TAIL FAULTS
basic informations

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There are many vertebra anomalies known in human medicine, with even more names and synonyms. There is also very little knowledge of the origin, morphology, systematic classification, etiology, pathogenesis and heredity of most of them.

In the veterinary medicine the faults are generally classified by genesis/pathogenesis and the heritability is assumed.

However there is very little scientific investigation undergoing at the present.

In the dog breeding the heritability is assumed and most anomalies present a disqualification from breeding. These anomalies are:

- Kinked tail
- Block
- Wedge vertebra/half vertebra
- malformed vertebra
- transitional vertebra

Suspected mode of inheritance

KINKED TAIL	= autosomal recessive
BLOCK	= autosomal recessive
Wedge vertebra/half vertebra	= polygenic autosomal
(malformed vertebra)	= autosomal recessive (with polygenic influence)
(transitional vertebra)	= autosomal recessive (today mostly based on changes in the last lumbosacral vertebra Cauda equina syndrome)

Today, many known tail anomalies are the breed specific features required by breed standards. Anomalies such as shorter tails, missing tails formed by congenital vertebral reduction, curved tails formed by multiple kinked tails are in some breeds not an anomaly at all!

Breeds with abnormal tail required by breed standard

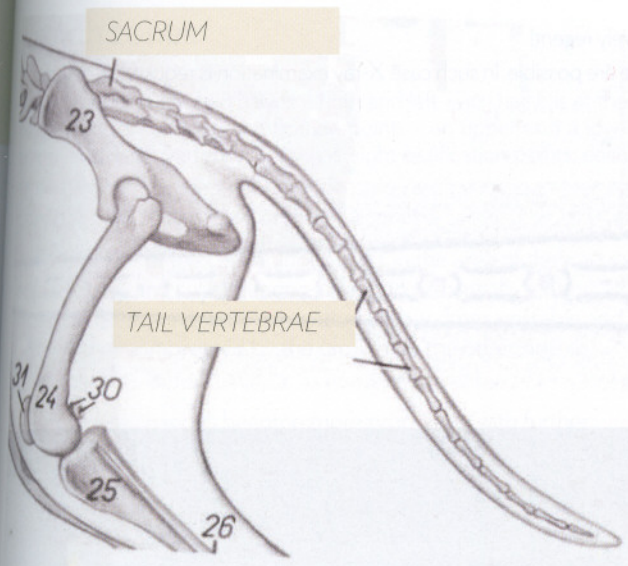
Curved tail(multiple kinks)

Puli, Pumi, Bulldog, Shar Pei, Appenzeller Sennehund, Alaskan Malamute, Boston Terrier, Greenland Dog, Norvegian Elk hound, Karelian Bear Dog, Norrbottenspets, Lapponian herder, Norwegian Buhund, Icelandic Sheepdog, Finnish Lapphund, Finnish Spitz, Svedish Lapphund, German Spitz, Wolfspitz, Volpino Italiano, Akita Inu, Chow Chow, Eurasier, Hokkaido, Kishu, Shiba, Japan Spitz, Basenji, Kanaanhund, Wetterhound, Portuguese Water Dog, Bolognese, Havanese, Maltese, Bichom frise, Tibet-Spaniel, Lhasa Apso, Shih Tzu, Tibet-Terrier, Pekinese, French Bulldog, Mops, Kyi Apso, Kyi Leo, Dingo,...

Shorter or no tail - (less than 10 vertebrae)

Catalan Sheepdog, Polish Lowland dog, Mudi, Welshcorgi Pembroke, Bouvier des Flandres, Austrian shorthaired Pinscher, Entelbrucher Mountain Dog, Westgotenspitz, Bouvier des Ardennes, ...

Schipperke (always born without tail), Berger des Pyrénées (shortened tail with a "tick"? (classical kinked) at the tip of the tail),



What is „normal" ?

Tail tip reaches about ankle height

Vertebrae: 20 or more (in situ 18-20)

Shape: hourglass, long stretch (S1-S5 somewhat barrel-shaped, with indicated spinous process, but distinct caudal-directed transverse process which is also decreasing. From S10-12 vertebra is becoming shorter and slimmer, last tail vertebra is often as a rudiment (greatly shortened or triangular).

- Each vertebra is isolated by intervertebral discs
- Vortex chain without angulation
- All vertebrae are moving freely (tight joints)

Movement in the tailset is dorsoventral, the tail itself has limited latero-lateral movement

Normal or not normal?

