Royal Kennel Club



Veterinary Conformation Assessment

Evidence base and background information

November 2026



Foreword

I've been involved in dogs all my life, as a breeder, exhibitor and judge. I know how much breeders care about producing healthy and happy dogs because I'm one of them. Becoming Chairman of the Royal Kennel Club (RKC) has given me a wider view. I now see the challenges and opportunities facing pedigree dogs from every side and the part the RKC can play in shaping their future.

The publication of ***A New Future for Dog Breeding*** at the start of 2026 set an important direction for our health and welfare work. It showed us where we need to focus our efforts. Addressing extreme conformation was one of those priorities. The Veterinary Conformation Assessment (VCA), which many of you will know as Nose-to-Tail, is an important step in taking that work forward.

We know extreme conformation can have a significant impact on a dog's health and wellbeing. It's a challenge facing dogs today and one we must not ignore. We want to celebrate breed type and the characteristics that make each breed special. But never at the expense of a dog's quality of life. We need to recognise and avoid extremes, while protecting the breed characteristics that go hand in hand with good health. Every dog should be fit for function and able to live a normal, active life. It should be able to just be a dog.

This report, written by Dr Alison Skipper, sets out the scientific evidence behind the VCA. It explains how the assessment criteria was developed. We want to be open about the approach we've taken. The assessment is based on evidence; it's open to scrutiny and it will evolve as our understanding grows. The launch is not the end of that process. As we gather more data, we'll keep learning, listening and building on what we've started. Change is needed and the VCA gives us an important tool to help encourage it.

For me, one of the most encouraging things about the VCA has been how it's been built. Vets, breeders and breed clubs have all given their knowledge and experience. It's through working together like this that we make progress. My advice to any new breeder has always been to watch, listen and never be scared to ask. It's the same here. Read the report and if you have questions, ask them.

A big thank you to Alison, our Health and Breeding team and everyone who has given their time to this work. We need to stand up for the 153 years that have gone before us. That means protecting the health and welfare of our dogs and the future of the breeds we love.

Gavin Robertson
Chairman, the Royal Kennel Club



Alison Skipper

This document was written by Dr Alison Skipper MA Vet MB Cert VR MA PhD MRCVS, Veterinary and Research Advisor at the Royal Kennel Club, who has led the development of the Royal Kennel Club Veterinary Conformation Assessment (RKC VCA). She has extensive experience in practical pedigree dog health work, a background in canine first opinion veterinary practice, a PhD in the history of breed related disease in pedigree dogs, and experience as a researcher in canine data science at the Royal Veterinary College.

Many people have contributed significantly to the development of the RKC VCA, including veterinary surgeons, breeders, scientists and other external stakeholders. Further information and support were provided by The Kennel Club's Health and Breeding Team, supported by volunteer members of The Kennel Club's Health and Breeding Advisory Group. A list of these contributors is provided in the Appendix.

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Contents

Foreword **2**

Alison Skipper **3**

Introduction **5**

Table 1: RKC Breeding for Health Framework 6

Development process **6**

How the assessment works **7**

Grading 7

Detailed description of criteria, with evidence base for their inclusion **8**

Observed criteria **8**

1) Nostrils 8

2) Dentition 8

3) Facial skin folds and excess facial skin 9

4) Eyelids 9

5) Eye socket and globe 9

6) Skin folds on body and legs 10

7) Outward or inward turning of the front feet 10

8) Outward or inward turning of the hind feet and hocks 10

9) Patella scoring 11

10) Tail length and mobility 11

Measured criteria **13**

11) Current measured criterion - craniofacial ratio 13

Other measurements (summary) **14**

Other elements of the assessment process **14**

Movement 14

Testicles 14

Body condition score 15

General comments 15

Advisory comments 15

Additional considerations **16**

Other measurements (discussion) **17**

Additional measurements relating to the head 17

Measurements relating to girth 18

Measurements relating to height, length and leg length 19

Appendix **22**

Additional information **22**

i) Body features that are not included in the RKC Veterinary Conformation Assessment 22

ii) The RKC Veterinary Conformation Assessment and the Innate Health Assessment 22

iii) List of contributors to the development of the RKC Veterinary Conformation Assessment 22

a) Breeder contributors 22

b) Veterinary contributors 23

c) RKC health advisory committee members 23

d) Other external stakeholders who have provided development feedback 23

e) RKC Health and Breeding team 23

References **24**

Introduction

The RKC Veterinary Conformation Assessment (VCA) is an important addition to the RKC's health provision, which will transform our approach to conformation-related disease. This delivers on a key finding and commitment that emerged from our 2026 report, "A New Future for Dog Breeding", which discussed the need to better address this and other problems with canine breed-related disease and outlined our plans for the future (1). The RKC Veterinary Conformation Assessment addresses the 'Conformation' domain in our Breeding for Health Framework (Table 1), which was launched in the "New Future" report. Its purpose is to assess visible conformation that may compromise canine health and welfare, which is the first topic within the "Conformation" domain. The other topics in this domain, "distinctive breed features of potential concern" and "changing conformation over time", can also be identified and monitored through the assessment process.

The RKC Veterinary Conformation Assessment provides detailed guidance for the visual assessment of a dog's body shape by a veterinary surgeon. The assessment is intended to be carried out in adult dogs over a defined minimum age, ideally before they are first bred from. It currently includes eleven criteria, each relating to a specific conformational feature that may compromise health and welfare if exaggerated to excess or abnormal. The current assessment also collects measurement data on other features with limited existing evidence but potential welfare significance, helping to fill these evidence gaps to inform the future development of further additional criteria.

The assessor assigns a numerical grade to each criterion. The grades assigned to the various criteria can be considered individually or added together to create an overall score. This provides a flexible system that can be used to compare dogs, can be customised to track known issues in particular breeds and, by comparing breed averages, can monitor change within a breed over time. Breeders can use this information to inform and support their breeding decisions, alongside other considerations, by aiding them to select breeding dogs with more moderate conformation. We will develop targeted breeding recommendations once we have sufficient data to do so. There is also scope to later introduce advisory guidance or regulatory controls that apply to individual criteria, to combinations of criteria, or to the overall score.

The RKC Veterinary Conformation Assessment is an assessment of visible body shape, intended to assist breeders in moving away from extreme conformation. It does not assess visible attributes other than body shape and movement, such as coat colour or coat type. It is designed to follow a standard approach that is suitable for use with dogs of any breed and is intended as a complementary tool to be used alongside other information that may guide breeding decisions. It does not replace breed-relevant clinical or DNA health tests. It does not consider genetic diversity or inbreeding. It does not necessarily offer a clinical diagnosis for problems that may be identified during the assessment, such as lameness; it does not assess all aspects of conformation in the same way as a show judge; it does not provide a full reproductive examination of suitability for breeding; nor does it assess temperament. These matters are important, but beyond the scope of the RKC Veterinary Conformation Assessment.

Table 1: RKC Breeding for Health Framework

Genetic diversity	Conformation	Breed-related disease and wellbeing
Population size	Visible conformation	Testable conditions
Harmful breeding practices/popular sires	Distinctive breed features of potential concern	Untestable conditions
Limited pedigree data	Shifting conformation over time (conformational 'creep')	Temperament / mental wellbeing

Development process

The RKC defines extreme conformation as *"a physical appearance that is so exaggerated that affected dogs suffer from poor health and welfare, with negative impacts on their quality and/or quantity of life"* (Brachycephalic Working Group (2024)). Following this definition, any physical feature that is sufficiently exaggerated or abnormal to cause a problem with canine health and welfare may be considered extreme and should be avoided. The RKC Veterinary Conformation Assessment has been constructed to provide a detailed, comprehensive and flexible overview of any tendency to extreme conformation for an individual dog of any breed. It was developed by the RKC Health and Breeding Team with support from an experienced veterinary panel, who agreed that the included criteria all have a potential impact on canine health and welfare.

This document explains the reasons and evidence for including each criterion, and why some aspects of extreme conformation are not directly addressed in the current assessment framework. Inevitably, there will be some variation in welfare impact between criteria. Some criteria relate to features that, if extreme, certainly cause disease or discomfort, while others relate to features that, if extreme, increase this risk. In some cases, as with brachycephalic airway obstructive syndrome (BOAS), we know that different physical features can have different health significance in different breeds (2). It can be difficult to determine exactly when features that exist along a spectrum start to become extreme, and not everyone will agree on where the "threshold of acceptability" sits. There may be uncertainty over whether a certain feature impacts health or welfare at all, especially if the potential impact is behavioural or through a slightly elevated risk rather than a strong association. Moreover, risk thresholds have not yet been established for some conformational criteria because, despite clinical and common-sense awareness of the associated issues, there has been limited prior research to quantify them. This is why some measurements do not yet feed into graded criteria and why the assessment is expected to evolve further after launch, as new evidence emerges. The RKC Veterinary Conformation Assessment will be a tool to provide some of this missing evidence. Current criteria may evolve, or new criteria may be added, as new scientific research informs a better understanding of conformation-related disease risks in dogs. Such changes will be communicated transparently and with due consultation, but are necessary for the VCA to serve as a robust tool for the future.

Because of the uncertainty and variation between criteria and measurements, and because the assessment only considers visible conformation, it is also important to note that, while the overall score provides a simple way to identify dogs at higher and lower levels of conformational risk, it does not in itself give an absolute measure of overall health or breeding suitability. Instead, individual high-risk findings should be interpreted independently as part of a wider evaluation of that dog's suitability for breeding. We will develop more specific and customised breeding advice as the assessment becomes more established and the evidence base grows.

We have followed a detailed development process to create this assessment, spanning eleven months. The assessment was known as the RKC Nose-To-Tail Veterinary Visual Assessment during much of this process, but will be launched as the RKC VCA for clarity and to avoid confusion with other provision from different organisations.

- Criteria were initially identified through a series of online workshops involving about twenty volunteer veterinary surgeons, who were mostly experienced general practitioners and, in many cases, also involved in the dog world. These criteria were then discussed with a small number of veterinary specialists.
- The RKC health & breeding team drafted detailed wording to define these criteria, describe grade boundaries and construct the logistical framework for the assessment. Members of the veterinary panel subsequently reviewed the wording and proposed grading framework.
- The draft criteria and assessment format were discussed with breeders at a series of online workshops open to all breeds and attended by 176 representatives from 128 breeds.
- A series of follow-up breed-specific workshops were held on request with 12 higher-impact breeds (and one criterion-specific session to discuss tails).
- The criteria were further refined in response to this feedback and underwent practical testing (33 dogs from 17 breeds, examined by 5 vets) at a preliminary evaluation day in June 2026.
- During a second consultation phase, the refined assessment was shared again with breed communities, which were invited to complete a feedback survey: this received 152 responses.
- In August and September, the assessment was piloted again at four championship shows and a rescue centre, so that by the end of this phase 250 dogs of 76 breeds had been examined in total.
- During the autumn, the criteria and logistical arrangements were finalised and shared with a small group of external stakeholders for their comments.
- Veterinary assessors were recruited and trained in the assessment process; this session included an opportunity to inform further refinements to the guidelines.
- The assessment launches in late November 2026.

How the assessment works

Grading

Each assessed criterion is graded from 0 to 3, where 0 is the absence of abnormality or extreme conformation and 3 is a severe form of abnormality or extreme conformation for that criterion. Grades 1 and 2 sit between these grades. Grade 1 describes conformation that is not generally expected to cause problems with health and welfare, whereas grade 2 describes conformation that is more likely to be of potential concern. Some breeds have distinguishing features that can be expected to lead to grades higher than 0 for certain criteria. The intention is not for every dog to score 0 across all criteria, but for breeders to use individual grades to identify and reduce exaggerated conformation that may affect health and welfare.

A pattern of 0s and 1s should indicate a dog where the assessed criteria are not exaggerated to a conformational extreme. However, it is anticipated that some criteria in some breeds will typically be graded 2 or 3 at scheme launch.

Detailed description of criteria, with evidence base for their inclusion

Observed criteria

Ten criteria are evaluated through visual observation and assessment, supported by manual examination where appropriate. These criteria are graded by reference to written guidelines that define each grade. Written descriptors do not refer to breed standards, because they must be relevant to dogs of any breed. For many criteria, extreme conformation may take different forms in different breeds, and the wording describes various alternatives that may be mutually exclusive. Where there is doubt about the grade for a certain criterion, it should be determined by the most extreme relevant feature that was observed. As a general principle, the grade descriptions do not refer to clinical signs of disease linked to extreme conformation (for example, inflammation in skin folds or corneal pigmentation), because these signs may fluctuate over time or vary with age, and so are not repeatable or consistent indicators. As far as possible, grade descriptions avoid subjective descriptions of physical features (for example, using words such as "moderate"), but instead use descriptors that relate more objectively to other visible attributes. However, we recognise that an element of subjectivity is inevitable when assessing physical features, and the written guidelines are intended to support consistency between assessors as far as possible. They also are intended to take account of what can realistically be assessed in a field setting; for example, it is not feasible to conduct a full dental examination, only to obtain a general overview of the dentition and bite. The written grade boundary descriptions are not included in this document for reasons of space. The current version can be found via the VCA page of our website: http://www.royalkennelclub.com/VCA

1) Nostrils

Welfare impact

It is well established that stenotic nares are a major contributing factor to brachycephalic obstructive airway disease (BOAS) and are the most reliable externally visible predictor of disease risk (3-6). Narrowed immobile nostrils obstruct airflow, causing respiratory compromise with direct impact on welfare.

