

CANINE HIP DYSPLASIA

For us to understand this hereditary disease, we must clarify the basic reasons why it repeatedly occurs and look for possible solutions, if this unfortunate disease is controllable in anyway. The information on this article is not meant to replace the existing scientific publications, but widen the understanding of this disease. Furthermore, the idea is to give the reader some further background information why this disease occurs, how it occurs, as well as some methods of controlling its development through nutrition.

With this information, we hope to increase the knowledge about this disease, so that one will have sufficient background information to make rational breeding choices and allowing detailed discussion of this disease with one's vet and nutritionist, based on actual scientific knowledge.

HIP DYSPLASIA

Hip Dysplasia is one of the most contradictory and widespread diseases occurring in mainly large breed dogs. Many different beliefs, misconceptions, stories, myths and even lies, have confused the issue. Not all readers will like what they read, but we believe the information here will allow the reader to have more knowledge and better understanding of the issue, and through understanding, can possibly also have some control of this difficult problem.

- Hip Dysplasia is one of the most common problems in dogs weighing over 25 kg's.
- Hip Dysplasia is a hereditary disease. It is a multigenetic, i.e. there are several genes responsible, but the Hip Dysplasia is also a nutritional and environment based problem
- A Hip Dysplastic dog is born healthy. The development of Hip Dysplasia occurs when the puppy grows. The unbalanced simultaneous development of hip joints bone- and soft tissue parts during the first 6 months of the puppy's life result to Hip Dysplasia.
- Nutrition and environment have a much larger part in the development of Hip Dysplasia than previously believed. The genetic concept of heritability's effect is now believed to be around **25 % ONLY**, in comparison to previously believe 75-100 %
- Nutritional consequences are qualitative as well as quantitative. (Diets with low nutritional values and/or excesses in daily feeding amounts).

At birth, the hip bone and the joint are pure cartilage. The quality of nutrition during the pregnancy has already affected the development of cartilages. When a puppy grows, the cartilage becomes bone. This is part of the growth process controlled by hormones. The bone formation and growth change the stress factors on the joint and if the opposing forces are too weak to hold the hip together, looseness develops which will cause mechanical damage to the joint and the hip bowls (femorals) upper part and edges. This develops into inflammation resulting into thickening and stretching on the jointcap, further stretching of cartilage and results to excess bone formation. One must understand that the joint contains the all important synovial fluid. The most important ingredient in this fluid is *nutrients*. Nutrients are derived from daily diet. Should the daily diet have excess or lack of any required nutrients, joint damage is bound to occur.

Genetics control and dictate growth. In layman's terms this can be described in following way:

1. From birth onwards, genetics dictate all nutrients to develop the main organs (heart, brains, liver, kidneys etc). For this, the main requirement is very high protein and energy requirement. (28/17)
2. Once these are sufficiently developed, these genes turned "off" and the genes dictating structure growth become active, i.e. skeleton is built. All possible nutrition is directed at bone growth. (This is when puppy starts to grow very rapidly. A dog grows in 6 months at speed which takes humans 13 years) Now naturally the nutritional requirements change, from high protein/high energy, to limited protein/limited energy. (23/13)
3. Only once the skeleton is fully built, these genes are turned "off" and the genes for muscles to support the skeleton will come "on"

By influencing nutritionally how genes become active or turned off, we can influence growth issues.

It is very important to note that any stress on joints before 3. can damage the cartilages, so caution is needed to avoid this and excessive exercise is to be avoided.

The development of joint damage:

1. Joint capsule thickens
2. Joint cartilage thins and wears from the stress points.
3. The bone will try to correct this by thickening its bone mass.
4. Cracks develop on the joint cartilage.
5. The regenerative and elastic properties of the articular cartilage are reduced and result into loss of lubrication and nourishment.
6. Scar tissue develops replacing the cartilage.
7. The femoral head is flattened resulting to abnormal wear of the articular cartilage developing bone-cartilage formations.
8. On stress points bone cartilage is worn out and the bone is bared.
9. Result is a painful and movement restrictive joint damage.

POSSIBLE REASONS TO HIP DYSPLASIA

We must understand the fact that Hip Dysplasia does not occur from one single reason, but there are several different culprits that jointly degeneratively affect the hip-joint. The growth deformation of the hip is a signal of bone formation, which does not only occur on the hip, but also on all other joints.

In spite of above mentioned multiple factors being responsible, hip dysplasia is the most common joint weakening and often painful problem. The joint effort by responsible breeders and vets are bearing fruit, although there are several matters not yet known to us, but what is known is that this disease is hereditary.