It is relatively easy to determine if the vertebrae are normal or not in an adult animal, however if any anomaly is present, it is very difficut to determine the genesis.

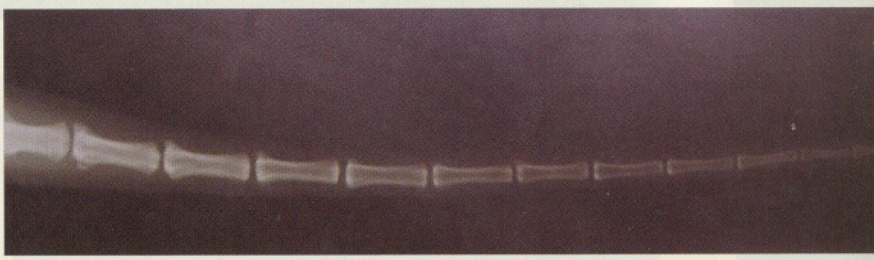
Changes like kink / wedge / block are often presented as acquired and non-hereditary.

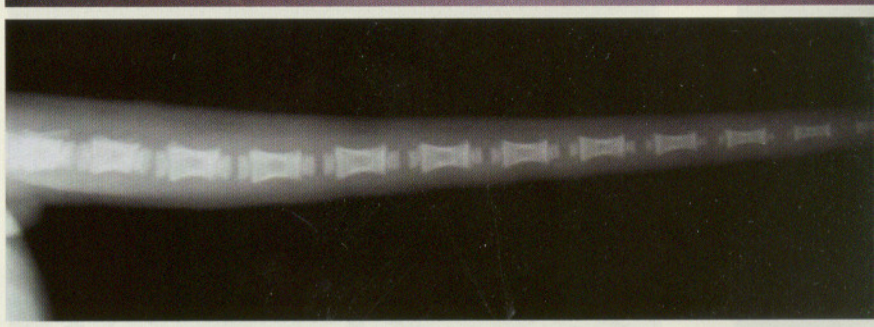
Currently we have about 3-5% of complaints on breeding tests and on exhibitions!

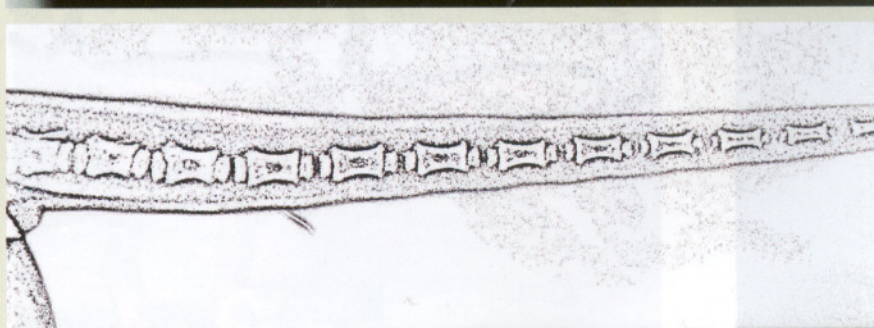
DTK study Dr. Tellhelm Giessen University of Giessen: out of 124 examined tail anomalies only 11 are result of an injury = 8.9%.

It is more difficult to to make clinical assesment in a puppy because the tail is still in developent

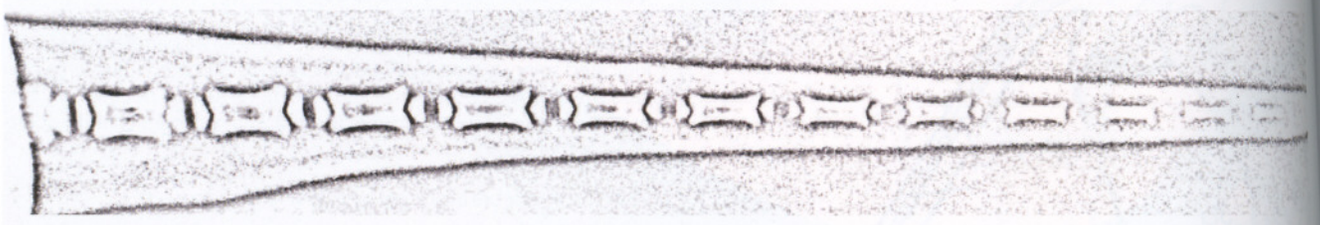
- shorter tail length
- vertebral segments less clearly definable
- greater mobility, joints and ligaments are less firm,
- greater movability, intervertebral column is disproportionately large, growth plates not closed
- less angulation, growth inhibition in the early stages is less clear
- changes of the tip of tail are difficult to palpate because the skin is too thick to determine fine changes in bone structuresIn a puppy it is more difficult to make clinical assesment because the tail is still in developent
- shorter tail length Vertebral segments less clearly definable
- greater mobility joints and ligaments less firm,
- greater movability intervertebral column disproportionately large, growth plates not closed
- less angulationgrowth inhibition in the early stages is less clear
- changes to tip of tail skin too thick to determine fine changes in bone structures
- However if an anomaly is present, the origin of this anomaly should be very clearly determined:





