

A Removable Orthodontic Device for the Treatment of Lingually Displaced Mandibular Canine Teeth in Young Dogs

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Summary: The malocclusion of lingually displaced mandibular canine teeth is a common orthodontic problem in the domestic dog. Several treatment methods have been described, and their advantages and disadvantages have been extensively reviewed. This article describes a functional technique used in 38 dogs of different breeds for correction of the malocclusion. The technique consists of stimulating the dog to play with specific toys. It is a simple, inexpensive, non-invasive technique that has a success rate comparable to conventional orthodontic techniques for treatment of this common malocclusion. J Vet Dent 16(2); 69-75, 1999.

Introduction

The malocclusion of lingually displaced mandibular canine teeth is a relatively common orthodontic problem in the dog.¹⁻⁶ This malocclusion may be due to a dental abnormality, a skeletal abnormality, or a combination of both.^{7,8} The palatal contact of the mandibular canine crown tips frequently causes discomfort and pain, and may lead to mucosal ulceration, infection, and even oronasal fistulation.⁷⁻¹⁰

Several treatment methods have been described to correct the abnormality or to relieve the discomfort of the animal.^{4,8,10-13} Movement of the maloccluded teeth may be undertaken using orthodontic appliances: inclined plane (direct or indirect),¹⁴⁻¹⁸ telescoping inclined plane,¹⁸ or active force devices (expansion screw, W-wire, modified quad helix).^{2,8,19} The majority of these are fixed appliances, though removable appliances are also described. Other treatment options include surgical repositioning,^{13,20,21} surgical crown reduction and extraction.^{8,10,11,13}

All of these techniques have advantages and disadvantages, which have been reviewed extensively.^{4,6,12} All of them require anesthesia on at least one occasion, with some techniques requiring multiple anesthetic episodes.

This paper describes a very simple, inexpensive, animal- and owner-friendly technique for correction of lingually displaced mandibular canine teeth when no other severe malocclusion is present. Additionally, the technique enhances the animal-owner bond. The technique can be described as a behavior modification technique using a removable orthodontic device.

Technique

This technique for correcting uncomplicated cases of lingually displaced mandibular canine teeth involves stimulating the dog to play, as often as possible, with specific rubber toys of an appropriate size and shape. Correct diagnosis is critical for success of treatment. No major jaw length discrepancy should be present. The diastema between the maxillary third incisor and canine teeth should be wide enough to accommodate the mandibular canine tooth in its corrected position. Playing with and chewing on a suitable object forces the mandibular canine teeth into a comfortable and more normal occlusal position.

The most appropriate objects to use are toys with a round or oval shape. Toys with ropes or handles should not be used, since dogs tend to take toys in their mouth the easiest way, e.g., by the rope if it is present. The size is important. Too small a toy will not touch both mandibular canines at the same time, and also might be taken too deeply into the mouth. Too large a toy (i.e., one that lies on top of the canine crown tips) might cause intrusive rather than lateral tipping pressure and might be uncomfortable, causing the dog to give up playing. The correct size of toy sits in between and just behind the canine teeth, and is larger than the distance between the canine teeth, and thus applies principally lateral pressure to the teeth while the dog plays.

In some dogs very large toys are needed, because the dog holds objects between its carnassial teeth rather than the canine teeth. In that case the toy needs to be so large that it does not fit between the carnassial teeth, as this is likely to result in some

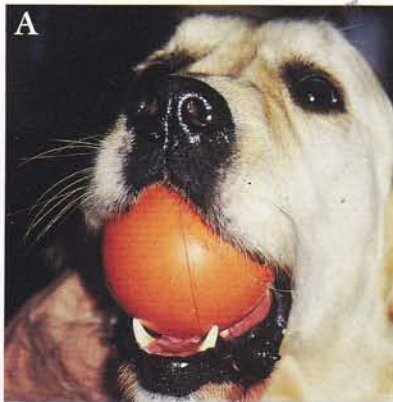


Figure 1: Dog with rubber ball (A) and dog with rubber chew toy in its mouth (B). The potential beneficial effect of the toy on lingually displaced mandibular canine teeth can be clearly seen. The toy subjects the teeth to tipping pressure in a labial direction.