Assessment

The RKC VCA assessment uses the same scale for nostril evaluation as the University of Cambridge/Royal Kennel Club Respiratory Function Grading Scheme (RFGS) (7). Nostrils are graded 0 to 3, where grade 0 are fully open and grade 3 have severe stenosis. The RKC VCA does not otherwise assess respiratory functionality, as it is not intended to substitute for or replace the RFGS. At-risk breeds should be evaluated using both schemes, as they largely provide complementary information. For this reason, nostril assessment under the RKC VCA does not involve a formal exercise requirement. However, the assessor should observe the mobility of the nares when grading, and should ensure they examine the dog after movement if this is in doubt (8).

2) Dentition

Welfare impact

This criterion assesses the presence, position and occlusion of the teeth and the related issue of relative jaw length. Dental malocclusion predisposes to tissue trauma due to abnormal tooth-to-tooth or tooth-to-soft tissue contacts, causing various degrees of wear, inflammation, infection and chronic change (9). Overcrowded and/or rotated teeth predispose to tartar accumulation and periodontal disease (10). Lingually displaced lower canine teeth may impinge on the hard palate, causing trauma (11). Marked maxillary or mandibular prognathism (overshot or undershot jaw) can also cause tissue trauma and difficulties with normal eating (11). All these dental abnormalities can affect welfare, with the extent of the impact varying with the nature and severity of the abnormality.

Hypodontia and oligodontia (varying numbers of reduced or congenitally missing teeth, most commonly the premolars) is also frequently seen in many breeds (12–15), is linked to the semi-lethal FOXI3 mutation in hairless breeds such as the Chinese Crested (16,17) and has been associated with reduced litter size in other breeds (18). Small numbers of missing teeth are unlikely to impact welfare, given that the condition does not cause pain or prevent eating, and indeed may paradoxically avert overcrowding and gingivitis in physically small breeds (14). However, there is clear value in being aware of significant hypodontia in potential breeding animals.

Assessment

Given that the RKC VCA may be carried out in a field setting, assessment is limited to what may practically be observed with relative ease in most conscious dogs. These include the "bite" (closed mouth occlusion of the incisors and canines), obvious overcrowding or absence of multiple teeth, obvious displacement of the canines, and prognathism. Grade descriptions are based on these features and ranked according to the severity of abnormality observed. The assessor is not expected to fully open the mouth or to count every tooth, just to observe the dentition in sufficient detail to determine the grade. If teeth have been removed through dental treatment, a veterinary letter can be accepted as evidence that they were previously present. The reason for any prior removal should be considered when deciding the grade. If such evidence is missing, the dentition must be graded according to what the assessor can personally observe.

There are some potentially inherited dental abnormalities that are not mentioned in the grading framework. These include certain features that could be resolved surgically before an RKC VCA assessment (for example, retained deciduous dentition), features that could not be

identified without more thorough examination and radiography (for example, dentigerous cysts or unerupted teeth), features that may have inherited or environmental causes (for example, enamel hypoplasia), features that may develop gradually throughout life (for example, gingival hyperplasia), and sporadic features such as supernumerary teeth (11,12). These features may be noted in the comments section if observed.

Because there are many types of dental abnormalities, assessors may wish to describe their observations in the advisory comments section of the form, particularly if they select grade 2 or 3 in a breed where dental abnormalities are uncommon. Guidance on the use of advisory comments can be found on page 15.

3) Facial skin folds and excess facial skin

Welfare impact

Some dogs have wrinkling, skin folds or other areas of excess skin on the face and head. This varies in its location and extent. In some dogs (with little or no excess skin) there are very fine forehead wrinkles that move or disappear as the dog changes its expression or ear position and which therefore cannot impact welfare. However, in others, there are permanent and sometimes deep skin folds over the bridge of the nose, hanging at the sides of the eyes, or in the lower lip. Excess skin and/or deep facial skin folds predispose to skin inflammation and infection, and to ectropion and/or entropion (19,20). Nasal folds may impinge on the cornea, causing discomfort and chronic trauma (20–22). Lip folds can predispose to chronic dermatitis (23). These conditions may require surgical correction in severe cases (24).

Assessment

Grading should be determined using the most extreme aspect of the criterion that can be identified. Any contact between skin folds and the cornea is significant, even if it only involves hair. The assessor may handle the dog's face to check whether skin folds are moveable and what lies under them. The description for each grade has been worded to consider anatomical features that are likely to remain stable in a mature dog. For this reason, variable clinical signs such as inflammation are not mentioned, and subjective words such as "moderate" have also been avoided. However, the assessor can note any inflammation or infection in the "general comments" section of the form. Guidance on the use of general comments can be found on page 15.

4) Eyelids

Welfare impact

Normal eyelids fit around the globe without turning inwards or outwards. Abnormal eyelids may turn outwards (ectropion), where the lower lid gapes away from the globe to varying extents, exposing the conjunctiva; they may turn inwards (entropion), where the lid/s rub on the cornea, causing irritation; or they may feature a combination of ectropion and entropion ("diamond eye"). In severe cases, the eyelids may be too abnormal to allow normal blinking and distribution of the tear film. The Harderian gland of the third eyelid (nictitating membrane) may also prolapse ("cherry eye") (25). These abnormalities are all well documented as potential welfare problems that may require surgical correction in severe cases and which are commonly found in certain breeds (26).

The RKC VCA eyelid criterion wording was developed in consultation with two veterinary ophthalmologists. Both ectropion and entropion are undesirable. However, entropion and diamond eye are graded more severely than mild ectropion alone, because of the greater likelihood of direct corneal irritation and associated pain.

Assessment

The assessor should examine the eyelids carefully, using a pen or phone torch if necessary and checking both the shape and whether they meet normally across the eyeball as the dog blinks. They may move the dog's head and/or touch the eyelids. The grading framework describes the anatomy for each grade but does not refer to possible clinical signs of associated disease such as inflammation or ocular discharge, because these may vary over time. If the eyelid is so slightly or intermittently inverted at the medial canthus that the assessor cannot clearly visualise entropion, grade 2 may be recorded. Any clearly visible entropion must be recorded as grade 3.

Distichiasis and ectopic cilia (extra or misplaced eyelashes) are other eyelid features that can cause ocular discomfort. They are not included in the RKC VCA because they are often difficult to see without magnification and good lighting, which may not be available in a field setting. However, if the assessor observes or suspects these features (for example, if there is heavy tear staining with no obvious cause), this may be noted in comments on the form, and further investigation may be recommended.

5) Eye socket and globe

Welfare impact

A normal eyeball (globe) sits deeply within a socket of suitable size. Some dogs have shallow eye sockets so that their eyeballs protrude, and this may be exacerbated by over-long eyelid openings so that more of the sclera (white part) of the eye is visible than normal. The normal eyelid blink may be impaired by this conformation (lagophthalmos) (21). Such eyes are commonly found in brachycephalic breeds, and are more vulnerable to physical damage, which may lead to secondary changes such as ulceration or deposits of pigment on the cornea (transparent surface at the front of the eye). Both the discomfort of ocular injury and the possible visual impairment that may follow may reduce welfare (21).

More rarely, dogs may have an eyeball that is too small (microphthalmos) (27,28). This is undesirable because very small eyes can be associated with impaired vision. Some internal eyeball structures may be missing or

abnormal; the eyeball may sit very deeply within its socket, the sclera may be visible, the third eyelid may protrude, and/or the eyeball may be largely covered by the upper and lower eyelids.

Strabismus (squinting) is also undesirable because it impairs effective vision and may reflect neurological and/or anatomical abnormalities such as hydrocephalus as well as those of the globe and eyelids (29).

Assessment

The RKC VCA assessment of the globe is intended to evaluate whether the globe is of normal size and well matched to its socket. This examination largely involves assessing the number of quadrants in which the sclera is visible around the cornea as the dog looks straight ahead, because this is a good measure of macroblepharon (over-long eyelid openings) and proptosis/exophthalmus (eyeball protrusion) (30). It is normal for a small amount of sclera to be visible laterally, and this is acknowledged in the guidance.

It should be noted that ectropion will also cause the sclera to be more visible, even if the globe and socket are normal. However, if a dog has ectropion this will already be captured in the grading for the previous criterion, and so visible sclera that is only caused by ectropion should be ignored when assessing the globe, to avoid double-scoring. Secondary changes, such as corneal pigmentation, may be noted in the comments section of the form if desired, but are not formally included in the grading system because they are progressive and may vary over time.

6) Skin folds on body and legs

Welfare impact

As with skin folds on the face, heavy skin folds on the body and legs are associated with an increased risk of inflammation and infection (19,23,24). For this criterion, grade boundary wording is based on the fact that deep, permanent folds are more likely to become infected than shallow folds that move as the dog moves, with heavy, numerous folds increasing the risk of these complications and a fold that encircles the tail base being particularly problematic because of its proximity to the anus, further increasing the risk of infection (31,32).

Assessment

The assessor may handle the dog's skin to investigate the depth of skin folds. Visible inflammation, infection or scarring of skin does not directly contribute to the assessment because it may change over time. However, active infection may be noted under "general comments".

7) Outward or inward turning of the front feet

Welfare impact

It is normal for the front feet to point straight ahead or turn very slightly outwards when the dog is standing square. Front feet that point inwards or that point outwards more than slightly may indicate angular limb deformity with carpal or pes valgus or varus (33). Angular limb deformity occurs sporadically or as a rare inherited disorder in many breeds (34,35), but is most commonly found in some short-legged chondrodysplastic breeds (36–38). The anatomical problems that contribute to angular limb deformities, and the severity and type of limb rotation that follows, vary considerably between and within affected breeds (38,39). However, there is good evidence that angular limb deformity is associated with pain, lameness and arthritis, and that such problems are more likely with more severe limb rotation (38).

Rotation of the front feet may also be associated with other chronic problems such as severe recurrent interdigital furunculosis (cysts) (40).

Assessment

Researchers have used a goniometer (a simple device resembling a protractor) to accurately measure various aspects of canine joint angulation, such as range of joint movement (41), carpal and pes valgus in various breeds of dog (33,38,42). During development of the RKC VCA, we trialled the use of a goniometer with a variety of assessors. We found that it was difficult to use this consistently and accurately under field conditions. At present, therefore, assessors are only asked to make a visual examination of any angular limb deformity and to grade it as mild, moderate or severe accordingly. They should ensure that they view the dog from the side and from the front. However, we may use goniometry to support assessment in the future, and suggest that any examination of front or hind feet rotation under the appeals process is supported by goniometry if appropriate.

Although most angular limb deformities result in turning of the feet, occasionally a dog may have marked rotational abnormalities in the proximal limb, such as obviously abducted elbows that are compromising normal movement, despite feet that still point forwards. In this situation the assessor may give an appropriate higher grade for this criterion even though the feet are not rotated, but should note their reason for this decision in the general or advisory comments section of the form as appropriate.

If other relevant pathology is noted during the assessment, such as the presence of active interdigital furunculosis, this may also be noted in the appropriate comments section.

8) Outward or inward turning of the hind feet and hocks

Welfare impact

Angular limb abnormalities can affect the hind legs, and may be linked to significant disease such as patella luxation or cruciate ligament rupture (47,48). For example, femoral and tibial torsion and angular abnormalities have been linked to medial and lateral

patella luxation and can involve the tarsal (hock) joint, typically in smaller breeds (47,49–51). Stifle valgus and/or tarsal varus ("cow hocks") can also be associated with extreme pelvic limb angulation, joint instability and ligamental laxity, particularly in larger breeds (52). As with the front legs, these rotational abnormalities and joint instabilities can lead to pain, lameness and arthritis. Other chronic problems such as ongoing interdigital furunculosis can also affect the hind legs and may cause pedal rotation (40).

Assessment

The assessment for rotation of the hind feet broadly follows the same process as for the front feet. The assessor should ensure that the dog moves into a stand naturally, rather than being stacked by the handler as for the show ring, before assessment, and should ensure that they view the dog from the side and straight behind. The assessor should observe the dog moving away in a straight line at a walk and/or trot as appropriate to assess the conformation and function of the hocks, which may appear more or less unstable or rotated during movement than at rest. As with assessment of the front legs, the use of goniometry is not required but may be helpful if assessing under the appeals process.

As with the front legs, in rare cases there may be proximal hind limb rotational abnormalities that do not impact the position of the feet. In this situation the assessor may award an appropriate higher grade but should note their reason for this decision in the general or advisory comments section of the form as appropriate.

9) Patella scoring

Welfare impact

Patella luxation is a well-described condition found across many breeds, with variable clinical impact, ranging from occasional laxity to permanent luxation that severely impairs movement (43,44). More severe luxation is associated with lameness, pain and damage to the stifle joint, including cartilage damage, cruciate ligament damage and arthritis (45). Patella luxation may require surgical intervention and can significantly impact a dog's quality of life.

Assessment

Many breed communities have long used a manual grading assessment for patella luxation, based on foundational work by R.W. Putnam and thereafter modified by others (43,44). The RKC VCA patella evaluation process is based on the Putnam scoring scheme, but has been slightly simplified to amalgamate Putnam grades 3 and 4 into grade 3 in our format. Since Putnam grades 3 and 4 both describe serious luxation with a major clinical impact, this does not impact the value of the evaluation. Variation in grading between assessors and over time has been reported as a possible concern with this approach (46), which we will monitor as the scheme rolls out. However, severe luxation should not change, so a grade 3 would be expected to be a constant finding.