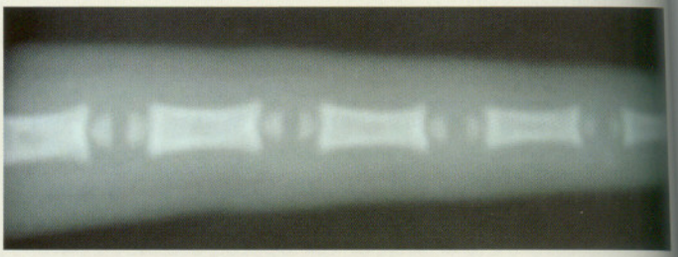


- acquired conditions (injuries) are less likely and if present, they are relatively recent!
- If the pathogenesis has not been completed, clear conclusions on cause are possible. In such case X-ray examination is required at 2 levels



Differences between puppies and adults

- stockier vertebrae
- larger distances between vertebral columns
- cartilaginous / connective tissue in relatively large proportion (Barely visible radiographically)
- each vertebra has two concave growth plates
- each growth plate has one triangular (pyramid shaped) ossification district
- transverse processes of S1-S5 (7) less pronounced with own ossification points



Growth zones

Each vertebra base has two halves – right and left, each half has at the beginning and an end two ossification points - an upper and a lower one. Thus, each vertebral body has eight ossification points, each growth zone has four ossification points.

This can be compared to the corners of a cube.

By multiplication of the cartilaginous mass in the area of the growth centers and subsequent ossification with insufficient or missing ossification this relatively soft mass becomes unstable and is deformed or compressed by the growth on the other side or surface.

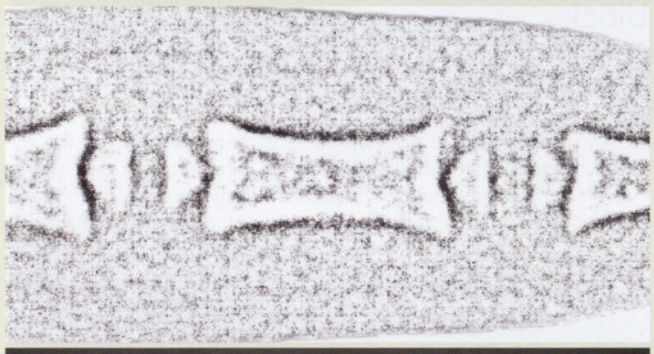
Naturally these changes become more prominent with further growth.

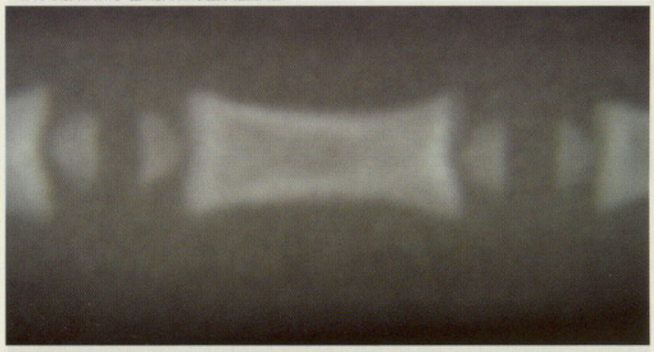
Growth is finished at 7-8 months !

Consequences of the growth anomalies:

- beginning or/and the end
- uni or/and bilateral deformations of the vertebrae
- with vertical or horizontal
- displacement of the axis of the vortex chain

These processes are inevitable and can not be influenced by external action! Upon completion of the vertebral ossification these deformations are „fixed„ and irreversible!