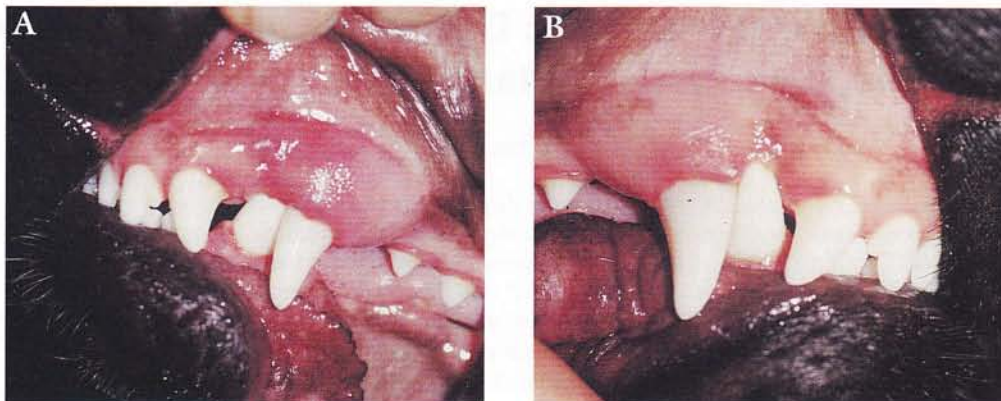


Figure 2: Case 17 at initial presentation, left lateral (A) and right lateral (B) views. Although the displacement of the left mandibular canine tooth is only moderate, clinically the situation is severe, with the tip of the crown of the mandibular canine tooth sitting in the periodontal space of the maxillary canine tooth.

degree of rostral, as well as lateral, tipping of the canine teeth. In selected cases, where rostral as well as lateral tipping is required, carrying the toy between the carnassial teeth can be useful in some cases but undesirable in others.

The composition and consistency of the object are important. The toy should be hard rubber, slightly deforming on chewing. Too soft a toy is unlikely to create enough pressure and would be rapidly destroyed by chewing. Toys that are too hard or abrasive could damage the teeth. The toy should have a smooth surface to avoid excessive tooth wear.

Active play for 15 minutes, 3 times per day is the recommended minimum; however, longer and more frequent episodes are preferable. The owner is advised to play with the dog as often as possible and to take away all other toys. Assuming a 1 week learning phase before the treatment becomes effective, 2 additional weeks are needed before any benefit from the treatment is likely to be seen. Occlusion is checked 3 weeks following the start of treatment, then again at monthly intervals as necessary. If no movement is seen after 3 weeks, other treatment methods should be considered.

Results

Thirty-eight dogs, most of them of large and giant breeds, are included in this series of referral cases seen during a 2-year period. The results are summarized in Table 1. The extent of displacement of the mandibular canine teeth has been divided into slight, moderate, and severe. Slight displacement indicates that the tips of the mandibular canine teeth contact the buccal half of the diastema between the maxillary third incisor and upper canine teeth. Moderate displacement indicates that the canine crown tips press into the palatal half of the diastema, and severe displacement is used for those dogs in which the crown tips of the canine teeth impact onto the palate. Table 1 also includes information on the presence or absence of other malocclusions. Mandibular retrognathia was present in several cases and the severity has been divided into either slight (less than 3mm) or significant (more than 3mm gap between the maxillary and mandibular incisor teeth).

Cases were followed for 2 weeks up to 2 years. One case was lost to follow-up. Long-term follow-up in most cases was done by telephone contact with the owner or through the referring veterinarians. No relapses were reported following use of this technique.

In 14 dogs with no other malocclusion present, the mandibular canine teeth displacement had been corrected within 2 months, treatment sometimes taking as little as 2 weeks. The time required for correction was recorded for 26 dogs, and ranged from 2-12 weeks. For dogs aged 5 months at the start of treatment, the time required for correction ranged from 2-8 weeks (median 3 weeks); for dogs aged 5½ months, time required was 2-6 weeks (median 4 weeks); for dogs aged 6 months, time required was 3-4 weeks (median 3.5 weeks); for dogs aged 6½ months, time required was 2-7 weeks (median 4 weeks); for dogs aged 7-9 months, time required was 5-12 weeks (median 7 weeks).

