeds) allowed something other than a scissor bite. 59% (104 breed standards) prefer a scissor bite but allow something other than a scissor bite, and only 20% (34 AKC breeds) require full dentition, 42 teeth. Occlusion is evaluated with the breed standard in mind. We must choose, however, one jaw relationship to describe as normal so that a discussion of other jaw structure will have meaning with less chance of confusion. The model chosen as normal in dogs, as it is in people, is the scissor bite. The normal head type in dogs is the mesatocephalic head shape, as seen in the German Shepherd Dog. The line of the teeth is seen as a smooth curve not broken by rotated or misplaced teeth. All other relationships, for scientific purposes, must be considered to be in malocclusion to a greater or lesser degree. When the standard for a breed requires something other than a scissor bite, such as a level, reverse scissor, or underjet bite, dental problems may result. Even though compatible with the written standard for that breed, one must realize that "acceptable" alternative jaw relationships may cause

dental problems from the trauma and inflammation which may occur when the teeth of one jaw strike the soft tissue or teeth of the opposite arch.

### **Normal occlusion**

Is described as a scissor bite. The labial surface of the mandibular incisors should fit behind but be touching the palatal or lingual surface of the maxillary incisors, and the upper incisors should overlap the lowers. A scissor bite is healthier than a level bite, because the upper and lower teeth will not cause attrition by constant contact and will still serve their original purpose of tearing the umbilical cords of the young and the flesh from carcasses of prey. The premolars are immediately behind the canines; four uppers and four lowers. In a healthy mouth the lowers are ½ tooth in rostral to the uppers with their large pointed central cusp directed exactly between their upper counterpart and the tooth in front of it; that is, the lower 4<sup>th</sup> premolar will point upward directly between the upper 4<sup>th</sup> and the 3<sup>rd</sup> premolar. They should mesh like pinking shears: all four uppers and lowers in an integrated line, when viewed from the side, designed for grasping. The lower tips should be no farther from the upper tips than would allow them to grasp a sheet of paper placed across the mouth between them. Excessive space (when a piece of paper cannot be stabilized between upper and lower premolars) is called freeway space and is an undesirable trait because elsewhere in the mouth other teeth are interfering, preventing full closure of the mouth. The carnassial teeth (upper large 4<sup>th</sup> premolar and lower large 1<sup>st</sup> molar) should be in anisognathic relationship. A normal (orthognathic) relationship, means that the face is wider than the jaw. The upper teeth are lateral to the lowers, and in close relationship, in order to serve the intended shearing function found in the carnivore. The lower first molar should be concealed by the large, upper 4<sup>th</sup> premolar when the mouth is closed.

The Dental Interlock is the next important landmark to examine when determining genetically sound jaw relationships. Three teeth define the interlock. The lower canine should be seen between, equidistant to, and not touching the upper third incisor or the upper canine. A potential problem exists if the lower canine is crowding, either forward against the upper 3<sup>rd</sup> incisor with space behind it, or backward against the upper canine with space in front of it.

When the lower carnassial tooth is found buccal to the upper carnassial tooth, it is referred to as a posterior crossbite. It may be due to a narrow face or a wide jaw and can occur unilaterally or bilaterally. It is very heritable and undesirable.