Wedge-shaped vertebra

In two dimensional projection

Often exists unilateral = wedge-shaped, rarely on both sides = trapezoidal. Very rarely = triangular.

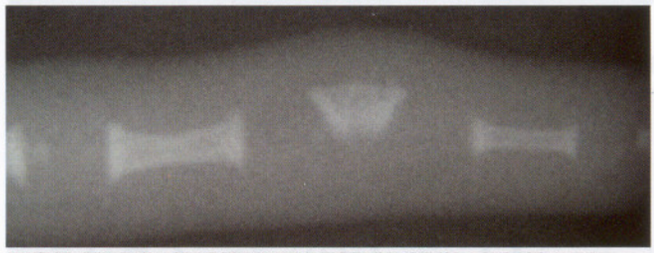
The deformation always depends on number and location of affected ossification points.

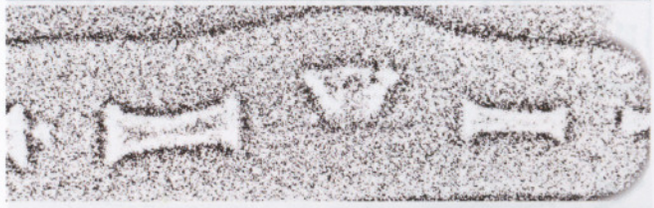
Intensity and form of the deformation is highly variable, mode of inheritance is autosomal recessive polygenic. Each ossification point has probably separate genetic control (8 locuses?)

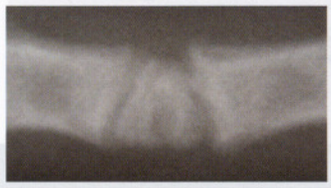
Phenotypic appearance is hard to predict!

According to DTK-Study by Dr. Tellhelm of Gissen University (studied 124 tail anomalies)

- About 50% of all tail anomalies are most often found on the last third or tail tip.
- The anomomalies are visible as the tail is slightly bent and carried curled.
- Vertebrae are always moving freely, often even with increased mobility in one direction.
- Vertebrae are freely sliding, there is often palpable bone building on one side.







Block

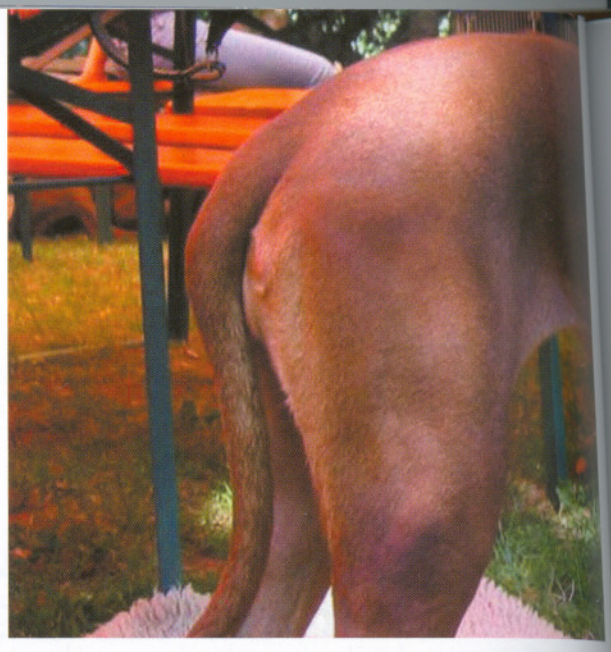
Merging of two or more vertebrae

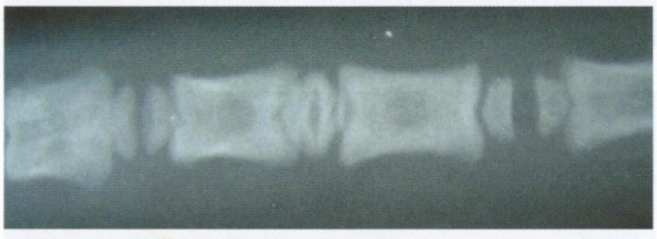
Blocked tail is formed by disruption of segmentation of the inter-vertebra column, usually there is no intervertebral disc (missing or significantly reduced separation between the vertebrae). Attention: blocked tail is commonly misinterpreted by Overprojection. Two X-ray projections are always necessary for successful assessment !