Putnam patella scoring gives a separate result for each stifle joint. To avoid double-weighting, the worse of these two results will contribute to the overall RKC VCA score. For breeds where patella luxation is a known problem, we can display the results for both patellae. This can be arranged through direct consultation with relevant breed communities. Discrepancy between the two results can also be noted in the comments section of the form if desired.

10) Tail length and mobility

Welfare impact

Two separate well-described genes are linked to shortened or absent tails in dogs. The "screw tail" seen in Bulldogs, French Bulldogs and Boston Terriers is caused by a mutation in the DVL2 gene (53). This mutation causes the loss of some tail vertebrae with malformation of others, so that screw tails often have marked bends or kinks, and/or reduced mobility. It also causes abnormal formation of vertebrae elsewhere in the spine and a more brachycephalic phenotype (54). The mutation is considered "fixed" or "nearly fixed" in all three breeds (meaning that almost all individuals are homozygous for this allele) (53). Nevertheless, screw tails vary considerably in length between individuals (particularly in Bulldogs, anecdotally); shorter tails may correlate with a greater risk of BOAS in Boston Terriers, and have been associated with a greater likelihood of clinically significant vertebral abnormalities in French Bulldogs (55–57). Shorter screw tails can also be recessed into the surrounding skin, causing inflammation and infection in the embedding skin fold (20,31,32). Absent or very short tails in brachycephalic breeds may also impair communication with other dogs and even with people (58–60), although not all research confirms this (61). Overall, there is good evidence that shorter screw tails have a higher welfare impact, supporting selection for longer tails in these breeds.

The "natural bob tail" (NBT) is seen in several other breeds, including Australian Shepherds, Schipperkes, Pembroke Welsh Corgis, and Polish Lowland Sheepdogs. NBT is caused by a mutation in the T-box transcription factor T gene (62,63). All NBT dogs are heterozygous for this allele, because the homozygous genotype is invariably lethal, usually (but not always) before birth (63,64). NBT dogs therefore cannot breed true; an NBT x NBT mating is likely to result in a smaller litter size, because of embryonic death of homozygotes, and the litter may include NBT puppies and fully tailed puppies without the NBT allele. The NBT phenotype varies from no visible tail at all, through shortened tails of varying lengths to almost full tails; NBT tails of any length are usually straight and have good mobility. Anecdotally, breeders generally say that variation in tail length cannot be predicted from parental phenotype.

Until recently, the T-box mutation has not historically been linked to other anomalies in heterozygous dogs

(63), although recent research identifies a potential association with transitional lumbosacral vertebrae, which may in turn be associated with degenerative lumbosacral stenosis (65,66). Other potential welfare implications of the bobtail phenotype concern the ethical question of breeding two heterozygotes together, which is beyond the scope of this document, and concerns relating to the potential impact of a very short or absent tail on normal canine movement and communication. Evidence suggests that the canine tail has a limited biomechanical role (67) but a significant role in communication, although this does not necessarily establish that poor welfare follows the absence of a tail (59,68). Future research may reveal whether effective communication in NBT breeds differs with tail length.

During VCA development, we considered whether a recessed, inverted tail should receive a higher grading than no tail at all, because its impact on welfare is likely to be greater. Given that an inverted or kinked tail can be surgically removed, we decided that a scale that did not include total lack of tail within the highest grade might have the unintended adverse consequence of encouraging undeclared docking. Nevertheless, we recognise that the clinical impact of no tail in a screw tail breed is likely to be greater than the clinical impact of no tail in an NBT breed. It is an important overarching principle that the RKC VCA framework can be applied to any dog, and that it assesses phenotype rather than genotype. For these reasons, the scoring system for this criterion cannot differentiate between screw tail and NBT other than through the nuances of grade boundary wording. However, most NBT breeds are expected to achieve low overall VCA scores, so are unlikely to be flagged as of high conformational concern overall. Moreover, since any future requirement for RKC VCA testing would be customised by breed, the system will allow the RKC to tailor any breeding advice or restrictions to the circumstances of each breed, for this and other criteria, on an evidence-based and consultative basis.

There are some breeds with "Spitz" type tails, which are of normal length but typically carried in a curled position over the back. The Pug has a long, curled tail and can have abnormal spinal vertebrae, but rarely has malformed caudal vertebrae and does not have a "screw" tail, despite references to this in some research, as the breed does not have the DVL2 mutation (53,69–71). For most breeds with "Spitz" tails there is no published evidence describing spinal issues and anecdotal knowledgeable evidence suggests that these dogs generally have no associated problems, although some may have isolated kinked vertebrae or irregularities in the small vertebrae at the very tip of the tail. For this reason, following the RKC VCA principles described above, a full-length tail that is carried over the back in any breed should be graded as 0 unless otherwise indicated, as described in the assessment guidance below.

Assessment

As with all RKC VCA criteria, the wording covers dogs of any breed. Longer and more mobile screw tails will have less impact on a dog's welfare, and the wording is particularly drafted to support this. In NBT breeds, the last vertebra at the end of a shortened tail will often narrow to a palpable point, and a fat pad and/or loose skin may extend further past the end of this bone. In contrast, if a dog is docked, the last vertebra is typically blunt-ended and may be covered by scar tissue and skin, with no fat pad. Tail length should be measured to the skin that covers the tip or end of the tail, ignoring any hair.

We have chosen the ischiatic arch as a landmark to compare with the length of the tail because it is very conveniently located and straightforward to identify in every dog. Although a tail that only reaches just beyond the ischiatic arch is still relatively short, if that tail is freely moveable and free from malformed vertebrae then it should be able to support normal canine social communication and hence should not impact welfare. In practice, the vast majority of grade 0 tails will be much longer than this.

Complete lack of a visible tail in any breed is advisedly a grade 3 to support selection for the presence of a visible tail and to avoid any incentive for illegal docking that might mask abnormal tail conformation. For NBT breeds, any visible tail would generally be expected to score grade 2 or lower, which will lead to a very low overall RKC VCA score unless there are other points of conformational concern. "Spitz" type curled tails that are full length should be scored as grade 0 unless there are any palpably abnormal vertebrae or other abnormalities of concern. If the tail is naturally carried over the back but would clearly reach at least to the ischiatic arch if moved ventrally, it is not necessary to move it into this position to confirm the grading, but the tail should be handled enough to confirm that there are no palpably abnormal vertebrae (other than small irregularities at the very tip, which are acceptable) before awarding grade 0.

Docking is only legal in the UK for spaniels, terriers and Hunt Point Retrieve (HPR) breeds or types, with the exact details of the legislation varying between the devolved nations (72). Dogs that have been legally docked in the UK or overseas should be accompanied by suitable paperwork to show that they have been docked legally. This should be recorded in "general comments". For breeds without the screw-tail and NBT genes (i.e. most legally docked spaniels, terriers or HPR breeds), docked dogs may then be scored as grade 0, since they are almost certain to have had long, mobile tails at birth. There are some breeds with the NBT gene where long-tailed dogs may be docked as puppies. In the UK, this is only legal for the Brittany and the Spanish Water Dog, which are both classified as HPR breeds under English and Welsh regulations (72,73). Other NBT breeds, such as the Australian Shepherd and the Welsh Corgi (Pembroke) cannot legally be docked in the UK but can be legally docked in some countries such as

the USA. Legally docked dogs of NBT breeds should be accompanied by a letter from the veterinarian (UK) or exporter (overseas) to confirm that the dog (identified by microchip number) had a long tail prior to docking. If this evidence is provided, the dog may be scored as grade 0. If such evidence is not available, the dog should be scored according to its visible conformation on the day.

If illegal docking is suspected, this may be noted in "advisory comments", and the assessor should refer to the FAQ below for further information on appropriate procedure.

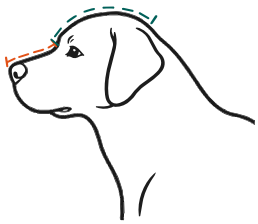
Measured criteria

These criteria consider aspects of body shape where extreme proportions are or may be linked to a higher risk of disease. Because dogs vary so much in size, measured criteria are often expressed as a ratio that compares two different body measurements in the same dog, which facilitates comparison between dogs and breeds (2,5,57,74–76). Within a single breed, measured criteria can also potentially be compared individually (57). Measured criteria give an indication of the risk of disease linked to that feature, but do not assess disease directly. For example, a more extreme craniofacial ratio (flatter face) is correlated with a higher risk of BOAS across multiple breeds and crossbreeds (2,57,71,75), but that does not mean that every dog that scores grade 3 for craniofacial ratio will necessarily have difficulty breathing; in some breeds, many do not (2). This is why the RKC VCA should be used alongside other health testing information in breeding decisions.

Canine morphometry (body measurement) is an emerging discipline. Research on this subject is currently limited, and there is no fully standardised set of measurements that are universally used by all researchers, with different studies frequently using differing measurement methodologies and measuring differing body parts (2,5,57,74–78). For some aspects of body shape, such as "long and low" conformation, there is already evidence to show that extreme proportions are linked to disease (76), but not yet enough evidence to determine where grade boundary thresholds should be set across all breeds. For some extreme proportions, such as inadequate ground clearance, we don't yet know which measurements will best assess disease risk or where grade boundaries should be set, because there is currently no directly relevant published evidence. For these reasons, only one of these criteria, craniofacial ratio, will contribute to the overall RKC VCA score at launch, but we will be gathering data for other possible measurements that may contribute to future criteria, once we can set appropriate grade boundary thresholds. Craniofacial ratio is discussed in the next section because it is already a formal criterion. Other measurements that are still under consideration for future inclusion are listed below and discussed in more detail later in the document, on page 17.

There are some inherent practical difficulties with physical measurement. Even with trained assessors, some level of inter- and intra-observer variability is inevitable (4,79). Some measurements, such as chest girth, can vary with body condition (80), and for some measurements, particularly neck girth, accuracy may be compromised if the dog has a heavy coat. Therefore, we will also assess the suitability and reliability of the additional measurements that we are trialling, before deciding which should contribute to formal criteria: this is another reason for delaying the inclusion of criteria based on these measurements until we are certain that they are sufficiently accurate and repeatable. Some body measurements used in other studies have been excluded from the current assessment. This is sometimes because these measurements are too difficult to obtain accurately or require a technical approach (such as measuring a photograph rather than a dog) that is not suitable for the RKC VCA format. Other measurements suggested in certain studies have been excluded because they are less likely predictors of disease, or simply because the total number of measurements must be limited for pragmatic reasons (77).

11) Current measured criterion - craniofacial ratio



Relevant measurements

- Length of muzzle (foreface) (orange line)
- Circumferential length of cranium (green line)

Welfare impact

Extensive research data across many breeds and crossbreeds shows that a lower craniofacial ratio (i.e. a flatter foreface or muzzle) broadly correlates with a higher risk of BOAS (2,57,71,75,81). Consequently, there is robust evidence to support the inclusion of craniofacial ratio as a criterion and to set appropriate evidence-based grade boundaries.

However, craniofacial ratio is a measure of risk, not a direct measure of disease, and does not identify all the factors that contribute to BOAS, which vary between breeds (4). Other RKC VCA criteria also provide important breed-relevant information on BOAS risk (2,4,6,57), and the RKC VCA does not replace the RFGS, which remains a vital test to directly identify which dogs show clinical signs of BOAS (3,7,82). Also, craniofacial ratio can be measured in different ways. For logistical reasons and following most relevant prior research (2,4,57,71,75), the RKC VCA uses a circumferential cranial measurement, described below. However, this gives a higher value than a straight-line measurement across the base of the cranium, as obtained on a lateral head photograph or MRI/CT scan image, and consequently generates a harsher value for craniofacial ratio than a straight-line measurement would, especially if there is cranial doming, which makes the cranial value larger and hence the overall ratio smaller. Comparison across

systems (for example, between the RKC VCA and the All-Party Parliamentary Group for Animal Welfare (APGAW)'s Innate Health Assessment (IHA), which uses a straight-line measurement in its illustrative materials (83)) should be aware of this discrepancy.

Assessment
The facial length (muzzle) should be measured on the dorsal midline from the rostral end of the nose leather to the indent of the stop. The cranial length should be measured circumferentially on the midline from the indent of the stop to the occiput. For most dogs, these measurements are readily made with a soft tape measure, but in dogs that are head-shy, very small or that have heavy facial wrinkling, it may be more convenient to take the measurements with a piece of string or narrow ribbon that is subsequently measured against the tape measure. If the dog resists handling by the assessor but is willing to allow the owner to take the measurements, this is acceptable provided the assessor is directly observing the process and can certify that the measurements are accurate.

For a few dogs, it may not be possible to measure the craniofacial ratio. If the assessor is completely confident that the dog would be a grade 0 because its muzzle is obviously well over the threshold, then the grade can be assigned without supporting measurements. However, this should be considered a last resort rather than a short cut. Full data collection should remain the standard approach, with this option used only where that is genuinely not possible; if the measurements cannot be recorded then the reason for this should be explained in the general comments section of the form. If the dog is not an unequivocal grade 0 and it is not possible to obtain the necessary measurements, then the overall assessment must be abandoned.