It is important to be able to identify the various deciduous teeth and adult teeth in the dog when evaluating its dentition. Puppies are born without visible teeth. They should have 28 deciduous teeth which normally begin erupting between the 3<sup>rd</sup> and 6<sup>th</sup> week. The number of adult teeth in the dog is 42. The canine teeth erupt between 5 and 6 months. Their function is for puncturing and holding. These 16 incisor and canine teeth are the rostral teeth. The caudal teeth are comprised, on each side, of 4 upper and 4 lower premolars which are aligned in a row with sharp front and back edges and pointed cusps. Their design is for grasping and shearing. Behind the premolars on each side are 2 upper and 3 lower molars. The molars all have opposing, flat occlusal surfaces. They serve to grind the food and masticate it before it is swallowed. The one exception is the large lower 1<sup>st</sup> molar, the front part of which is shaped as a premolar. The front part of this tooth performs a shearing action with the upper 4<sup>th</sup> premolar, while the back portion of the tooth grinds food against the upper first molar. The upper fourth premolar and the lower first molar, for this reason, are called the carnassial teeth and are identified in all carnivores as such. The first premolar normally erupts at 5 to 6 months. The second and third premolars erupt at 6 months, the fourth premolar between the 5<sup>th</sup> and 6<sup>th</sup> month and the second and third molars between the 6<sup>th</sup> and 7<sup>th</sup> month.

### **Class I malocclusion**

Is the most important malocclusion for the serious breeder to identify. It contains subtle changes in the dental relationship while the length of the maxilla and lower mandible remain normal. It can occur in four basic formats. The first form of Class I malocclusion occurs in conjunction with a scissor bite because the relationship of the length of the dog's face and jaw are proper. The most subtle of the Class I changes are seen as a shift in the relationship of the upper and lower premolar interdigitation. Instead of a lower premolar properly pointing exactly between the appropriate two upper premolars, it, and possibly one or more other lower premolars, will be seen as shifted, either 1/3 or ½-a-tooth etc., in front or behind its normal position. A lower 4<sup>th</sup> premolar whose central cusp is oriented exactly opposite the upper 3<sup>rd</sup> or 4<sup>th</sup> premolar's central cusp is said to be "½-tooth off." One or all lower or upper teeth may have shifted.

The second form of Class I malocclusion occurs with proper upper and lower premolar interdigitation indicating a normal upper and lower jaw relationship. But there will be one, two, or three displaced/mal-oriented rostral teeth. An rostral crossbite occurs when a dog has a normal premolar interdigitation, a healthy canine dental interlock, and a scissor bite with the exception that one to several of the incisors are in reverse scissor orientation. The third form of Class I malocclusion is narrow-based lower canines in which one or both lower canines impinge(s) on the upper gums or palate. The fourth form of Class I malocclusion is seen when individual teeth are crowded, rotated or misplaced while an incisor scissor relationship is still maintained. In circumstances of this fourth kind, we might, instead, see one or both lingually displaced lower first molars. This is a posterior crossbite. Many genes govern the size of each segment of each side of the upper and lower arch. When one sees the premolar teeth and the dental interlock shifting before seeing the loss of the scissor bite, it is a subtle indication that if the gene impact is compounded, the next and more exaggerated effect will be a change in actual jaw length and relationship.

### **Class II malocclusion (overjet, overbite, overshot, brachygnathic, parrot mouth, sharkbite)**

Occurs when the lower incisors are behind the uppers but do not touch them. Some breed standards tolerate 1/16 to 3/16" of horizontal space between the upper and lower incisors in their allowable standard, but be aware that if you breed two such animals, the genetic impact of the "fault" may well be intensified. The Class II malocclusion should be described in horizontal millimeters of gap between the upper and lower central incisors and as a fraction of tooth displacement at the lower 1st, 2nd, 3rd or 4th premolar. For example, a dog might be described as having a 5mm Class II bite at the central incisors and be ½- tooth off at the upper 2nd premolars. No breed standard tolerates an overbite. A serious problem that may occur is seen when the lower canines penetrate the upper gums or palate. This penetration can cause an irritable temperament, and the defect invites impacted food and subsequent infection in the puncture sites. If the defect is adjacent to the upper canines, an infection alongside these teeth can result in their eventual loosening and loss from the mouth.