The breeders need to set aside earlier beliefs and misconceptions in analysing the different existing theories about genetic, nutritional and environmental reasons, which all play a part in the development of hip deformation. The genes are the major reason for hip dysplasia, but nutrition and environmental controls contribute much more, lack or excess nutrients cause more bone growth problems than genetics alone.

In following, we will try to outline why we believe nutrition is so important, but first we need to understand what we do mean with nutrition:

- **Proper nutrition is important to your dog's health. A diet with only one or two meat protein sources may not be enough, three should be minimum, four is ideal.**
- **Proper nutrition is not only important to your dog's daily nutrition, but it is imperative in recuperation from different illnesses or injuries.**
- **In knowing the basic requirements on nutrition, one can be assured of feeding the pets correctly for a long and healthy life.**

Dogs nutrition must contain water + 5 nutritional groups.

Water: Water is the most important single nutrition.

Protein: Proteins are the building blocks of the body. The blocks are called amino-acids, of which the body uses to maintain and build itself. The better building block, the stronger body.
(tiles, boards)

Carbohydrates: These are the starting fluids for energy and the conveyor belts for transporting the nutrition and sugar chains.
(conveyor belts)

Fat: Fats give energy. Fat is also needed for utilization of fat-soluble vitamins. Fats and oils are important sources of unsaturated fats, the sources for good skin and shiny coats.
(electricity, heating oil)

Minerals: Minerals have important control functions. Macrominerals (Calcium, phosphorus, magnesium, potassium and soda) are the largest group. Microminerals (iron, zinc, copper, manganese and selenium) are very important in controlling bodily functions and keeping it alive.
(plaster, glue, nails)

Vitamins:
(bosses telling each ingredient to do its specific job)

The main actions are to control bodily functions. Vitamins are divided into two groups; Fatsolubles (A,D,E, and K) and watersolubles (Thiamine, riboflavin, niacin, pantothenic acid, folic acid, B6 and B12-vitamins.

**If one of the ingredients is not in balance with the others,
they are all inbalanced !!**

To continue our quest for answers in controlling this disease;

What can we do to control this disease and REDUCE its effects ?

The recent studies have shown the importance of nutrition to the development of puppies. Puppies fed with a lower protein/lower energy diet during the greatest growth period, were found to have better and stronger hip joints than the ones fed with very high or very low protein diets.

Eventhough these studies proved to the scientists the importance of nutrition, no conclusions could be made as to why. One of the thesis was that the nutrition somehow affected the pH-value of the synovial fluid and this was believed to affect the thickness of the synovial fluid and its lubricating properties. The thickness then depends on dissolved nutrition which is the basis for joint pressure.

In earlier studies, the amount of synovial fluid was thought to make stronger joints, but this theory was later proven wrong, the amount of synovial fluid did not make a difference.

The latest studies have shown undisputedly that wrong nutrition is one of the main culprits to hip dysplasia. Lack or excess of nutrients are the reasons that catapult the genes to create the problem. We now know that this can be partially controlled through nutrition. Reason:

SYNOVIAL FLUID = NUTRITION FOR THE CARTILAGE

The cartilage will get all its nutrients from the synovial fluid. The synovial fluid gets its nutrients from the diet eaten. The better the diets nutritional value, the thicker (more nutrients) the synovial fluid.

The synovial fluid is inside a fibrous capsule. This capsule is formed of the inner part and outer part. Within this capsule is where the synovial fluid is. The studies conducted clearly show that the pathological formations are caused by the biological changes in the synovial fluid and this is the area where hip dysplasia occurs. Why is not yet fully known.

Nutrition has shown to play a very important role which must be taken seriously. The balance and quality of nutrients play a paramount role. By selecting a widebased, scientifically balanced diet, specially for the pregnant bitch and the puppies, one can nutritionally reduce the depth and development of this disease.

It is extremely important to note the effects of minerals and vitamins in a given diet. These together influence the formation of enzymes. Enzymes make metabolism to function, they are the "labourers". It is of no importance what diet the dog eats, if the vitamins and minerals in the diet are not in balance. For anybody who understands the function of vitamins and minerals, it is easy to conclude what an imbalance of vitamins and minerals can do, specially in a pregnant bitch or puppies. This imbalance will prevent the metabolism to function.

What in practise can we do ?

The industrial feeds have tremendous nutritional differences. These differences can be seen in any dogs health. In growing puppies these differences can culminate into serious growth deformations and illnesses.

A diet wide in its rawmaterial base (several meats as protein sources), and well balanced vitamin and mineral content, will give the growing puppy the base on which its healthy development is based. If the diet does not contain all nutritional rawmaterials, the puppy cannot develop in best possible form. The puppy's development is directly linked to its diet.