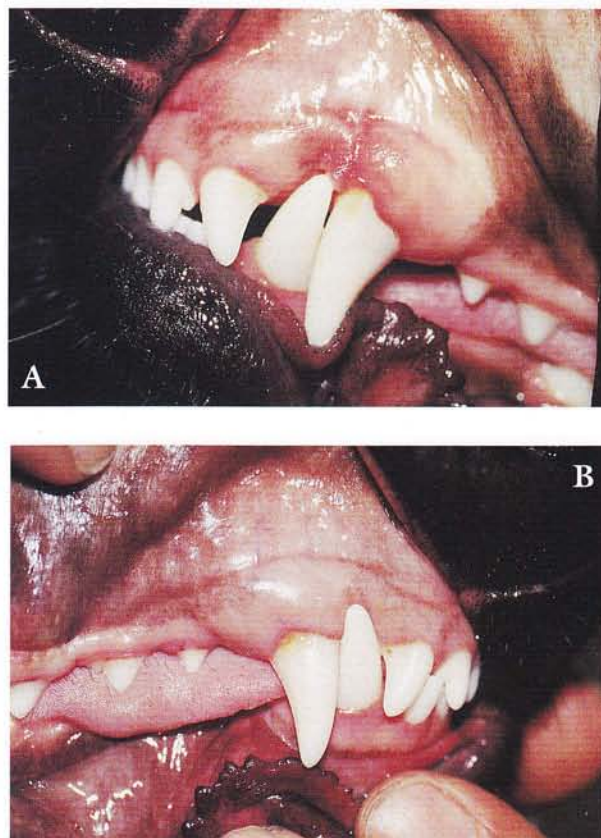


Figure 3: Case 17 after 17 days of treatment, left lateral (A) and right lateral (B) views. The mandibular canine crown tips have moved 4mm labially.

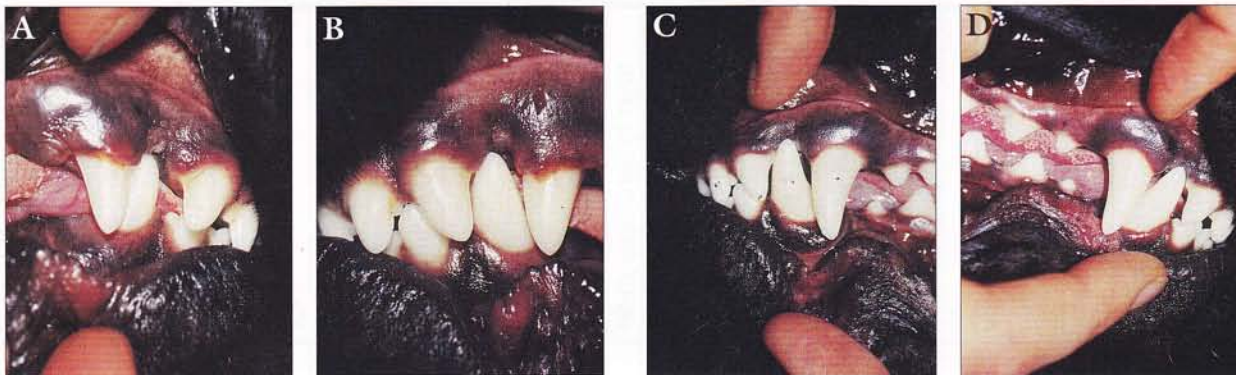


Figure 4: Case 24 at initial presentation, right lateral (A) and left lateral (B) views.

Case 24 four months later, left lateral (C) and right lateral (D) views.

Four dogs had retained deciduous canine teeth present in the mandible. The deciduous teeth were extracted. The malocclusion was corrected in these four dogs. One of these dogs also had rostral (incisor) crossbite.

Eight dogs had slight to severe narrowing of the mandible (unilateral or bilateral). In a normal occlusion, the mandible needs to be slightly smaller than the maxilla. The buccal face of the mandibular first premolar tooth falls just palatal of the palatal face of the maxillary first premolar tooth. If the mandible is narrow as compared to the maxilla, a gap can be seen between the mandibular and maxillary first premolar teeth when looking at the jaws in a ventrodorsal view. The difference between slight and severe was made in an arbitrary way. The lingual displacement of the canine teeth in six of these dogs was corrected in 2 weeks to 2 months. In one, a Staffordshire terrier, the lingual displacement of the canine teeth was corrected only on the least affected side, and crown reduction was performed on the canine tooth on the severely affected side. In another dog, an Airedale terrier, the tooth moved 3.5mm in 3 weeks, and then continued to move at a rate of 0.5mm per month.

Eight dogs had slight or severe mandibular retrognathia, and these had the worst outcome in the series of cases. Three of them, with slight mandibular retrognathism, were corrected in 2-3 weeks. One was moving slowly (0.5mm per month), one was unilaterally corrected, and in three dogs the canine teeth did not move. One of these dogs, an Airedale terrier with a severely narrowed and slightly retrognathic mandible, did not want to play with any toys. A combination of acrylic inclined planes attached to the maxillary canine teeth and gingivoplasty of the maxillary third incisor-canine diastema were used to provide relief of the animal's discomfort.