Other measurements (summary)

The following measurements are also currently obtained during the RKC VCA process, but do not currently contribute to formal criteria, nor, therefore, to the current overall total score. As we collect more data, further criteria based on these measurements will be added to the overall assessment, where this is supported by suitable evidence. The rationale and methodology for trialling these measurements is discussed later in this document, on page 17.

- **Intercanthal distance**
- **Circumferential cranial width**
- **Neck girth**
- **Chest girth**
- **Back length (shoulder to tail base)**
- **Height at shoulder**
- **Distance from sternum to ground**
- **Distance from point of elbow (olecranon) to ground**

Other elements of the assessment process

Movement

The many vets and breeders that we consulted during the development of the RKC VCA unanimously agreed that observing movement is an important part of assessing a dog's visible conformation. They also agreed that even trained assessors differ in their skill at identifying and interpreting lameness. Movement also varies enormously between breeds, and this variation is not necessarily linked to welfare issues, although it sometimes may be. For these reasons, it was agreed that it would be impractical to grade movement in the same way as other criteria; this would also be problematic in the event of a query or appeal, as movement can vary over time.

The RKC VCA therefore involves moving the dog away from and towards the assessor at a suitable pace and for long enough to make a broad judgment. There are no set requirements of distance, speed or time, as appropriate assessment will vary by breed. The assessor is not asked to grade movement or lameness. If a problem is identified, they are not expected to carry out a full clinical examination of the limb or make a diagnosis. They are simply asked to assess whether the movement is generally **acceptable** or **unsatisfactory**. Low-grade lameness where there is no obvious cause, or where a cause is identified that is not related to extreme conformation, such as a cracked nail, may be recorded as **acceptable**. If low-grade lameness is noted and/or a cause is identified, this may be noted in the general comments section of the form. Suboptimal conformation that causes relatively subtle movement issues (for example, straight stifle angulation without angular limb rotation or patella subluxation) does not preclude an **acceptable** result. However, if the movement examination reveals an obvious and marked abnormality that appears to be linked to extreme conformation, the result should be recorded as **unsatisfactory**. Examples of conditions leading to this outcome could include severe pes varus that renders forward motion difficult; repeatedly "skipping" or "bunny-hopping", associated with patella luxation; rubbing together of inturned "cow hocks" as a dog moves away; obvious ataxia with a suspected spinal cause; or plantigrade weightbearing in the hind limb. If an unsatisfactory result is obtained, the observation that has led to this finding should be recorded in the "advisory comments" section of the form.

Testicles

The form records whether a male dog has both testicles present in the scrotum. Any departure from this should be noted in the "advisory comments" section of the form. A veterinary certificate recording the removal of one or both testicles may be used to confirm that they were previously present (if appropriate). While the RKC VCA is primarily intended as a pre-breeding examination, there is no reason why a neutered animal cannot be assessed under the scheme, providing this is recorded appropriately, as this

might provide useful contextual information for related breeding animals.

Body condition score

The body condition score should be recorded using the standard WSAVA scale from 1 to 9 (84). The weight may also be recorded if scales are available, but it is recognised that this may not always be the case in peripatetic settings. Extreme body condition scores (1 or 2; 8 or 9) should be highlighted to the owner as potential welfare concerns and may be noted in the advisory comments section of the form. Mild overweight (BCS 6 or 7) may be noted in the general comments section of the form if desired.

General comments

This section of the form is provided to note comments that do not directly concern suitability for breeding. These may include general positive comments ("lovely dog"), or comments on potentially temporary observations that do not necessarily impact suitability for breeding ("overweight"; "2/10 lame LF, cause not determined"; "infected ears, should see a vet"). If extreme obesity is recorded (body condition score 8 or 9), this should be noted in the advisory comments section instead, because of its potential significance as a breeding concern due to potential heritability and possible dystocia in bitches (85,86).

Advisory comments

This section of the form is provided for comments that are directly thought to relate to suitability for breeding. These divide into several categories:

a) Breed-specific anatomical features of concern that have not been recorded elsewhere; for example, open fontanelle, syndactyly, suspected dermoid sinus, excessively elongated pinnae. Such problems are too breed-limited to be included as separate criteria but may be significant in certain breeds and so should be recorded if found. Breeders may also request that normal findings are recorded in such breeds (for example, absence of observed dermoid sinus in a Rhodesian Ridgeback), and this may also be accommodated here.

b) Sentinel clinical abnormalities that trigger suggested referral to another clinical health scheme, such as audible respiratory noise in a brachycephalic breed (advise RFGS) or visible cataract (advise examination under BVA/RKC/ISDS eye scheme). The RKC VCA is not intended to include an accurate examination of such problems, which should be evaluated through the relevant health scheme by an appropriately qualified and authorised assessor. However, any observed abnormalities should be flagged for further investigation.

c) Abnormalities of size. It is difficult to determine a specific cut-off boundary for "too small" or "too big", as other aspects of construction will impact soundness at any body size. Nevertheless, extreme miniaturisation and gigantism that are linked to unsoundness are undesirable and may be noted here, particularly if there are other associated concerning features, such as an enlarged cranium and neurological signs in a tiny dog.

d) Abnormalities of movement related to conformation that have led to an "unsatisfactory" movement observation; for example, abnormal gait related to luxated patella.

e) The reason/s for any grade 3 criteria should be noted here. This is helpful for criteria where there are several possible reasons for a high grade, such as dentition.

f) Problematic temperament. The RKC VCA is not an assessment of temperament, and if it is not possible to handle the dog safely, the assessment may be abandoned and recorded as incomplete for this reason. However, if the assessor is able to conduct the examination but is sufficiently concerned about the dog's behaviour to flag this as an issue, this may be recorded here.

g) Extreme body condition score that impacts suitability for breeding, as discussed above.

This list is not exhaustive, and the assessor may use this section for any other findings related to suitability for breeding that they identify during the examination. Temporary and other observations that do not necessarily impact suitability for breeding should be noted in "general comments" instead. Challenges with completing the examination other than problematic temperament (such as field conditions, a dog that is unused to standing still, etc) may be recorded in the general comments section or may require the assessment to be abandoned. This decision is at the assessor's discretion, depending on whether the results were impacted enough to significantly compromise the rigor of overall assessment.

Additional considerations

Assessor training

Any RCVS registered veterinarian who has the right to practice in the UK is eligible to apply to join the assessors list. Veterinarians who wish to become assessors will need to complete a short RKC training process to ensure that they understand the operation of the assessment and to support consistency between assessors. Initially, this training will entail attendance at an in-person training day, followed by annual in-person refresher training. As the RKC VCA becomes more established, we will explore the possible development of other training options.

Minimum age for assessment

At launch, following feedback from breed communities, there will be a minimum age for assessment of eighteen months across all breeds. However, we recognise that some breeds mature more rapidly than others and that it may be desirable to breed from slow-maturing dogs before they have reached full conformational maturity. Therefore, we will be fine-tuning assessment age categories during 2027, following feedback and consultation with relevant breed communities. It is likely that in some breeds eighteen months will be the minimum age for a provisional assessment and that there will be a second minimum age for a final assessment, to balance practical needs against the greater reliability of an assessment at maturity. In these breeds a provisional assessment is only recommended for dogs that will be bred before the minimum age for final assessment; otherwise, the final assessment can be used as a one-time evaluation as in other breeds. It is also possible that for some early-maturing breeds we may reduce the minimum age for assessment to one year, recognising that in such breeds dogs may be bred from before they reach eighteen months.

There is no maximum age for assessment, but we expect that most dogs will be assessed in young adulthood, since the RKC VCA is primarily intended as a pre-breeding assessment. Owners should be aware that aging changes in older dogs might lead to slightly higher grades for some criteria, such as limb rotation. A final assessment will remain valid indefinitely and will not expire.

Integration with RKC health provision

At launch, the RKC VCA will sit separately from other health provision while any initial problems are identified and resolved. Tested dogs will be identified on Health Test Results Finder, but the assessment results will be shown as "Test result with owner" and not publicly displayed.

After the first year of VCA operation, some results will be visible on HTRF. This is likely to include the total score, the number of grade 3s awarded, if any, and whether there are any advisory comments. This level of disclosure has been decided following extensive consultation with breed communities to balance transparency with the need to avoid overwhelming detail that may prove confusing.

We will later be placing the RKC VCA on our Health Standard for some breeds. This is an evidence-based list of the priority clinical and DNA health tests for each breed that we recognise, with the most important tests for each breed listed under Good Practice, and additional tests that are also desirable for more comprehensive screening listed under Best Practice. All new tests are initially placed in Best Practice, but for some breeds the RKC VCA will be moved to Good Practice after an introductory period. These decisions will be evidence-based and discussed with breed communities.

We will also be developing a broader mandatory health testing framework to cover clinical and DNA testing across all breeds. The RKC VCA will eventually be included within this for some breeds.

Surgical intervention

If surgical intervention is suspected the assessor should discuss the situation with the owner. If prior surgery is confirmed by the owner, the affected criterion should be recorded as a grade 3, irrespective of what it looks like on the day, on the basis that any extreme conformation that is sufficiently severe to require surgery may be considered unsuitable for breeding and that it is no longer possible to establish what this feature would have looked like previously. The owner should be reminded that such surgery should be reported to the RKC and the RKC should be notified of the situation, both via the advisory comments section of the form and by separate direct communication. The same process should be followed if the owner volunteers information about previous surgery that the assessor could not otherwise have identified. If the veterinarian suspects that the dog has been illegally docked, they may also wish to inform the owner that this is illegal and that whoever docked the dog committed an offence; they are not legally obliged to make further disclosures but may contact the RCVS if they wish to do so (87).

If the owner claims ignorance of the dog's history or that no surgery has been performed, but the assessor remains certain that surgery has been carried out, the assessment should be abandoned and the RKC alerted to the situation.

It is inevitable that some surgical corrections will pass undetected: no system is perfect. However, breeders who knowingly participate in such deception are masking health problems in their breed and acting against the breed's interests. Failure to disclose such information undermines efforts to improve a breed's health for future generations, which impacts canine welfare and sabotages other people's efforts to improve canine health.

Appeals process

An appeals process will be available for owners who wish to challenge a grade assigned following a VCA assessment. The process will follow a consistent approach with other RKC health assessment appeals and will be administered by the RKC.

Any appeal must be submitted in writing to the RKC within 30 days of the original assessment. The owner must identify

the specific criterion or criteria they wish to appeal. Once an appeal has been requested, the original result will be withdrawn or withheld from publication until the appeal is complete. The appeal panel will be made up of trained RKC VCA assessors who are willing to undertake appeals. The RKC will nominate an assessor from this panel to carry out the second assessment. The owner must arrange an appointment and bring the dog and the assessment form issued by the original assessor. The second assessor will reassess all criteria, regardless of which criteria are being appealed. They must photograph the features relevant to each appealed criterion and submit these photographs to the RKC alongside the completed assessment form as supporting evidence. Where appropriate, more rigorous methods may be used to review grading decisions. For example, the mild, moderate and severe grade boundaries for front and hind limb rotation may eventually be supported by goniometry, once sufficient research data are available to establish appropriate boundaries.

The RKC will review the original assessment, the second assessment and the photographs relating to the appealed criteria before issuing the final result. If the evidence does not allow a clear resolution, a third opinion will be sought. The RKC will confirm the final result to the owner in writing. The decision following the appeal is final, and no further appeal will be possible.

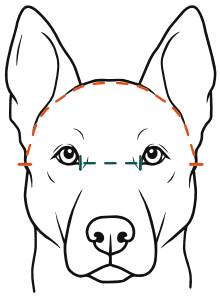
The completed second assessment and supporting evidence must be received by the RKC within 90 days of the original assessment. If the appeal is not completed within this timeframe, the original result may be resubmitted for publication.

Legal context

A full discussion of the current and future legal context for, and implications of, the RKC VCA is beyond the scope of this document. The VCA only assesses visible conformation, and so cannot certify that a dog is suitable to breed from, since other considerations may also affect this decision. After launch, we will develop tailored breeding advice that assists breeders to avoid extreme conformation and that considers the relevant legislation.

Other measurements (discussion)

The reasons for trialling other measurements that may contribute to future additional criteria are discussed below in more detail.



Additional measurements relating to the head

- **Intercanthal distance (green line)**
- **Circumferential cranial width (orange line)**

The two most important cranial conditions linked to conformation that researchers have tried to quantify through measurement are BOAS and Chiari-like malformation/syringomyelia (CM/SM) (2,75,88,88–91). As discussed above, there is good evidence to support the use of craniofacial ratio as a risk factor for BOAS. However, this criterion only assesses the relative lengths of the circumferential cranium and foreface. It does not provide any information about the width of the cranium, which is also a risk factor for BOAS (4). Craniofacial ratio can be influenced by shortening of the cranial base and associated doming, which are known risk factors for CM/SM (88–91), but cannot be used alone to assess this because both measurements are in the same plane and because muzzle length is so variable between breeds. For these reasons, additional cranial measurements could provide further insight into both BOAS and CM/SM. However, many possible measurements have proved poorly repeatable (4), have not been shown to correlate with disease (92), require the use of callipers, which complicates the assessment in a field setting (88), or are only accurate when measured on a correctly positioned photograph rather than a dog (81).

Therefore, we are trialling two additional measurements that may prove informative and which are feasible to obtain: intercanthal distance and circumferential cranial width. The rationale for their choice is discussed below. The evidence base for these measurements is currently not so strong as for the craniofacial index measurements. However, craniometric researchers often note that small study populations can limit statistical significance for findings that might have reached significance with larger sample sizes (2,92). Despite the various limitations of the RKC VCA format, the large sample sizes made possible may enable us to validate these measurements as useful tools.