Many breeders flatly blame the genes when faced with hip dysplasia. This is the easiest and simplest way of finding the "guilty" party.

We must be able to look at this problem from actual facts. The effects of given diet is paramount.

Correct balanced nutrition = correct building blocks, are the basis for healthy development and growth.

The speed of growth is astonishing and this speed sets the demands for the quality of nutrition. When the puppy grows, these demands change. The problem with large breeds is too fast growth. The growth process needs to be supported with heavier nutrition during the first 3-9 weeks. After this, the nutrition needs to be controlled downwards.

We recommend a very strong puppy diet (27 % protein, 18 % fat) for the first 3-9 weeks. After this a drastic reduction in nutrients (protein 23 %, fat 13 %) for the following 10-14 months. By doing this, we can control the speed of growth and most importantly, do not allow any excess amounts in the nutritional level of the synovial fluids resulting into the mentioned overgrowth of cartilage and through this, bone deformation.

We must also recognise that a high quality diet also improves and maintains a higher immunity level in the animal. A puppy which has been fed with a highly nutritional diet, has better chances in fighting diseases than the one fed with a diet with lower nutritional values. Puppies that have been fed with a highly nutritional diet, do not suffer from skin- or coat problems. Also allergies will not be able to freely form as the puppies immunity level is high, allowing it to properly fight off any intruding disturbance before it can transform into an allergy. (further information on our article concerning pre- and probiotics).

Our experience is based on breeding. We rely on scientists to tell us how the body functions and why. Rest we learn from actual breeding of puppies. The scientist themselves admit that when a study is over 4 years old, it has normally been proven false. We cannot stare at a study made in the 70's and 80's, unless there are studies in the 90's and then after 2000, proving the earlier studies correct.

There has been tremendous leaps made in recent years in the science of finding out exactly what makes the bone grow. At the end of the article we will have the text of the abstract. What this finding means is simply that these scientists found the tiny small protein that makes bone grow (morphogenetic) and found away to use it in the benefit of sick dogs. It took them close to 10 years to conduct this study, but it shows how far our scientists are getting in their quest of finding the answers. Soon they will find a way to control BSE (a protein gone crazy) and AIDS (a virus breaking down immunity). The latest finding in genetic research has already found many genes directly responsible for hereditary diseases and illnesses. There are so many things yet unknown, but sooner or later these secrets will be relieved. While we wait, we can take steps to correct problems as we know of today.

Back to our own real life experiences directly linked with bone growth problems:

- A 4 month old puppy of a New Founlander, front paws turned outwards (O.D.). Diet consisted of homecooked diet together with low quality (low cost) industrial feed. The puppy moved to 100 % Large and Giant Breed Lamb&Rice diet 23/13. At 8 months, paws straight, today a healthy adult. No coat or skin problems, no allergies.
- German Shepperd, breeder had recommended a grainbased industrial feed. At 8 months of age, front legs badly turned outward, joints very loose and bent. Changed to same Large and Giant Breed Lamb&Rice, legs started to visibly normalize in 4 weeks, at 12 months straight and well formed, healthy legs.

- Breeder (+30 years) of golden retrievers. Earlier with homecooked, later with "latest" high quality industrial feeds. Hip Dysplasia rate 32 %, (inspite of carefully analysed feeding). Average hip dysplasia rate in the country 44 %. Changed totally into Eagle diets in 1991. After 7,5 years, Hip Dysplasia rate 18,8 %. Not only this, but average litter size increased from 5-7 to 8-10 puppies per litter. No allergies, no skin or coat problems. Survival rate increased from 88 % to 98 %. Bitches and puppies fed Eagle Puppy. Puppies on same until 4 months, then switched to Eagle Maintenance for 4-12 months, then Eagle Adult and/or Lamb&Rice as adult diet.
- Puppy buyer, from the above breeder, "saved" money and fed cheap grainbased diet. Puppy grew up on this low quality diet. Had puppies from a healthy dog, 6 puppies alltogether, one did not survive, 1 puppy was healthy, 4 had hip dysplasia.
- Maremmano Abruzzese, 9 months, front legs turned outward, heavy cartilage accumulation at joints, clearly visible. Switched to Eagle Lamb&Rice diet. Legs corrected, but some of the excess cartilage remained. At 12 months changed to Eagle Adult diet.
- Great Dane 7 months. Front legs turned inward. Change to Eagle Lamb&Rice diet. In 2 weeks visible improvement seen, within 4 weeks legs normal. At 18 months changed to Eagle Adult.