One bull terrier with a wry bite and severe narrowing and retrognathism of the right mandible showed no movement of the mandibular canine tooth over a period of 2 months. One Bichon Frisé had a malpositioned right mandibular canine tooth. The root of the mandibular right third incisor tooth blocked any labial movement of the canine tooth, and this incisor tooth was extracted. The malpositioned (ectopic) canine tooth was only half erupted. The root was not exposed after extraction of the incisor, but the remainder of the crown (still in the alveolar bone) was exposed. The canine tooth moved into normal position over a period of 4 months. One mixed breed dog showed a more complex malocclusion. Left mandibular and maxillary deciduous canine teeth were retained. With the

mandible being 2mm longer than the maxilla, the permanent mandibular canine teeth were touching the palatal sides of the maxillary third incisor teeth. The left third incisor tooth had already moved buccally, being inclined 45° compared to a normal position. The right third incisor tooth was still in a normal position. To give this dog a more comfortable bite, the left third incisor tooth was extracted. On the right side, only the retained deciduous canine teeth were extracted, and the dog was given a rubber ball to play with. Although the left mandibular canine tooth seemed to be trapped behind the maxillary third incisor tooth, it moved into a normal position over a period of 5 weeks.

Discussion

Lingually displaced mandibular canine teeth are a common malocclusion, reported in many breeds.¹⁻⁶

Several orthodontic treatments have been described. The most widely used are inclined planes, attached to the maxillary teeth, in different forms: direct acrylic inclined plane,^{15,17,18} indirect acrylic or metal inclined plane.^{14,16} In young, growing dogs the use of a telescoping inclined plane is preferable, to overcome the problem of inhibited jaw growth resulting from use of fixed appliances.^{10,22} These are all functional devices, which rely on the dog to create orthodontic force when it closes its mouth. Active devices are also used, placed in the mandible. Examples are expansion screws, W-wire, and modified quad-helix.^{2,8,10,13,19} Surgical repositioning is another technique that has been used for movement of maloccluding teeth.^{13,20,21} For these treatments no major jaw discrepancies should be present. When major jaw discrepancies are present, surgical crown reduction (including partial pulpectomy, pulp capping, and surface restoration) of the mandibular canine teeth is often the best treatment, although extraction is another option.^{10,11} Use of an external fixator for forward movement of mandibular canine teeth has been described in a case of mandibular retrognathia.²³ Some of these techniques are more appropriate and have fewer adverse effects than others. For successful use of any orthodontic appliance, a cooperative dog and owner are necessary.^{4,8,10,12} Good oral hygiene is necessary to reduce mucosal inflammation around the appliance, and frequent examination is recommended. All toys should be removed to avoid loss or breakage of the appliance.

In the rubber-ball technique, cooperation is also necessary. The owner needs to actively play with the dog and the dog needs to be willing to play. In most cases, when working with young dogs, interest in playing is not a problem. Toys other than the round