Intercanthal distance

Welfare impact

Intercanthal distance has previously been measured with a soft tape measure on dogs, with callipers on anaesthetised dogs (unsafe in conscious dogs), or with a ruler on photographs, in different studies (2,4,92). Intercanthal distance has been combined with skull width (see below) to create the eye width ratio, which has been correlated with BOAS in certain breeds, with lack of statistical power due to small sample sizes possibly limiting its wider value (4,81). Prior research does not support intercanthal distance as a useful measurement for CM/SM risk in dogs, although it has been used as a signifier for similar pathology in people (92). We will consider its overall value after a trial period and decide whether to retain this measurement in the future.

Assessment

The straight-line distance between the inner canthi (corners) of the two eyes is measured using a soft tape measure or, if preferred for certain dogs, a piece of string or ribbon that is then itself measured. If there is a nasal fold that obstructs measurement, this may be manually displaced if necessary to facilitate the process.

Circumferential cranial width

Welfare impact

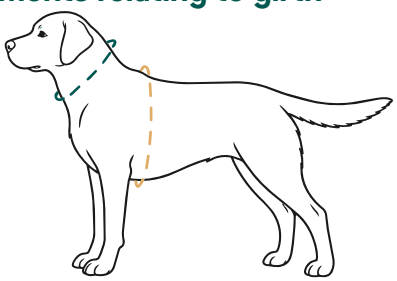
Extreme brachycephalic conformation predisposes to CM/SM (93) and is a positive predictor of BOAS risk (2,75). Detailed imaging studies have identified how this anatomy is altered in brachycephalic breeds and have correlated these changes with disease (81,89,92,94). Shortening of the foreface is a significant factor in BOAS that can be quantified through the craniofacial ratio, as discussed above. The relative width and length of the overall skull, known as the skull index, and of the cranial vault, known as the cranial index, are also used to identify and quantify brachycephaly (81,95) and have been correlated with BOAS risk (4,5) and CM/SM risk (88,91,96) in some breeds. Both these indices can be calculated by combining skull width measurement with the craniofacial ratio measurements previously described. Researchers have considered what external skull width measurements are most suitable for this purpose, and these techniques are discussed below.

Assessment

External measurement of the width of the skull is complicated because the width of the cranial vault cannot be directly measured, due to the overlying musculature. As with cranial length, there is also the difficulty that a circumferential measurement will be influenced by cranial doming but that a linear measurement is difficult to obtain on a dog rather than a photograph or scan. Researchers have addressed this problem in several ways. As with other measurements, the literature can be confusing, because "skull width" or "head width" can refer to several different measurement approaches. Some early studies in this field used "the linear distance along the dorsal plane from the left angular process of the mandible to the right angular process of the mandible"(75,77), which obviously involves mandibular landmarks. Some studies have assessed the straight-line distance between the zygomatic arches on dogs, either through measurement with callipers (88,92) or with soft tape measurements, using extended fingers to guide positioning (4,71). Others have assessed this measurement on accurately-positioned photographs (2,57).

More recently, some researchers have evaluated other measurements, such as the circumference of the head measured over the widest point of the zygomatic arch (92) or the distance between the two zygomatic arches at the widest point, measured over the top of the head (95,97). We are trialling the use of this second measurement, which we are terming the circumferential cranial width for consistency with our use of circumferential cranial length. However, this measurement does not include the whole circumference of the head and mandible, just the dorsal semi-circle across from one zygomatic arch to the other. This measurement is suitable for use on dogs in a field setting and is expected to be more consistent between assessors than a linear measurement that requires the use of fingers as guides, which has been used in some previous research (71). The circumferential cranial width should be measured across the top of the cranium between the widest points of the two zygomatic arches, approximately midway between the eyes and the ears. As with other measurements, a soft tape measure should be used where possible, but a piece of string or narrow ribbon may be used instead, and itself subsequently measured.

Measurements relating to girth



- **Neck girth (green line)**
- **Chest girth (gold line)**

Welfare impact

A thicker neck, where more soft tissue surrounds the airway, is a known risk factor for BOAS in some brachycephalic breeds, as is obesity (higher body condition score) (2,4,57). This raises the question of whether obesity contributes to greater neck girth. One study of controlled weight loss in dogs of various non-brachycephalic breeds found that, while thoracic and abdominal circumference decreased with weight loss, neck girth did not (80), suggesting that these risk factors could be independent, but further research would clarify this. The influence of neck girth on BOAS, like other conformational risk factors, varies between breeds (2), but is useful contextual information for breeding decisions and may also have relevance for non-brachycephalic breeds.

Within a breed, neck girth can be used as a direct indicator of BOAS risk where evidence supports this (4,75), but this approach cannot be used across all breeds because of

their variation in size. Previous BOAS research has therefore compared neck girth with chest girth as a ratio (2,57). However, because this approach has only previously been used in a few brachycephalic breeds, we do not have data to validate it across all breeds, which is why this criterion is currently provisional and does not contribute to the overall RKC VCA score.

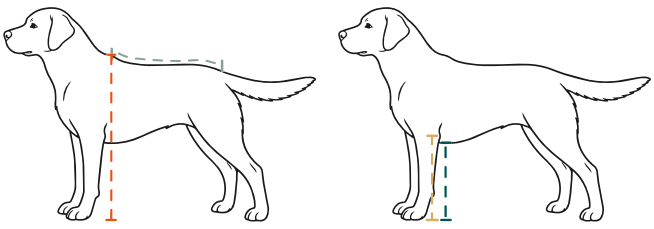
There are other possible reasons to measure chest girth, because there is also some evidence to suggest that exaggerated chest girth may be a predisposing factor to other diseases. Several studies have found that a deeper thorax relative to its width is associated with a higher risk of gastric dilation and volvulus in susceptible breeds (98–100). Breeds with a high prevalence of dilated cardiomyopathy tend to be large and are often deep chested (101). Research has also shown that electrical transmission within the normal canine body heart varies with body shape (102). Consequently, it is possible that thoracic conformation may be an indicator for cardiac disease risk, but this has not been thoroughly investigated. We are not measuring thoracic width and depth separately, but could estimate thoracic depth using other included measurements and compare this with the girth measurement to look for underlying risk factors.

Although neck and chest girth are both impacted by body condition, together they provide considerable information about the size and bulk of the dog, particularly if combined with other measurements such as height at the shoulder. These data may therefore also be used to identity other new morphological characteristics that correlate with health.

Assessment

Neck girth should be measured with a closely fitting soft tape measure positioned at the mid-point of the neck, where a buckle collar would typically sit. Chest girth should be measured just behind the elbow, at the deepest point of the sternum. In dogs with profuse coats, the assessor should attempt to position the tape measure next to the skin by parting the hair; it may be easier to use a piece of string for this purpose and measure the string afterwards. If the coat is so heavy that the assessor is not confident of their measurements, this should be noted in general comments.

Measurements relating to height, length and leg length



- **Back length (shoulder to tail base) (grey line)**
- **Height at shoulder (orange line)**
- **Distance from sternum to ground (green line)**
- **Distance from point of elbow (olecranon) to ground (gold line)**

Scientific context

Short-legged canine phenotypes are produced by a variety of genes. Two important and relevant FGF4 retrogenes have been identified (103). One, on chromosome 12, usually termed 12-FGF4RG, FGF4L2 or CDDY, causes chondrodystrophy: somewhat shorter legs as compared to wild type and a substantially increased risk of IVDD (103–105). The other, on chromosome 18, usually termed 18-FGF4RG, FGF4L1 or CDPA, causes chondrodysplasia: markedly shorter legs with varying degrees of bone curving and limb rotation but without a similarly elevated risk of IVDD (36,37,106,107). Various other genes are also known to contribute to leg length reduction in some dogs (36), and these vary in their breed demography and pathological implications; for example, one causes a significant association between reduced height and inherited primary open angle glaucoma in certain breeds (108). Shortened limbs that are curved and rotated are also at higher risk of developing osteoarthritis or other secondary pathology (38).

Most research attention that considers genetic causes for limb shortening has concerned the two FGF4 retrogenes. Some breeds are almost or completely homozygous for FGF4L2/CDDY, so have an elevated risk of IVDD, but do not have a high allele frequency of FGF4L1/CDPA and so do not have obviously shortened or rotated legs; these include the Cocker Spaniel and Beagle (36,103). There are some breeds that are almost or completely homozygous for FGF4L1/CDPA but that do not have a high allele frequency of FGF4L2/CDDY, and thus have short legs but no elevated risk of IVDD; these include breeds such as the Scottish and West Highland White Terriers (36,103). However, many breeds, particularly those with the “long and low” phenotype, have high or universal allele frequency for both retrogenes; these include Dachshunds and both Cardigan and Pembroke Corgis (36,103,107). There are also many breeds where one or both retrogenes are present but at lower levels, potentially allowing greater phenotypic variation (36,37,103,107).

There is potential value in genotyping to select away from FGF4L2/CDDY in breeds where this is feasible, to reduce susceptibility to IVDD (37,103,107). However, even in breeds that are almost or totally homozygous for FGF4L2/CDDY, not all individuals are clinically impacted by IVDD, and incidence varies between impacted breeds (37,109); for example, Cavalier King Charles Spaniels actually have a higher prevalence of FGF4L2/CDDY than many Dachshund populations, yet have a substantially lower prevalence of clinical IVDD (105,109–112). Various factors have been linked to these differences – for instance, spinal disease in Dachshunds has been correlated with coat type (110,113), body size (110,113), exercise levels (113) and body proportions (76). Therefore, although genotyping obviously allows direct selection away from alleles such as FGF4L2/CDDY in breeds where they are not fixed, there is also value in phenotypic assessment of overall conformation, which is a complementary approach that includes visible variation from all genetic causes and which, if correlated with data on pathology, also potentially enables some assessment of biomechanical factors that may impact clinical disease. The section below discusses measurements that concern

height, body length and leg length proportions and that are currently being recorded within the RKC VCA.

Back length

This is primarily considered as a ratio relative to height at the shoulder.

Note on terminology

Few researchers have measured back or body length in dogs, and terminology and methodology within this field has not yet been standardised. The terms "body length" and "back length" have been used differently by different researchers. The RKC VCA considers back length, defined as the distance from the cranial edge of the scapula to the tail root, on the dorsal midline. Alternative definitions are discussed below, in the "assessment" section.

Welfare impact

Short backs

Abnormally shaped vertebrae with malformed, shortened or missing vertebral bodies (including severely malformed tail vertebrae) can be associated with neurological signs in brachycephalic breeds (69) and can cause kyphosis and other forms of spinal curvature or instability (114). While such anomalies are most accurately identified through diagnostic imaging, this is relatively expensive, so there is obvious potential value in a low-cost, low-intervention screening approach that could highlight dogs at greater risk of disease. Visual assessment of shortened back length (which could reflect underlying vertebral pathology) may have some predictive value for disease in some brachycephalic breeds, but prior studies have used various methodologies and have had mixed findings, further complicating the issue. Data collection from a larger number of dogs through the RKC VCA could therefore potentially confirm whether this approach has predictive value to identify health risks associated with shorter backs. However, such investigations would need to be within-breed studies directly using back measurements, rather than presenting them as a ratio to height. This is because ratios that describe shorter backs relative to height are ambiguous: they do not differentiate between dogs with relatively short backs and dogs with relatively long legs. Consequently, this information is confusing within an all-breed context, and hence also unsuitable for supporting grade boundaries that capture short-backed extreme conformation.

Long backs

The idea that longer backs (relative to height) might predispose to IVDD is not new (115), but very little research has actually investigated the body proportions of breeds with a high prevalence of IVDD. One study has identified a correlation between the risk of IVDD and a greater back length: height ratio, both within the high-risk Dachshund and across crossbreeds of different sizes (76). Shorter-backed high-CDDY allele frequency breeds such as Cocker Spaniels may still have an elevated risk of IVDD compared to other breeds (107,112), so it is likely that this association is multifactorial, perhaps reflecting other genetic and biomechanical influences. Nevertheless, this evidence suggests that selection for less "long and low" conformation could reduce the prevalence of IVDD in genetically susceptible breeds (76). Another multi-breed study correlated longer backs with higher levels of hip dysplasia (74). In the future, RKC VCA data could be compared with other clinical test data such as IVDD screening and hip scores to further investigate whether certain body proportions are associated with these diseases. However, because previous research has been limited and has used varying methodologies (see below), we do not consider there is currently sufficient across-breed evidence to determine where RKC VCA grade boundaries should be situated, in contrast to the situation for craniofacial ratio. Therefore, at present we are collecting this data without including it in the overall RKC VCA score.

Assessment

Previous studies have measured height at the highest, most cranial or mid-point of the shoulder, with techniques including a straight line measurement on a photograph (74), a stadiometer (a vertical stand with a moveable horizontal arm) on a dog (76,78), or a curved line measurement with a soft tape measure on a dog (57). These studies have all compared height to body length and/or back length. "Body length" has been used to describe measurement from the point of the shoulder (greater tubercule of the humerus) to the ischiatic tuberosity on a lateral photograph (74), "the distance from the sternum to the rear of thigh", measured on the dog (76), "the distance along the body from the dorsal plane of the withers to the cranial-most point where the tail meets the body … [m]easured along the median plane of the dog" (77), and the "distance from the cranial edge of scapula to the tail root on the dorsal midline" (2,4,57). "Back length" has been used to describe the distance from the mid-point of the withers to the sacrum (76) and "the distance from the scapula to the pelvis" (78).