**Class III malocclusion (underjet, underbite, undershot, brachycephalic, prognathic, sow mouth, monkey bite).**

This problem is seen in a mild form as a level bite (even). 79 of the 159 American Kennel Club breeds (50%) permit a level bite. In a level bite the upper and lower incisors meet, incisal edge to incisal edge. A level (even) bite is identified as a Class III malocclusion by the forward shift of the lower premolars. If intensified, the condition increases to become a reverse scissor bite. The lower incisors overlap the upper incisors, but the lingual surface of the lower incisors are in contact with labial surface of the upper incisors. If the trait is further intensified, a horizontal gap will be seen between the front of the upper incisors and the backs of the lower incisors; these dogs are described as having an underjet. Some breed standards call for a reverse scissor bite; some allow a 1/8" horizontal gap between the overlapped upper and lower incisors. A reverse scissor bite is more healthy than a level bite because it can be very functional in a fashion similar to a scissors bite, but some lines of dogs have large enough upper incisors to cause damage to the supporting tissues behind the lower incisors. As mentioned earlier, the most damaging of symmetrical bites which, unfortunately, is accepted by half the 159 American Kennel Club breeds, is the level bite. The level bite is traumatic because there is a constant wearing away (attrition) of the incisal edge of the front teeth as they interfere with each other. Additionally, the continual trauma resulting from the upper incisors pushing against the lower incisors creates inflammation of the supporting tissues that surround the tooth roots. This inflammation can promote periodontal disease and the eventual loosening and loss of the involved teeth. When an underjet or level bite is identified in an animal whose breed standard considers it undesirable, the next challenge is to determine if the underjet dog has a long mandible or a short maxilla. It is helpful, here, to open the mouth and examine the upper premolars for rotation and crowding. The first premolars to rotate are usually the 3rd and then the 2nd upper premolars. If premolars are rotated and crowded, then the dog is said to have a short face. If the upper premolars are positioned normally, then the lower jaw is determined as having a long jaw. The importance of this revelation is to determine the origin of the trait as seen in animals of previous generations. As previously stated, the goal is to breed to a better mate.

**Wry bite**

Is one identified as asymmetrical. When evaluating occlusion and the incisal relationship, the dental interlock and the interdigitation of the premolars are all found to be normal on one side, the other side must also be evaluated. If one side is normal and the other side is abnormal, then examine the animal head-on for symmetry. In an asymmetrical (*wry*) bite, the upper and lower central incisors will not be in symmetrical alignment. The alignment will be 1/8 tooth or more deviated, and one side the dental interlock will be abnormal. Additionally, the incisor bite on one side may be in scissor occlusion, while the other side may be in reverse scissor occlusion. Furthermore, in cases such as this, an open bite is often seen when the mouth is fully closed; it is identified as a vertical gap existing between the upper and lower incisors allowing the tongue to protrude. A wry bite can be the result of either an asymmetric face or an asymmetric jaw, or both. A wry bite is very heritable and difficult to breed out of a line of dogs.

**Other malocclusions**

**Dropped incisors**

Is a breeder's term for when mandibular incisors, usually the centrals, are labial to the natural curve of the arch. It is inherent in the lines of a number of breeds, and in the smaller breeds many times it is accompanied developmentally by insufficient bone to adequately and firmly support those two teeth.

**Narrow-based canines**

Appear as an animal that has the lower canines traumatizing the upper gums, teeth or palate. It can be the result of an overjet bite (Class II malocclusion), lower canines that are displaced inwardly by retained deciduous teeth, improperly located and as yet unerupted adult tooth buds, or a hereditarily narrow mandible which can affect one or both sides of the jaw. Several conditions may appear similar. It is important, especially here, to correctly identify the origin of the condition if an improvement in the line is to be made through selective breeding. Normally the upper and lower first three premolars should be interdigitated in orientation and the upper and lower arcade are in a shearing orientation opposite each other. If the lower 1st, 2nd and/or 3rd premolars are oriented in a line, but are more toward the midline rather than in a healthy shearing orientation in relation to their upper counter parts, there will be a horizontal gap between the upper and lower premolar cusps; then the mandibles are said to be narrow. Most commonly this is seen as a narrowing, or pinching inward, of the lower jaw at the 1st premolar. In almost every instance the problem is considered hereditary.