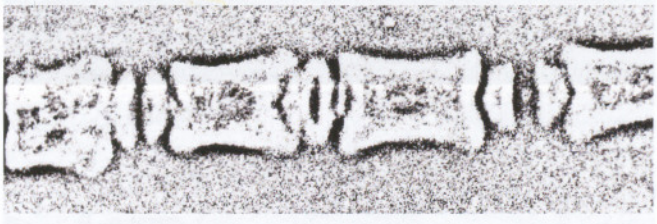
Mode of inheritance is autosomal recessive, phenotypic appearance is well predictable!

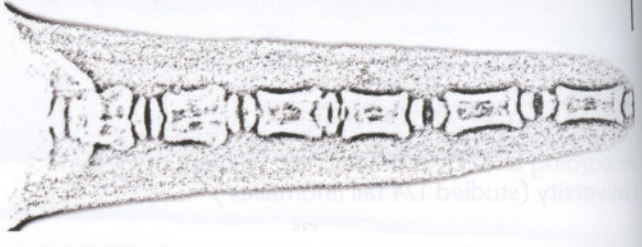
Blocked tail represents about 25-30 % of all tail anomalies. For anomalies that are not clearly determined as block, classic knick is assigned.

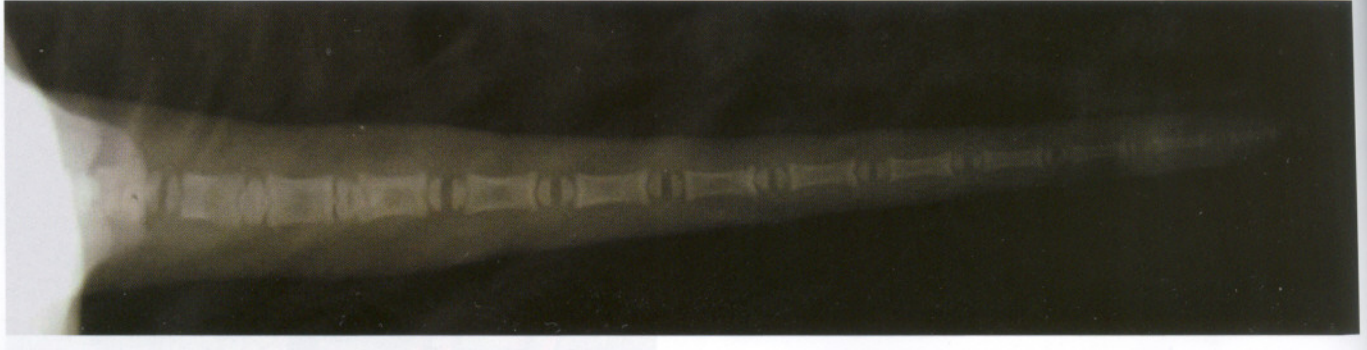
Blocks are most often found at tail set or first third of the tail. Usually visible (bend is present immediately before and after the block, while the area of block formation is straight). The vertebra are not moving or only slightly moving and there is no angulation!











Classical kinked tail

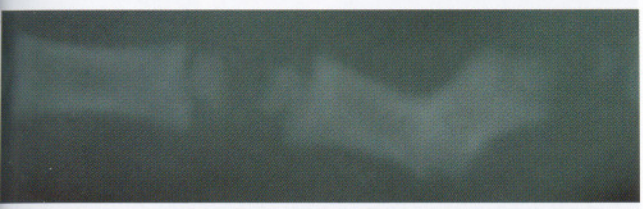
Malformed Block/wedge shaped vertebra

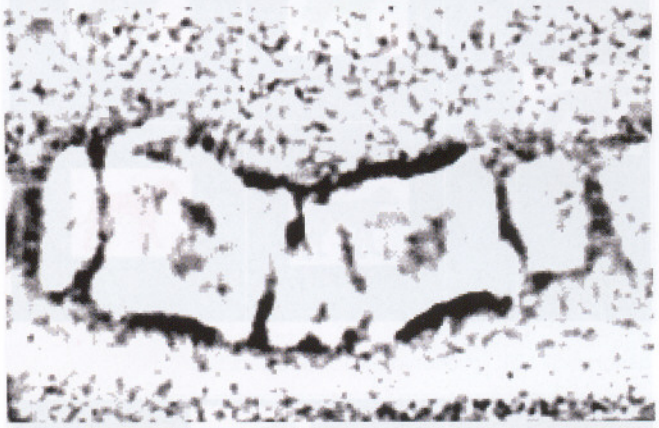
Kinked tail can be described as partial merger of two vertebral bodies (or as an „incomplete block"). The development of deformities similar to wedge shaped vertebrae is not independent but viewed as mixed process. The location of incidence and statistical analysis suggests otherwise.