	BREED	SEX	AGE	DESCRIPTION*	OTHER DENTAL / OCCLUSION PROBLEMS	RESULT	OTHER/FURTHER TREATMENT
1	West Highland White terrier	M	6m	bilateral, moderate	no	corrected, 4w	no
2	Newfoundland	F	5m	severe on right side	no	corrected to slight 2w, no further movement	gingivoplasty right side
3	Newfoundland	F	5m	bilateral, moderate	no	corrected, 3w	no
4	Bobtail	F	7m	bilateral, moderate	no	lost to follow-up	no
5	Briard	M	5.5m	left side moderate, right side slight	no	corrected, 3w	no
6	Leonberger	F	5.5m	slight on left side	no	corrected, 4w	no
7	Leonberger	M	5.5m	moderate on left side	no	corrected, 4w	no
8	Leonberger	M	6.5m	moderate on left side	no	corrected, 4w	no
9	Airedale terrier	M	7m	left side severe, right side moderate	severe narrowing of the mandible, slight mandibular retrognathia	not corrected	direct inclined plane, gingivoplasty
10	Airedale terrier	F	6m	bilateral, moderate	slight narrowing of the mandible	corrected, 4w	no
11	Bichon Frisé	M	9.5m	severe on right side	malpositioned C, I3 root blocking movement of canine tooth	corrected, 3m**	extraction of I3
12	Bearded collie	F	8m	slight on left side	slight mandibular retrognathia	not corrected	gingivoplasty
13	Rottweiler	M	7m	severe on left side	severe mandibular retrognathia	not corrected	crown shortening
14	Cocker spaniel	M	5m	bilateral, moderate	no	corrected, 2w	no
15	Briard	F	5m	left side severe, right side slight	no	corrected, 3w	no
16	Maltese	M	7m	bilateral, moderate	no	corrected***	no
17	German shepherd	F	5.5m	left side moderate, right side slight	no	corrected, 3w	no
18	German shepherd	F	6m	moderate on left side	left mandible narrow and slightly retrognathic, supernumerary maxillary left P1 tooth	corrected**	no
19	Cocker spaniel	M	5m	slight on right side	right mandible narrow, retained maxillary right deciduous canine tooth	corrected, 3w	extraction of deciduous tooth
20	German shepherd	F	6.5m	bilateral, moderate	retained mandibular deciduous canine teeth	corrected**	extraction of deciduous teeth
21	Rottweiler	F	6m	bilateral, severe	rostral crossbite, retained mandibular deciduous canine teeth	corrected, 4w	extraction of deciduous teeth
22	Staffordshire bull terrier	M	5m	left side severe, right side moderate	narrowing of mandible	right side corrected, 2m	crown shortening of left mandibular canine tooth - dentin sealant
23	Rottweiler	F	6.5m	left side severe, right side moderate	severe left mandibular retrognathia	right side corrected, 4w	crown shortening of left mandibular canine tooth - dentin sealant
24	Flatcoated retriever	M	5.5m	left side moderate, right side severe	retained maxillary deciduous canine, supernumerary maxillary left P1 teeth	corrected, 4w	extraction of deciduous teeth

Table 1. Clinical Features of 38 dogs with Lingually Displaced Mandibular Canine Teeth

25	Dobermann	F	8m	slight on left side	left mandible narrow	corrected, 2m	no
26	Bearded collie	M	6m	moderate on left side	slight mandibular retrognathia, narrow left mandible	corrected, 3w	no
27	Norfolk terrier	F	6m	severe on right side	crowded incisors, retained mandibular deciduous canine teeth	corrected, 3w	extraction of deciduous teeth
28	Russian terrier	M	5.5m	bilateral, moderate	narrow mandible	corrected, 6w	no
29	Bull terrier	M	5m	severe on right side	wry bite, severely narrowed and retrognathic right mandible	not corrected**	needed surgical crown reduction
30	German shepherd	F	5.5m	moderate on left side	narrow and slightly retrognathic left mandible	corrected, 2w	no
31	West Highland White terrier	M	6.5m	bilateral, moderate	severe mandibular retrognathia	moving****	no
32	Leonberger	M	7m	slight on left side	no	corrected, 6w	no
33	Airedale terrier	M	6m	severe on right side, slight on left side	severely narrowed right mandible	Moving****	no
34	Dachshund	M	6.5m	severe on right side, moderate on left side	narrow mandible	corrected, 7w	no
35	American Staffordshire terrier	F	5m	bilateral, moderate	no	corrected, 5w	no
36	Rottweiler	M	5.5m	bilateral, moderate	retained mandibular deciduous canine teeth	corrected***	extraction of deciduous teeth
37	Mix breed	M	7m	bilateral, severe	wry bite, retrognathic maxilla, mandibular canine teeth trapped by maxillary lateral incisor teeth, retained deciduous canine teeth left side	corrected, 5w	extraction of deciduous teeth, extraction of right maxillary lateral incisor tooth
38	German shepherd	M	6.5m	slight on right side	narrowed right mandible	corrected, 2w	no

* Criteria for describing the severity of the condition are described in text.

** Re-examination by referring veterinarian.

*** Did not come for re-examination beyond 3 weeks, then seen several months later. Time of movement is unknown.

**** No further follow-up.

or oval rubber chew toy should be taken away, and several toys may induce more play activity than only one. In multiple dog households, many toys may be necessary because the older dogs steal toys from a younger one.

All the commonly used orthodontic techniques require multiple anesthetics with the associated risk and expense. The rubber toy technique is inexpensive and avoids the necessity of anesthesia. It would be advisable to obtain full pre- and post-treatment impressions and radiographs, as with any orthodontic technique, but some owners are not willing to have their dogs anesthetised just to take impressions. As a compromise, hard wax bite wafers can be used to record crown tip positions in most conscious dogs. Photographs can be taken to record the extent of malocclusion, taking a rostral, left and right view of each case.