This variation makes it difficult to compare findings between different studies and means that we have had to decide which approach to use. During pilot trials, the RKC VCA used soft-tape measurements between the easily-found landmarks of the cranial edge of the scapula and the dorsal root of the tail to measure back length, and soft tape measurement from the ground to the highest point of the scapula on the midline, following the curve of the dog's body, to measure height. This approach is rapid, convenient in a field setting, inexpensive and easy to follow, but does have the disadvantage that following the curve of the body will give a higher height measurement for a wider, more muscular dog, compared with a straight-line approach with a measuring stick, as typically used when measuring dogs for breed standard (or agility category) compliance. This should have limited impact on within-breed VCA comparisons, but must be recognised when making comparisons between breeds of different body types or when correlating data from this assessment with information from settings where a straight-line approach is used. It is also possible, more concerningly, that soft-tape measurements of height may be less repeatable and reliable than those obtained through use of a stadiometer or measuring stick, and we have some evidence of this from the pilot trials. Therefore, we will also be evaluating shoulder height measurement using the

stadiometer approach over the next few months before making a decision about which approach to adopt. This is another reason for the delay in developing criteria that use this measurement.

Ground clearance or leg length ratio

Welfare impact

Despite extensive research considering the adverse consequences of angular limb deformities and investigating the pathological impact of limb-shortening retrogenes (33,36,38,78,103,106), relatively little research has as yet attempted to quantify the impact of unduly short legs on canine welfare by correlating leg length or ground clearance measurement with disease, as has been achieved for craniofacial ratio; morphometric research in this area has tended to consider back length compared to height rather than ground clearance (74,76). Nevertheless, there is sufficient evidence to be concerned about the welfare implications of extremely short legs. Most breeds with very short legs will have a high allele frequency for FGF4L1/CDPA, which produces shortened, curved long bones in the legs (36). While the appearance of these breeds varies, extreme shortening can be associated with angular limb deformity, joint incongruity, arthritis and secondary problems such as inflammation of the skin in the axillae or feet due to chronic trauma (38,52). Extremely short legs can obviously also reduce stride length and hence mobility, and if sufficiently extreme may even allow direct trauma to the sternum from contact with uneven ground. For all these reasons, it is appropriate to consider ground clearance within the RKC VCA, and possible approaches are discussed below.

Distance from sternum to ground

The distance from the sternum to the ground can be compared to the height of the dog at the shoulder to calculate the ground clearance ratio or fraction. This figure is included in certain breed standards, such as the RKC ("ground clearance never less than one quarter of height at withers" and FCI ("ground clearance one third of height at withers") breed standards for Dachshunds (116,117). Ground clearance is also one of the criteria in the All-Party Parliamentary Group for Animal Welfare (APGAW)'s Innate Health Assessment (IHA), with the pass/fail threshold here set at one-third of body height across all breeds (83). Yet, despite these practical uses and the common-sense assumption that extreme lack of ground clearance must compromise mobility, there is currently no published literature that directly correlates sternal ground clearance measurement with any pathology or that provides any population level data for ground clearance measurements for comparison within and between breeds. Therefore, we are collecting this data as part of the RKC VCA process to evaluate its value and significance.

Distance from point of elbow (olecranon) to ground

The distance from the olecranon to the ground has been compared with chest circumference as a ratio in one study of three chondrodysplastic breeds, which found that short legs and a larger chest correlated with conformational abnormalities such as elbow incongruity and limb rotation (38). In another study, a similar measurement, "the length of the antebrachium from the olecranon process of the ulna to the palmar surface of the manus", was used to quantify the effects of the two FGF4s retrogenes on limb shortening (78). This measurement obviously excludes the upper limb and digits but provides a rapid and simple way of assessing lower leg length. Olecranon-ground length could also be combined with other measurements; for instance, it could be compared with height at shoulder to provide an estimate of lower leg length compared to overall height. Therefore, we are assessing the value of this measurement after a trial period and will decide whether to retain it in the future.

Appendix

Additional information

i) Body features that are not included in the RKC Veterinary Conformation Assessment

Some body features that are known to be linked to certain health issues are absent from the current version of the RKC VCA. This is not because we consider them unimportant, but because of practical or administrative difficulties in currently including these criteria within a single assessment suitable for use in all dogs. Omitted features fall into several groups:

a) Features that are known to be linked to disease, but which are only found in a very small number of breeds. For example, open fontanelles can be a concern in very small toy breeds; dermoid sinus is a concern in Rhodesian Ridgebacks; syndactyly (fused toes) can be a concern in King Charles Spaniels. The assessor may note breed-specific anomalies of this sort in the "advisory comments" of the RKC VCA form. Breed-specific features of concern are also considered separately in the second row of our Breeding for Health Framework, so where appropriate we can introduce breed-specific measures to address such problems in the future.

b) Conformation that is known to predispose to disease, but which is difficult to assess within the current RKC VCA format. For example, several skull measurements are included in the assessment, but others are omitted for logistical reasons, so that the current format does not fully encompass all measurements that may be predictors for Chiari-like malformation/syringomyelia (84). We may address this and other such omissions in the future by developing additional targeted provision, which could be added on to the main RKC VCA process for relevant breeds on an evidence-based case-by-case basis.

c) Body features that may be associated with disease, but where more extreme conformation is not directly correlated with worse disease. For example, dropped ears are more likely to develop otitis externa than pricked ears, but pendulous ears are not more likely to develop otitis externa than V-shaped dropped ears, so that it would not be possible to develop a straightforward evidence-based graded scale for this criterion (118). If the assessor felt that the ears of a certain dog were so extreme that they were causing a clear welfare impact – for example, if a dog was standing on its own ears as it moved – then this could be noted in the advisory comments, as noted above.

d) Body features that are outside the scope of the current assessment, such as colour and coat type. These features may be addressed separately on a case-by-case basis as our health provision continues to evolve.

ii) The RKC Veterinary Conformation Assessment and the Innate Health Assessment

The RKC VCA has obvious parallels with the All-Party Parliamentary Group for Animal Welfare (APGAW)'s Innate Health Assessment (IHA), launched in November 2025, which comprises ten similar criteria with binary pass/fail thresholds. The IHA is intended for self-assessment use by anyone who is considering breeding from a dog or potentially acquiring a puppy or adult dog. We see these schemes as complementary. The IHA has been designed as a free-to-use dog conformation assessment tool that is easy to access, understand and execute by any person regardless of experience or qualifications and to cover all dogs regardless of type or pedigree status. Its ease of access and understanding also means that the IHA is suitable as a wider public educational tool. In contrast, the RKC VCA is more nuanced and comprehensive, and is administered by trained veterinarians. It is thus more suitable for use by breeders who wish to accurately monitor any tendency towards extreme conformation as they make breeding decisions.

Two IHA criteria are absent from the RKC VCA: merle colour and spinal flexibility.

- The RKC VCA only considers body shape, not colour. While there are well-documented health risks associated with merle breeding, these are increasingly well understood and hence navigable by skilled breeders. RKC breeding governance already regulates merle. APGAW has now modified the IHA's merle criterion to offer a conditional pass for merle dogs that have been genotyped to ensure safe pairings. This exemption uses genetics advice provided by the RKC Health and Breeding Team. We will be developing RKC internal guidance and provision to further reduce risks associated with merle breeding in the future.
- While spinal flexibility is obviously important, our veterinary panel considered it too subjective and variable to certify accurately.
- Seven of the remaining eight IHA criteria are paralleled in the current RKC VCA criteria, together with our other criteria. The eighth, ground clearance, is included in the measurements that we are currently trialling, as discussed elsewhere in this document.

iii) List of contributors to the development of the RKC Veterinary Conformation Assessment

a) Breeder contributors

We would like to thank the many hundreds of breeders who have helped to shape the RKC through their participation in online workshops and surveys, their practical support of pilot sessions by providing dogs, and their invaluable feedback as the project has evolved. The RKC VCA could not have been developed without their support.

b) Veterinary contributors

The veterinarians on the next page have all given their time on a voluntary basis to support the development of this tool, within our discussion panel, providing expert consultancy, and/or participating in our pilot trials. We are very grateful to them all for their support.

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References

1. Skipper A. A New Future for Dog Breeding [Internet]. Royal Kennel Club; 2026 Jan [cited 2026 Aug 4]. Available from: https://www.royalkennelclub.com/media/cbsnewyj/rkc_report_2026_full-version.pdf
2. Tomlinson F, Liu NC, Sargan DR, Ladlow JF. A cross-sectional study into the prevalence and conformational risk factors of BOAS across fourteen brachycephalic dog breeds. PLOS ONE. 2026 Feb 18;21(2):e0340604. doi:10.1371/journal.pone.0340604
3. Liu NC, Adams VJ, Kalmar L, Ladlow JF, Sargan DR. Whole-Body Barometric Plethysmography Characterizes Upper Airway Obstruction in 3 Brachycephalic Breeds of Dogs. Journal of Veterinary Internal Medicine. 2016 May 1;30(3):853–65. doi:10.1111/jvim.13933
4. Liu NC, Troconis EL, Kalmar L, Price DJ, Wright HE, Adams VJ, et al. Conformational risk factors of brachycephalic obstructive airway syndrome (BOAS) in pugs, French bulldogs, and bulldogs. PLOS ONE. 2017 Aug 1;12(8):e0181928. doi:10.1371/journal.pone.0181928
5. Liu NC, Troconis EL, Sargan DR, Ladlow JF. Breed-specific anatomical risk factors of brachycephalic obstructive airway syndrome: A comprehensive computed tomographic study from nares to cervical trachea. The Veterinary Journal. 2025 Dec 1;314:106484. doi:10.1016/j.tvjl.2025.106484
6. Sharp CAT, Liu NC, Guy A, Ladlow JF. The mobility of the brachycephalic canine nostril in relation to the degree of nostril stenosis. The Veterinary Journal. 2024 Apr 1;304:106085. doi:10.1016/j.tvjl.2024.106085
7. Royal Kennel Club. Respiratory Function Grading Scheme [Internet]. [cited 2026 Aug 18]. Available from: https://www.royalkennelclub.com/health-and-dog-care/health-dog-care/health/getting-started-with-health-testing-and-screening/respiratory-function-grading-scheme/
8. Personal communication with Jane Ladlow.
9. Hale FA. Dental and Oral Health for the Brachycephalic Companion Animal. In: Health and Welfare of Brachycephalic (Flat-faced) Companion Animals. CRC Press; 2021.
10. Hale FA. 14 Dental and Oral Health for the Brachycephalic Companion Animal. Health and Welfare of Brachycephalic (Flat-faced) Companion Animals: A Complete Guide for Veterinary and Animal Professionals. 2021;235.
11. Niemiec B, Gawor J, Nemec A, Clarke D, McLeod K, Tutt C, et al. World Small Animal Veterinary Association Global Dental Guidelines. Journal of Small Animal Practice. 2020;61(7):E36–161. doi:10.1111/jsap.13132
12. Gawor J. Hereditary oral disorders in pedigree dogs. Proposals for their evidence and assessment.
13. Martins MC, Valadares SA, Gawor JP, Mestrinho LA. Skeletal-dental features in 33 bull terrier dogs. BMC Vet Res. 2022 Feb 7;18(1):65. doi:10.1186/s12917-022-03164-0
14. Coelho JC, Varela C, Mestrinho L. Longitudinal Evaluation of Permanent Dental Anomalies in a Group of Yorkshire Terriers Referred for Dental Consultation. J Vet Dent. 2025 Sep 1;42(5):365–71. doi:10.1177/08987564251322660
15. Pavlica Z, Erjavec V, Petelin M. Teeth Abnormalities in the Dog. Acta Vet Brno. 2001;70(1):65–72. doi:10.2754/avb200170010065
16. Kupczik K, Cagan A, Brauer S, Fischer MS. The dental phenotype of hairless dogs with FOXI3 haploinsufficiency. Sci Rep. 2017 Jul 14;7:5459. doi:10.1038/s41598-017-05764-5 PubMed PMID: 28710361; PubMed Central PMCID: PMC5511229.
17. Parker HG, Harris A, Dreger DL, Davis BW, Ostrander EA. The bald and the beautiful: hairlessness in domestic dog breeds. Philos Trans R Soc Lond B Biol Sci. 2017 Feb 5;372(1713):20150488. doi:10.1098/rstb.2015.0488 PubMed PMID: 27994129; PubMed Central PMCID: PMC5182420.
18. Zorkoltseva IV, Akberdin IR, Kulikova AV, Knyazev SP, Borodin PM, Axenovich TI. Changes in litter size in Kerry Blue Terrier dogs with abnormal dentition. Russ J Genet. 2006 Mar;42(3):339–40. doi:10.1134/S1022795406030161
19. O'Neilll DG, Rowe D, Brodbelt DC, Pegram C, Hendricks A. Ironing out the wrinkles and folds in the epidemiology of skin fold dermatitis in dog breeds in the UK. Sci Rep. 2022 Jul 6;12:10553. doi:10.1038/s41598-022-14483-5 PubMed PMID: 35794173; PubMed Central PMCID: PMC9259571.
20. Jackson H, Gow D. Dermatological Problems in the Brachycephalic Patient. In: Health and Welfare of Brachycephalic (Flat-faced) Companion Animals. CRC Press; 2021.
21. Sebbag L, Sanchez RF. The pandemic of ocular surface disease in brachycephalic dogs: The brachycephalic ocular syndrome. Veterinary Ophthalmology. 2023;26:31–46.
22. Packer RMA, Hendricks A, Burn CC. Impact of Facial Conformation on Canine Health: Corneal Ulceration. PLOS ONE. 2015 May 13;10(5):e0123827. doi:10.1371/journal.pone.0123827
23. CVPM SW RVT. Skin Fold Dermatitis (Intertrigo) in Dogs. Today's Veterinary Practice [Internet]. 2019 Oct 10 [cited 2026 Aug 11]. Available from: https://todaysveterinarypractice.com/dermatology/skin-fold-dermatitis-intertrigo-in-dogs/
24. Paterson S. Intertrigo in the dog: aetiology, clinical signs and therapy. Companion Animal. 2017;22(2):72–7.
25. Wiley.com [Internet]. [cited 2026 Jul 15]. Veterinary Ophthalmology, 2 Volume Set, 6th Edition | Wiley. Available from: https://www.wiley.com/en-gb/veterinary-ophthalmology-2-volume-set-6th-edition-p-9781119441816
26. O'Neill DG, Mustikka MP, Brodbelt DC, Church DB, Vaattovaara V. Conformational eyelid disorders in dogs under primary veterinary care in the UK - Epidemiology and clinical management. PLOS ONE. 2025 Jun 30;20(6):e0326526. doi:10.1371/journal.pone.0326526
27. Petersen-Jones SM, Crispin SM. Manual of small animal ophthalmology. 1993.
28. Murgiano L, Banjeree E, O'Connor C, Miyadera K, Werner P, Niggel JK, et al. A naturally occurring canine model of syndromic congenital microphthalmia. G3 Genes|Genomes|Genetics. 2024 Jun 1;14(6):jkae067. doi:10.1093/g3journal/jkae067
29. Dewey CW. Congenital Abnormalities of the Skull, Vertebral Column, and Central Nervous System, An Issue of Veterinary Clinics of North America: Small Animal Practice, E-Book: Congenital Abnormalities of the Skull, Vertebral Column, and Central Nervous System, An Issue of Veterinary Clinics of North America: Small Animal Practice, E-Book. Elsevier Health Sciences; 2016. 177 p.
30. Richter M. Brachycephalic Ocular Syndrome.
31. Roses L, Yap F, Welsh E. Surgical management of screw-tail in dogs. Companion Animal. 2018 May 2;23(5):287–92. doi:10.12968/coan.2018.23.5.287
32. Vasiadou C, Papazoglou LG. Surgical management of screw tail and tail fold pyoderma in dogs. Journal of the Hellenic Veterinary Medical Society. 2016;67(4):205–10. doi:10.12681/jhvms.15640