Conclusions:

Eventhough our experiences are not "scientificly" based as such, these give a clear signal of the paramount effects that the daily diet has. These experiences of ours, together with the information flowing from the scientists, confirm our belief of the importance of nutrition.

- Every dog has to be monitored as an individual. Every dogs methabolism works a little differently. Many aspects influence this. Environment is one big issue. Does the animal live under stressfull conditions ? This alone can mean upto 30 % more nutrients being consumed by the stress factor, not the dog.
- It is impossible for anybody to give exact feeding amounts to any breed of dogs. Even within a litter, there are considerable differencies in the utilization of nutrients from a diet. For breeders of large breed dogs, a hint of potential problems is:

Front legs turning inward = Not enough nutrients, specially high quality proteins.

Front legs turning outward = Too much protein and energy

- All breeders know the importance of the balance between calcium and phosphorus. However, many breeders do not follow the daily feeding amounts. Calsium and phosphorus values on the bag of food are given as percentages. If a dog is on a diet which is 80 % digestible, the actual intace of these minerals is proportionally much higher than on a diet of 90 % digestibility. This is one of the reasons for imbalances and arises from improper feeding amount. Never supplement with calsium on an industrial feed. Calsium is one of the cheapest rawmaterials, so one can be assured that maximum amount are in the bag. It is more important to follow ratios. Good balance is 1.4-1.5 % calsium, 1.0-1.1 % phosphorus. Any excess or lack of these, will most likely result to bonegrowth problems.
- The balance of vitamins and minerals is of extremely important. When preparing diet at home, it is allmost impossible to have the correct optimal balance. (None of us has a laboratory at home to inspect each rawmaterial of their vitamin and mineral contents). This is best to be left with the manufacturer.
- Proteins being the basic building blocks, there should be several sources of different protein sources. A diet consisting of chicken, meat, fish and egg, is recommended. If on every bite the dog eats, it gets all of these, the changes for satisfying the dogs needs are better met, than with a singular protein source. Vegetable based materials should not be protein sources. They are cheap as rawmaterials, but the utilization of vegetable based proteins by the dog is very low and we really see no reason why vegetables should be used as protein sources as meats are so much better.

We hope this article sheds some light to this difficult question. Below are several references where you can continue your own research. Our aim is to have healthier dogs bred. Anything that can be done to achieve this aim, is wellcome.

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References: Prf em PhD DMV S.Paatsama, PhD DMV P.Axelsson, Prf PhD MD T.S.Lindholm, Phd MD T.J.Gao, R.D.Kealy, S.E.Olsson, D.F.Lawler, J.C.Cargill, G.Lust, W.T.Beilman, V.T.Rendanom S.J.Morgan

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Title: CLINICAL APPLICATION OF CANINE AND MOOSE BONE MORPHOGENETIC PROTEIN IN THE TREATMENT OF CANINE FRACTURES AND IN ELBOW DISEASE (ULNAR OSTEOATOMY)

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Abstract

BMP FAMILY

Bone morphogenetic protein BMP existing in the bone matrix was reported by Urist 1965. It differentiates mesenchymal cells to bone forming cells resulting in bone formation endochondrally. 12 different BMPs have been characterized in the BMP family. BMP still remains the only morphogen of known physico-chemical composition that has been synthesized by recombinant gene technology. The current litterature, 775 references offers only a few studies dealing with the use of BMPs in dogs.

BMP ASSAY

One kilogram canine diaphyseal bone yielded after processing 10 mg of partially purified (pp) cBMP. The osteo-inductivity of the pp cBMP was assayed using BALB mice, a radiologically proved ectopic bone formation was found 3 weeks after cBMP implantation in muscle pouch. Isoelectric focusing was performed by determining the isoelectric points. The cBMP was also chromatographically characterized. The pp moose(m) BMP was prepared and characterized similarly to the cBMP.

CARRIERS

There are still difficulties to select an effective biologic delivery system for the BMP application. Biomaterials, such as Biocoral and Tricalciumphospate used in this study have been applied in clinical and experimental surgery. These carrier materials are immunologically inert, osteoconductive, biogradable and mechanically strong.

CLINICAL APPLICATION

Pp cBMP was applied subcortically in delayed radius-ulna and a non-union femoral fracture. The small sized, strong carriers provide an advantage in the treatment of fracture in small sized bone. Pp mBMP was used in a femoral neck and a acetabular fracture of dogs suffering from severe hip dysplasia. The healing of these fractures confirms the usefulness of BMP in veterinary orthopedics. The pp mBMP was also applied in ulnar osteotomy in two dogs suffering of elbow disease (incongruence, subluxation and Radius curvus syndrome). The ulnar remodeling and the elbow joint funtion achieved have raised the need for further study.

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