According to earlier studies and literature (Adams/Willis), mode of inheritance is autosomal recessive.

Phenotypic appearance is well predictable.

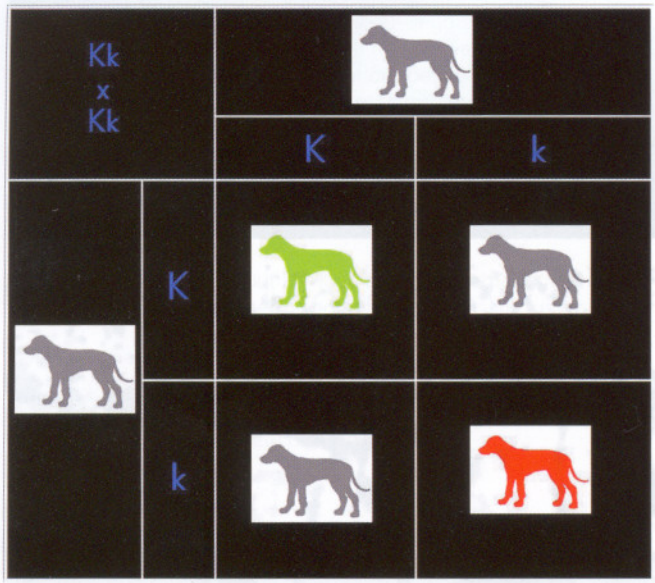
According to recent study from University of Gissen Kinks represent about 20-25 % of all tail anomaliesc.Usual localisation: very often on the tail tip, first and last third, but also in the second third. Kinks are very clearly visible. Vertebrae have no or limited movement and tail is always angled. There is significang bone building palpable on one side.



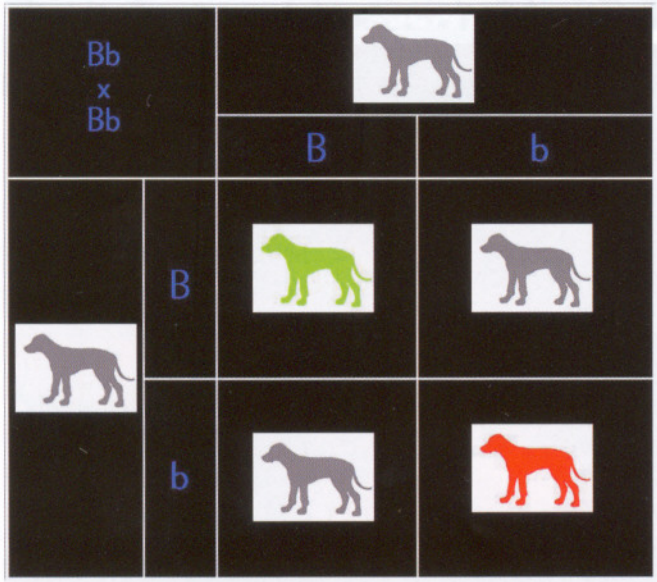


Mating heterozygous - partners for kinked or blocked tails

both partners have no signs but both are carriers



genotypical 1:2:1 phenotypical 1:3 affected25 %



37 litters without tail faults = 58,73 %
26 litters with tail faults = 41,27
41 litters without DS and Ridgeless = 65,02

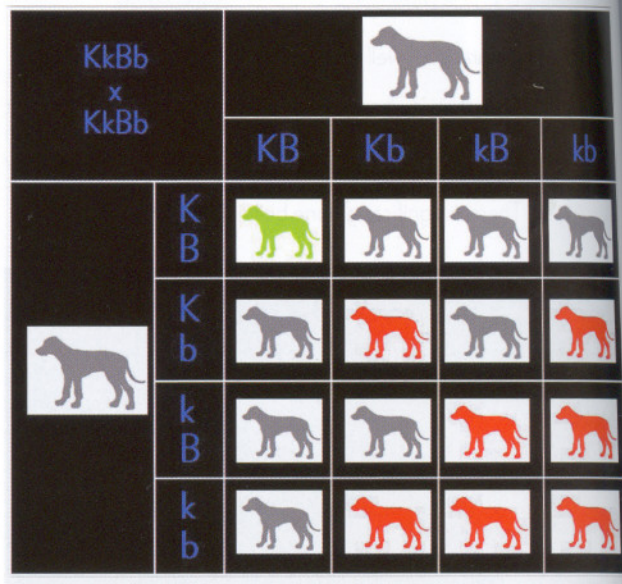
Mating heterozygous - partners for kinked tails and blocked tails

both parents have no signs of both deformities

genotypically 1:1:2:2:4:2:2:1.1

phenotypically 9:7 3 x Kinks/3 x block/1 x kink and block

Affected 43,75 %



If there is one affected animal found in a litter, we can statistically expect following results in percents:

1 kink => 25 % tail anomalies
1 block => 25 % tail anomalies
1 kink and 1 block => 43,75 % tail anomalies

The probability, that kink and block are found in one puppy is 1:6 in all affected puppies and 1:16 in all puppies. If there is one puppy with wedge-formed vertebra found increase these percentages to an indeterminate degree.

Frequency of tail abnormalitiesin DZRR

- evaluation 2004: total 535 puppies in 63 litters

	Faults total	DS	Ridgeless	Bites	Crowns	Testicles
%	30,84	3,18	4,67	0,93	11,40	1,12
535	165	17	25	5	61	6

Puppeis and tail faults in affected litters based on litter control

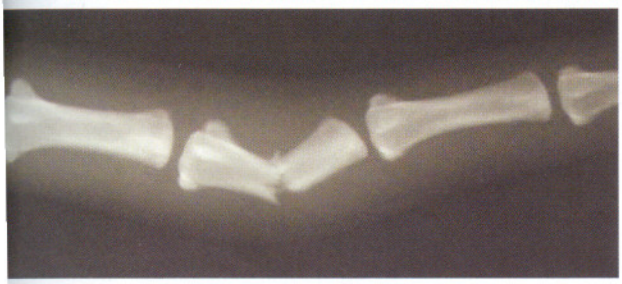
Frequency of tail abnormalities in DZRR

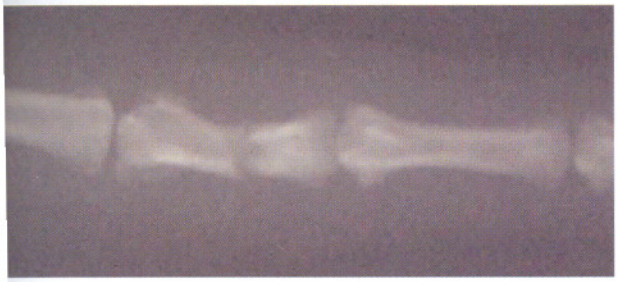
- 26 litters with tail anomalies
- total 243 puppies 51 tail faults = 20,99 %
- Statistically would be expected25%in affected littersWith already one autosomal recessive trait

Injuries

„new" injury:	„older" injury:
Soft tissue swelling !	new bone formation (callus)!
increased warmth	no soft tissue swelling
soreness !	not usually painful
skin lesions	possible angulation
hematomas	limited mobility
abnormal mobility!	possible lesions
crepitus!	(Hypertrophy/Alopecia)
Changes in sensitivity	Tail is carried normally
Partial or full paralysis	
Tail is carried „hanging" !	

Diagnose only via technical equipment, better in university hospital because of possible challenges





Litter control DZRR club (VDH)

„All roads lead to Rome "

Any suspicious finding must be written in the protocol even if the suspicion is only vague.

Single report for litter control: point 12. tail: if there is suspicion for kink in the tail or block, the evaluation must not be „clear", but „suspected tail anomaly" should be reported. Puppy is marked as not suitable for breeding and the reason is descrubed as „suspected tail fault".

Furthermore, the puppy should be seen as incorrect! The contrary proof lies with the breeder or puppy owner! The club or advisor is not entitled to make diagnosis, the veterinary assesment is required to make decision

Nevertheless, the Advisor and the breeder recommend an X-ray examination:

- available in almost every practice, quick results, little stress for the puppy usually no sedation / anesthesia required, cost about 30 to 70 €

Radiograph of the entire tail (or at least of the part in question) is required. Radiographs must be in two planes perpendicular to each other and must be of good quality. The veterinary report must clearly specify the origin of the tail deformation! Veterinary certificate (best with radiographs / copies of x-rays)must be presented to the chief breed advisor who can correct the documents before applying for pedigrees.