### **Interceptive orthodontics**

An important concept to have is that, in the growing pup, the face and jaw grow independently, as do the left and right sides. Genes for growth and development govern each of the four quadrants and sections within each quadrant. Usually the face and the jaw grow at the same rate with periodic segmental growth spurts occurring in various parts of the face and jaw. If an internal stress were to occur in a genetically healthy pup at the time it was about to experience a growth spurt, that segmental growth might be interrupted and that portion of either the upper or lower jaw could fall behind in its development. Furthermore, if the development of the facial bones fell behind and the face was short, the upper incisors could become trapped behind the lower incisors. If the mandibular growth was interrupted, the lower deciduous canine teeth might penetrate and create a pit in the palate of the longer face. Since puppies sleep 80% of the time and the jaw is closed at rest, the jaw would continue to grow at the same rate as the face but the lower canines would be trapped and the jaw growth could not catch up. Interceptive orthodontics is a procedure in which the interfering rostral teeth are extracted. The procedure should be scheduled as soon as the problem is detected, preferably at eight weeks of age to allow the short jaw as much time as possible to catch up - if it will, before the adult teeth erupt. This procedure in no way stimulates jaw growth; it merely removes interference to allow a growth catch up.

### **Missing teeth**

A genetic problem increasingly found in more lines of dogs and in more breeds of dogs. Unfortunately only thirty-seven (37 of 159) AKC breed standards require a full dentition. The unerupted tooth buds are present and can be identified by dental radiograph at ten weeks of age.

### **Supernumerary teeth**

Also a genetic trait. When evaluating a dog's bite, you must avoid incorrectly deciding that a dog has a Class I malocclusion when, in fact, an extra premolar makes it appear that the premolars are not properly interdigitated. You must also avoid judging a dog to have a wry bite if the asymmetry is an illusion caused by the presence of an extra/supernumerary 7<sup>th</sup> incisor in the upper or lower arch.

### **Persistent deciduous teeth**

A condition in which one should never allow two teeth of the same kind to be in the same place at the same time. Especially if a breed or line of breeding is known to retain its deciduous teeth, any deciduous tooth still in place as the tip of its successor is about to erupt should be carefully extracted so that its entire root is retrieved. Risk of adult tooth displacement and oral disfigurement and discomfort exists if a deciduous tooth is allowed to remain while the adult tooth is erupting. The mandibular adult canines will be displaced lingually and the adult maxillary canines may be displaced forward (*Spear teeth*) which, in addition to being unsightly, often seriously reduces the space between it and the upper 3<sup>rd</sup> incisor where the properly aligned lower canine would normally fit. Adult teeth which erupt in the wrong position can compromise the oral health of the dog. These teeth should be moved orthodontically, extracted surgically, or recontoured (*odontoplasty*) to avoid or alleviate discomfort.

### **References**

- Saidla JE. Dentistry: Genetic, Environmental, and Other Considerations. In: Ettinger SJ and Feldman EC eds. Textbook of Veterinary Internal Medicine 5th edition, WB Saunders, Philadelphia 2000 pp.1122-26.
- Stockard CR. The Genetic and Endocrine Basis for Differences in Form and Behavior No. 19. The Anatomical Memoirs. Wistar Institute of Anatomy and Biology, 1941, pp. 150-153.
- Holmstrom SE, Frost P, Eisner ER. Periodontal Therapy and Surgery . In: Veterinary Dental Techniques, 3rd edition, p. 282, 2004. WB Saunders, Philadelphia, PA.
- McCoy DE. Surgical management of the tight lip syndrome in the Shar Pei dog. J Vet Dent volume 14 p.95, 1997.
- Eisner, ER. Bites, Breath, and Benevolent Breeding, 6th edition, 2012, self-published (contact dog2thdoc@gmail.com)