The rubber ball technique has several other major advantages as compared to working with the previously described appliances, which can cause several problems.^{2,4,6,8,10,12} In young dogs, jaw growth might be inhibited by appliances that cement the maxillary canine and incisor teeth in fixed position.^{6,10,22} When teeth are not fully erupted at the time a fixed appliance is placed, it is likely that continued eruption will result in displacement of the appliance.⁸ Pressure from appliances might lead to soft tissue trauma. Good oral hygiene is not mandatory for successful outcome when using the rubber ball technique. Oral soft tissue trauma from pressure, inflammation, and ulceration are very unlikely with this technique, unless the dog is allergic to rubber. Jaw growth is not inhibited as is seen with some of the fixed appliances.

People obtain dogs for their pleasure, but often do not spend enough quality time with them. In a world where time is money and work is often stressful, no time is left for the companion that was intended to relieve stress in the first place. I often see young dogs that are bored and lazy. The moment the owner starts to actively play with the dog, the dog's character changes dramatically and a strong bond between owner and dog is formed. Once owners are used to playing, they often will go on doing so because they see the benefit and enjoyment for the dog and themselves.

Minimum play time required for this technique is not known. Compliance with specific timing recommendations in this group of dogs is not known. The rubber ball technique could be considered to be a modification of a technique formerly used in children with reverse bite in the incisor region ('spatula biting').²⁴ Children were taught to close their mouth in a specific way on a wooden tongue spatula and bite on it for 5 to 10 minutes, 3 times per day. This was attempted for 2 weeks, and if no correction was made, another technique was used. These time schedules were used as guidelines. In the technique described here, examination is recommended after 3 weeks because most owners and animals need 1 week of learning the technique.

The age of the animal is an important factor. When teeth are only partly erupted, the toy needs only to guide the erupting tooth in the correct direction. Once erupted, the tooth needs to be redirected into a more appropriate position. The technique worked in fully erupted teeth as well as in teeth which were still erupting; however, the time required for correction was longer in the fully erupted teeth.

After orthodontic treatment, a retention period is usually necessary to prevent return of the tooth to its former position. When using conventional orthodontic appliances for treatment, a retention period is generally considered necessary. In the case of lingually displaced mandibular canine teeth, a retention period is usually not necessary since the natural dental interlock retains the canine teeth in the desired position.^{4,8,10,13} With the technique described in this article, additional retention is provided by continued use of the toy. It appears that there is little risk of overcorrection (labioversion) of the canine teeth. This did not happen in any of the 38 cases reported here, even when very large toys were provided long-term.

As with any technique, correct diagnosis is critical for success of treatment. No major jaw discrepancy should be present. In the case of a severely retrognathic mandible, the outward movement of the mandibular canine tooth is inhibited by the maxillary canine tooth. In less severe cases, the technique does seem to work if a very large rubber ball is used so it can tip the canine teeth not only laterally, but also rostrally to a certain extent. The diastema between maxillary third incisor and canine teeth needs to be wide enough to accommodate the mandibular canine teeth.

Lingually displaced mandibular canine teeth have been described as being primarily caused by retention of deciduous canine teeth.^{6,13,19} In this series of 38 cases, only four dogs had retained mandibular deciduous canine teeth. More than 50% of the dogs reported here had a clinically detectable jaw length or width abnormality. Skeletal malocclusions are considered inherited unless a developmental cause can be reliably identified.⁸ Owners of these dogs need to be advised about the heritability of this condition, and informed that the treated dog should not be bred.

To date, there have been no reports of the frequency with which lingually displaced canine teeth correct as jaw growth continues. Early fixed-device orthodontic treatment is not recommended.^{6,8,10,22} Although treatment as described here may not have been necessary for some of these dogs, there is no reason not to encourage the owner to play with the dog.

The success of this very simple and functional technique suggests that more research is needed regarding heritability and environmental influences on jaw development. Some of the minor skeletal malocclusions may be produced by lack of function. Studies in dogs have shown an influence of occlusal forces on jaw growth.²⁵ It has been shown in experiments in rats that food consistency influences jaw development.²⁶ Feeding commercially-available diets may have an influence on jaw development and occlusion, because of the lack of function. Providing the dog with something to chew on, and play and work with, could be beneficial to jaw growth and occlusion.

In properly selected cases (young dogs, no major jaw discrepancies), the 'rubber toy' technique is successful with correction of the malocclusion within 4 weeks in most cases. This technique eliminates the need for more involved orthodontic techniques, which require multiple anesthetic episodes. The technique also encourages development of a strong bond between owner and animal during the course of treatment.

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