33. Pulkkinen HSM, Lappalainen A, Junnila J, Laitinen-Vapaavuori OM, Hyytiäinen H. Thoracic Limb Angular Deformity in Chondrodystrophic Dogs: Repeatability of Goniometric Measurement of External Rotation and Carpal Valgus. VCOT open. 2022 Oct 21;5(2):e123–30. doi:10.1055/s-0042-1750030

34. Kyöstilä K, Lappalainen AK, Lohi H. Canine Chondrodysplasia Caused by a Truncating Mutation in Collagen-Binding Integrin Alpha Subunit 10. PLOS ONE. 2013 Sep 25;8(9):e75621. doi:10.1371/journal.pone.0075621

35. Mäkeläinen S, Ekman S, Hytönen MK, Lohi H, Kyöstilä K, Simon T, et al. A nonsense mutation in the PRKG2 gene in dalmatian dogs with chondrodysplasia. PLOS ONE. 2025 Nov 26;20(11):e0322107. doi:10.1371/journal.pone.0322107

36. Parker HG, VonHoldt BM, Quignon P, Margulies EH, Shao S, Mosher DS, et al. An Expressed Fgf4 Retrogene Is Associated with Breed-Defining Chondrodysplasia in Domestic Dogs. Science. 2009 Aug 21;325(5943):995–8. doi:10.1126/science.1173275

37. Bannasch D, Batcher K, Leuthard F, Bannasch M, Hug P, Marcellin-Little D, et al. The Effects of FGF4 Retrogenes on Canine Morphology. Genes. 2022 Feb 10;13:325. doi:10.3390/genes13020325

38. Lappalainen AK, Pulkkinen HSM, Mölsä S, Junnila J, Hyytiäinen HK, Laitinen-Vapaavuori O. Breed-typical front limb angular deformity is associated with clinical findings in three chondrodysplastic dog breeds. Front Vet Sci. 2023 Jan 17;9. doi:10.3389/fvets.2022.1099903

39. Turunen K, Lappalainen A, Junnila JJT, Hyytiäinen H, Lilja-Maula L. Exercise habits and musculoskeletal health of the Finnish Dachshund population: an online survey study. Acta Veterinaria Scandinavica. 2026 Aug 13. doi:10.1186/s13028-026-00877-2

40. Duclos DD, Hargis AM, Hanley PW. Pathogenesis of canine interdigital palmar and plantar comedones and follicular cysts, and their response to laser surgery. Veterinary Dermatology. 2008;19(3):134–41.

41. Reusing M, Brocardo M, Weber S, Villanova Jr J. Goniometric evaluation and passive range of joint motion in chondrodystrophic and non-chondrodystrophic dogs of different sizes. VCOT Open. 2020;3(02):e66–71.

42. Kwon M, Kwon D, Lee J, Lee K, Yoon H. Evaluation of the Radial Procurvatum Using the Center of Rotation of Angulation Methodology in Chondrodystrophic Dogs. Front Vet Sci. 2022 Jan 3;8. doi:10.3389/fvets.2021.774993

43. Brühschwein A, Burg-Personnaz J, Zöllner M, Reese S, Meyer-Lindenberg A. Comparison of CT-measured angles of pelvic limbs without patellar luxation of six canine breeds. Front Vet Sci. 2023 Jul 13;10. doi:10.3389/fvets.2023.1194167

44. Aghapour M, Bockstahler B, Vidoni B. Evaluation of the Femoral and Tibial Alignments in Dogs: A Systematic Review. Animals. 2021 Jun;11(6):1804. doi:10.3390/ani11061804

45. Yasukawa S, Edamura K, Tanegashima K, Seki M, Teshima K, Asano K, et al. Evaluation of bone deformities of the femur, tibia, and patella in Toy Poodles with medial patellar luxation using computed tomography. Vet Comp Orthop Traumatol. 2016;29(1):29–38. doi:10.3415/VCOT-15-05-0089

46. Isono A, Harada Y, Kanno N, Hara Y. Tibial torsion malalignment in small dogs with medial patellar luxation. Veterinary and Comparative Orthopaedics and Traumatology. 2025;38(04):162–70.

47. Silva Gobeti A, Marrs JJ, Story AL, Hilfiker H, Fox DB. Comparison of axial tibial-metatarsal alignment in dogs of varying size with and without medial patellar luxation. Front Vet Sci. 2026 Apr 16;13. doi:10.3389/fvets.2026.1781687

48. Zink C, Schlehr MR. Working Dog Structure: Evaluation and Relationship to Function. Front Vet Sci. 2020 Oct 20;7. doi:10.3389/fvets.2020.559055

49. Putnam RW. Patella Luxation in the Dog [Master's]. University of Guelph; 1968.

50. Singleton WB. The Surgical Correction of Stifle Deformities in the Dog. Journal of Small Animal Practice. 1969;10(2):59–69. doi:10.1111/j.1748-5827.1969.tb04021.x

51. Rezende CMF, Tôrres RCS, Nepomuceno AC, Lara JS, Varón JAC. Patellar Luxation in Small Animals. In: Canine Medicine - Recent Topics and Advanced Research [Internet]. IntechOpen; 2016 [cited 2026 Jul 28]. Available from: https://www.intechopen.com/chapters/52766 doi:10.5772/65764

52. Mäki K. Improving the enforcement of Finnish animal welfare legislation related to animal breeding. 2025.

53. Mansour TA, Lucot K, Konopelski SE, Dickinson PJ, Sturges BK, Vernau KL, et al. Whole genome variant association across 100 dogs identifies a frame shift mutation in DISHEVELLED 2 which contributes to Robinow-like syndrome in Bulldogs and related screw tail dog breeds. PLOS Genetics. 2018 Dec 6;14(12):e1007850. doi:10.1371/journal.pgen.1007850

54. Niskanen JE, Reunanen V, Salonen M, Bannasch D, Lappalainen AK, Lohi H, et al. Canine DVL2 variant contributes to brachycephalic phenotype and caudal vertebral anomalies. Hum Genet. 2021 Nov 1;140(11):1535–45. doi:10.1007/s00439-021-02261-8

55. Schlensker E, Distl O. Heritability of hemivertebrae in the French bulldog using an animal threshold model. The Veterinary Journal. 2016 Jan 1;207:188–9. doi:10.1016/j.tvjl.2015.10.044

56. Schlensker E, Distl O. Prevalence, grading and genetics of hemivertebrae in dogs.

57. Tomlinson F, O'Neill E, Liu NC, Sargan DR, Ladlow JF. BOAS in the Boston Terrier: A healthier screw-tailed breed? PLOS ONE. 2024 Dec 31;19(12):e0315411. doi:10.1371/journal.pone.0315411

58. Siniscalchi M, D'Ingeo S, Minunno M, Quaranta A. Communication in Dogs. Animals. 2018 Aug;8(8):131. doi:10.3390/ani8080131

59. Leaver SDA, Reimchen TE. Behavioural Responses of Canis familiaris to Different Tail Lengths of a Remotely-Controlled Life-Size Dog Replica. Behaviour. 2008;145(3):377–90.

60. Eretová P, Liu Q, Přibylová L, Chaloupková H, Bakos V, Lenkei R, et al. Can my human read my flat face? The curious case of understanding the contextual cues of extremely brachycephalic dogs. Applied Animal Behaviour Science. 2024 Jan 1;270:106134. doi:10.1016/j.applanim.2023.106134

61. Canori C, Biffi E, Gaggia L, Iuliano B, Valsecchi P. Do looks matter? Investigating facial expressions and intraspecific communication across different dog morphotypes. Applied Animal Behaviour Science. 2025 Oct 1;291:106720. doi:10.1016/j.applanim.2025.106720

62. Haworth K, Putt W, Cattanach B, Breen M, Binns M, Lingaas F, et al. Canine homolog of the T-box transcription factor T; failure of the protein to bind to its DNA target leads to a short-tail phenotype. Mammalian Genome. 2001 Mar 1;12(3):212–8. doi:10.1007/s003350010253

63. Hytönen MK, Grall A, Hédan B, Dréano S, Seguin SJ, Delattre D, et al. Ancestral T-Box Mutation Is Present in Many, but Not All, Short-Tailed Dog Breeds. J Hered. 2009 Mar 1;100(2):236–40. doi:10.1093/jhered/esn085

64. Indrebø A, Langeland M, Juul HM, Skogmo HK, Rengmark AH, Lingaas F. A study of inherited short tail and taillessness in Pembroke Welsh corgi. Journal of Small Animal Practice. 2008;49(5):220–4. doi:10.1111/j.1748-5827.2007.00435.x

65. Berg JA, Sævik BK, Lingaas F, Trangerud C. Association between the natural bobtail phenotype and lumbosacral transitional vertebra in Brittany dogs and Danish-Swedish Farmdogs. Can Vet J. 2026 Aug;67(8):882–8. PubMed PMID: 42544340; PubMed Central PMCID: PMC13429198.

66. Berg JA, Saevik BK, Lingaas F, Trangerud C. Transitional lumbosacral vertebrae in black Norwegian elkhound and Brittany dogs: Clinical findings and its association with degenerative lumbosacral stenosis. Acta Vet Scand. 2025 Feb 12;67(1):10. doi:10.1186/s13028-025-00797-7 PubMed PMID: 39939978; PubMed Central PMCID: PMC11816518.

67. Rottier T, Schulz AK, Söhnel K, Mccarthy K, Fischer MS, Jusufi A. Biomechanical modeling of Border Collies (Canis familiaris) for insights of tail and limb use during the aerial phase of jumping [Internet]. bioRxiv; 2023 [cited 2026 Jul 27]. p. 2022.12.30.522334. Available from: https://www.biorxiv.org/content/10.1101/2022.12.30.522334v2 doi:10.1101/2022.12.30.522334

68. Siniscalchi M, D'Ingeo S, Minunno M, Quaranta A. Communication in Dogs. Animals. 2018 Aug;8(8):131. doi:10.3390/ani8080131

69. Lackmann F, Forterre F, Brunnberg L, Loderstedt S. Epidemiological study of congenital malformations of the vertebral column in French bulldogs, English bulldogs and pugs. Veterinary Record. 2022;190(1):e509. doi:10.1002/vetr.509

70. Ryan R, Gutierrez-Quintana R, Haar G ter, Decker SD. Relationship between breed, hemivertebra subtype, and kyphosis in apparently neurologically normal French Bulldogs, English Bulldogs, and Pugs. American Journal of Veterinary Research. 2019 Feb 1;80(2):189–94. doi:10.2460/ajvr.80.2.189

71. Youens E, O'Neill DG, Tivers M, Belshaw Z, Neufuss J, Packer RMA. A solution right under our nose? Crossbreeding extreme brachycephalic dogs results in better health outcomes while preserving behavioural profiles and dog-owner relationship quality. Animal Welfare. 2026/08/05 edn. 2026;35:e41. Located at: Cambridge Core. doi:10.1017/awf.2026.10095

72. Tail docking. BASC [Internet]. [cited 2026 Jul 27]. Available from: https://basc.org.uk/gundogs/advice/tail-docking/

73. EXPLANATORY MEMORANDUM TO THE DOCKING OF WORKING DOGS' TAILS (ENGLAND) REGULATIONS No.1120.

74. Roberts T, McGreevy PD. Selection for breed-specific long-bodied phenotypes is associated with increased expression of canine hip dysplasia. The Veterinary Journal. 2010 Mar 1;183(3):266–72. doi:10.1016/j.tvjl.2009.11.005

75. Packer RMA, Hendricks A, Tivers MS, Burn CC. Impact of Facial Conformation on Canine Health: Brachycephalic Obstructive Airway Syndrome. Ambrósio CE, editor. PLoS ONE. 2015 Oct 28;10(10):e0137496. doi:10.1371/journal.pone.0137496

76. Packer RMA, Hendricks A, Volk HA, Shihab NK, Burn CC. How Long and Low Can You Go? Effect of Conformation on the Risk of Thoracolumbar Intervertebral Disc Extrusion in Domestic Dogs. PLOS ONE. 2013 Jul 24;8(7):e69650. doi:10.1371/journal.pone.0069650

77. Sutter NB, Mosher DS, Gray MM, Ostrander EA. Morphometrics within dog breeds are highly reproducible and dispute Rensch's rule. Mamm Genome. 2008;19(10–12):713–23. doi:10.1007/s00335-008-9153-6 PubMed PMID: 19020935; PubMed Central PMCID: PMC2748280.

78. Bannasch D, Batcher K, Leuthard F, Bannasch M, Hug P, Marcellin-Little DJ, et al. The Effects of FGF4 Retrogenes on Canine Morphology. Genes. 2022 Feb;13(2):325. doi:10.3390/genes13020325

79. Söder J, Ehnberg L, Löfberg E, Höglund K, Bergh A. Intra- and inter-observer reliability of girth measurements of the neck, chest, and abdomen in dogs. Front Vet Sci. 2025 Mar 13;12. doi:10.3389/fvets.2025.1546951

80. Chapman M, Woods GRT, Ladha C, Westgarth C, German AJ. An open-label randomised clinical trial to compare the efficacy of dietary caloric restriction and physical activity for weight loss in overweight pet dogs. The Veterinary Journal. 2019 Jan 1;243:65–73. doi:10.1016/j.tvjl.2018.11.013

81. Tomlinson F. Defining Brachycephaly in Dogs: External Conformation, Skull Morphology and Obstructive Airway Disease [PhD]. [Cambridge]: University of Cambridge; 2026.

82. Liu NC, Sargan DR, Adams VJ, Ladlow JF. Characterisation of Brachycephalic Obstructive Airway Syndrome in French Bulldogs Using Whole-Body Barometric Plethysmography. Rosenfield CS, editor. PLoS ONE. 2015 Jun 16;10(6):e0130741. doi:10.1371/journal.pone.0130741

83. PetProov A&. Innate Health Assessment [Internet]. [cited 2026 Aug 18]. Innate Health Assessment (IHA) Tool | Check Your Dog's Innate Health. Available from: https://tool.innatehealthassessment.org/buyer-check

84. WSAVA Body Condition Score (Dog) [Internet]. [cited 2026 Aug 4]. Available from: https://wsava.org/wp-content/uploads/2020/01/Body-Condition-Score-Dog.pdf

85. Wallis N, Raffan E. The Genetic Basis of Obesity and Related Metabolic Diseases in Humans and Companion Animals. Genes. 2020 Nov;11(11):1378. doi:10.3390/genes11111378

86. Wallis NJ, McClellan A, Mörseburg A, Kentistou KA, Jamaluddin A, Dowsett GKC, et al. Canine genome-wide association study identifies DENND1B as an obesity gene in dogs and humans. Science. 2025 Mar 6;387(6741):eads2145. doi:10.1126/science.ads2145

87. BVA AWF. The practical and legal approach to the docked puppy [Internet]. [cited 2026 Aug 18]. Tail-docking-guidance_2017. Available from: https://animalwelfarefoundation.org.uk/wp-content/uploads/2017/12/Tail-docking-guidance_2017.pdf

88. Mitchell TJ, Knowler SP, van den Berg H, Sykes J, Rusbridge C. Syringomyelia: determining risk and protective factors in the conformation of the Cavalier King Charles Spaniel dog. Canine Genet Epidemiol. 2014 Jul 29;1(1):9. doi:10.1186/2052-6687-1-9

89. Knowler SP, Kiviranta AM, McFadyen AK, Jokinen TS, La Ragione RM, Rusbridge C. Craniometric analysis of the hindbrain and Craniocervical junction of Chihuahua, Affenpinscher and cavalier king Charles spaniel dogs with and without Syringomyelia secondary to Chiari-like malformation. PLoS One. 2017;12(1):e0169898.

90. Rusbridge C, Knowler S, Pieterse L, McFadyen A. Chiari-like malformation in the Griffon Bruxellois. Journal of Small Animal Practice. 2009;50(8):386–93.

91. Harcourt-Brown T r., Campbell J, Warren-Smith C, Jeffery N d., Granger N p. Prevalence of Chiari-like Malformations in Clinically Unaffected Dogs. Journal of Veterinary Internal Medicine. 2015;29(1):231–7. doi:10.1111/jvim.12477

92. Santifort KM, Bellekom S, Carrera I, Mandigers PJ. CT-based and manual external skull measurements for Chiari-like malformation and syringomyelia in Pomeranians. PLoS One. 2024;19(11):e0313203.

93. Rusbridge C, Knowler P. The Need for Head Space: Brachycephaly and Cerebrospinal Fluid Disorders. Life. 2021 Feb 12;11(2):139. doi:10.3390/life11020139

94. Selba MC, Oechtering GU, Heng HG, DeLeon VB. The Impact of Selection for Facial Reduction in Dogs: Geometric Morphometric Analysis of Canine Cranial Shape. The Anatomical Record. 2020;303(2):330–46. doi:10.1002/ar.24184

95. da Silva PHS, Castanheira ITF, Galera PD. Comparative applied craniofacial morphometry in popular brachycephalic breeds: A tool for preventive medicine and risk stratification. Research in Veterinary Science. 2026 Jun 1;205:106163. doi:10.1016/j.rvsc.2026.106163

96. Santifort K, Bellekom S, Carrera I, Mandigers P. Craniocervical Morphometry in Pomeranians—Part II: Associations with Chiari-like Malformation and Syringomyelia. Animals. 2024 Jan;14(13):1859. doi:10.3390/ani14131859

97. Kumar BP, Shammi M, Ramani C, Ramesh G, Balagangadharthilagar. Morphometric assessment and body condition scoring as predictors of brachycephalic obstructive airway syndrome in dogs. Int J Vet Sci Anim Husbandry. 2025;10(10):348–52. doi:10.22271/veterinary.2025.v10.i10e.2657

98. Schellenberg D, Yi Q, Glickman NW, Glickman LT. Influence of thoracic conformation and genetics on the risk of gastric dilatation-volvulus in Irish setters. Journal of the American Animal Hospital Association. 1998 Jan 1;34(1):64–73. doi:10.5326/15473317-34-1-64

99. Glickman LT, Glickman NW, Schellenberg DB, Raghavan M, Lee TL. Incidence of and breed-related risk factors for gastric dilatation-volvulus in dogs. Journal of the American Veterinary Medical Association. 2000 Jan 1;216(1):40–5. doi:10.2460/javma.2000.216.40

100. Glickman L, Emerick T, Glickman N, Glickman S, Lantz G, Pérez C, et al. Radiological Assessment of the Relationship Between Thoracic Conformation and the Risk of Gastric Dilatation-Volvulus in Dogs. Veterinary Radiology & Ultrasound. 1996;37(3):174–80. doi:10.1111/j.1740-8261.1996.tb01216.x

101. Dutton E, López-Alvarez J. An update on canine cardiomyopathies – is it all in the genes? Journal of Small Animal Practice. 2018;59(8):455–64. doi:10.1111/jsap.12841

102. Mateos Pañero M, Battaia S, Ramera L, Perego M, Santilli RA. R-peak time in clinically healthy dogs with different thoracic conformations. Vet J. 2021 Feb;268:105592. doi:10.1016/j.tvjl.2020.105592 PubMed PMID: 33468300.

103. Batcher K, Dickinson P, Giuffrida M, Sturges B, Vernau K, Knipe M, et al. Phenotypic Effects of FGF4 Retrogenes on Intervertebral Disc Disease in Dogs. Genes. 2019 Jun;10(6):435. doi:10.3390/genes10060435

104. Donner J, Freyer J, Davison S, Anderson H, Blades M, Honkanen L, et al. Genetic prevalence and clinical relevance of canine Mendelian disease variants in over one million dogs. PLoS Genet. 2023 Feb 27;19(2):e1010651. doi:10.1371/journal.pgen.1010651 PubMed PMID: 36848397; PubMed Central PMCID: PMC9997962.

105. Sullivan S, Redden D, Hardeng F, Sundqvist M, Kutzler M. The relationship between radiographic disc calcification score and FGF4L2 genotype in dachshunds. Journal of Veterinary Internal Medicine. 2025 Jan 1;39(1):jvim17281. doi:10.1111/jvim.17281

106. Mhlanga-Mutangadura T, Hansen L, Katz ML. Absence of FGF4 Retrogene Insertion on Chromosome 18 Results in a Tall Phenotype in Grand Basset Griffon Vendéen Dogs. Veterinary Sciences. 2025 Sep;12(9):916. doi:10.3390/vetsci12090916

107. Chondrodystrophy (CDDY and IVDD) and Chondrodysplasia (CDPA) [Internet]. Available from: https://vgl.ucdavis.edu/test/cddy-cdpa

108. Glaucoma-causing ADAMTS17 mutations are also reproducibly associated with height in two domestic dog breeds: selection for short stature may have contributed to increased prevalence of glaucoma - ProQuest [Internet]. [cited 2026 Jul 30]. Available from: https://www.proquest.com/openview/82d7e73389cab80d601c1412cd2093ef/1?pq-origsite=gscholar&cbl=2040153

109. Dickinson PJ, Bannasch DL. Current Understanding of the Genetics of Intervertebral Disc Degeneration. Front Vet Sci. 2020 Jul 24;7. doi:10.3389/fvets.2020.00431

110. Hopper M, Liu CC, Embersics C, Otamendi A, Sullivan S. Dachshund spinal health by coat and size type. J Vet Intern Med. 2026 Jul 30;40(4):aalag153. doi:10.1093/jvimsj/aalag153 PubMed PMID: 42531050; PubMed Central PMCID: PMC13421367.

111. Summers JF, O'Neill DG, Church DB, Thomson PC, McGreevy PD, Brodbelt DC. Prevalence of disorders recorded in Cavalier King Charles Spaniels attending primary-care veterinary practices in England. Canine Genet Epidemiol. 2015 Apr 18;2(1):4. doi:10.1186/s40575-015-0016-7

112. Bergknut N, Egenvall A, Hagman R, Gustås P, Hazewinkel HAW, Meij BP, et al. Incidence of intervertebral disk degeneration–related diseases and associated mortality rates in dogs. Journal of the American Veterinary Medical Association. 2012 Jun 1;240(11):1300–9. doi:10.2460/javma.240.11.1300

113. DachsLife 2015: an investigation of lifestyle associations with the risk of intervertebral disc disease in Dachshunds | Companion Animal Health and Genetics | Springer Nature Link [Internet]. [cited 2026 Aug 3]. Available from: https://link.springer.com/article/10.1186/s40575-016-0039-8

114. Guevar J, Penderis J, Faller K, Yeamans C, Stalin C, Gutierrez-Quintana R. Computer-Assisted Radiographic Calculation of Spinal Curvature in Brachycephalic "Screw-Tailed" Dog Breeds with Congenital Thoracic Vertebral Malformations: Reliability and Clinical Evaluation. PLOS ONE. 2014 Sep 8;9(9):e106957. doi:10.1371/journal.pone.0106957

115. Verheijen J, Bouw J. Canine intervertebral disc disease: A review of etiologic and predisposing factors. Veterinary Quarterly. 1982 Jul;4(3):125–34. doi:10.1080/01652176.1982.9693852

116. Dachshund (Smooth Haired) | Breed Standards | Kennel Club [Internet]. [cited 2026 Aug 24]. Available from: https://www.royalkennelclub.com/breed-standards/hound/dachshund-smooth-haired/

117. FCI Dachshund breed standard [Internet]. [cited 2026 Aug 24]. Available from: https://www.fci.be/nomenclature/Standards/148g04-en.pdf

118. O'Neill DG, Volk AV, Soares T, Church DB, Brodbelt DC, Pegram C. Frequency and predisposing factors for canine otitis externa in the UK – a primary veterinary care epidemiological view. Canine Genet Epidemiol. 2021 Sep 7;8(1):7. doi:10.1186/s40575-021-00106-1



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