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The Hip Extension Treatment

Investigations and Evaluation Using the Horizontal Electromotor Extension and the Manual Medical Hip Traction

1. The Hip Extension Treatment

Many physiotherapeutic measures to treat diseased hip joints are renowned in orthopaedics. One of them is the traction treatment, mostly combined with other physiotherapeutic applications such as electrotherapy, peloids – mostly overheating or cryotherapy, exercise baths and intensive physiotherapeutic treatment measures.

Precise instructions on the implementation of this hip traction treatment are exceedingly rarely found and then found in Lehrbüchern der manuellen Medizin (Manual Medicine Textbooks) (Kaltenborn, Lewit, 6th International Congress Book of FIMM FRISCH, 1979) as well as in Zeitschriften der manuellen Medizin (Manual Medicine Journal).

The traction manipulation results are reported in the 1979 FIMM Congress manual: conservative coxarthrosis treatment. Long-term intermittent hip joint traction results in coxarthrosis are reported by A. Bernau in Orthopädischen Praxis (Orthopaedic Surgery), Volume 8, August 1985, p. 633 ff. However, not only coxarthrosis, but also coxitis present in children with rheumatic diseases, is mentioned.

1.1. Hip joint anatomy

A short reiteration of the hip joint anatomy is given for better understanding: The hip joint is an anatomically and mechanically simple triaxial joint (sphaeroid). The fe-moral neck forms an angle averaging 128 (collodiaphysis angle) with the femoral shaft. The angle to the femoral shaft condyles, the so-called antetorsion angle, is approximately 12 degrees in the frontal plane.

The femoral neck axis is diagonal to the frontal axis and proceeds towards the superior medial and anterior direction.

The hip socket (acetabulum) has a lateral opening, with an inferior direction of 30 - 40 and anterior direction of 30 - 40. The socket is surrounded by a labrum acetabular fibrocardilaginar ring, which rests on the socket edge and, therefore, contributes to further indentation of the bone socket. The largest possible congruence between the hip socket and femoral head is almost 90 degrees of bending. This is explained in terms of developmental history since human kind is gradually raised from the quadripedal posture (80 - 90 hip joint bending) during evolution.

The femoral head with socket is enveloped by the joint capsule, which is fixed at the socket edge and at the femoral neck up to the linia intertrochanterica up to the fossa trochanterica and up to 15 mm over the trochanter minor. The so-called capsule sagging, the frenulum, can be folded to one side during corresponding abduction and duction or rotations and constricted on the opposite side for this purpose during permanent constriction in the neutral position.

The articular capsule fibres run in different directions, diagonally to circularly so that constriction as well as loading in all planes is possible. The reinforcing overlying ligaments in the capsule, which provide fixation of the femoral head in the socket, are important. These are ligamenta ilio-femorale and pubofemoral located in front as well as the ischio-femoral ligament lying in the dorsal plane. The arrangement of the ligaments between the source and the root also produces the same increasing contortion during increasing extension and unbundling during flexion. This tension directions are also explained by the developmental history of the quadripedal posture.

The so-called ligament teres or ligament femoris capitis guides the feeding vessels of the femoral head. The hip socket emanates in the caudal section and is strained due to the ligament transversum towards thefemoral head and inserts in the fovea caputis femoris (centralis). At the maximum point of the circumference, this lies towards the inferior and posterior sides. The tensile force of the ligament of 45 daN is indicated as the maximum loading.

All functions of the muscle groups described were discussed further here.

It is important to understand the hip joint function that three degrees of freedom are involved to bring about mobility in the three axes mentioned. The first one is around a transversal axis with flexion/extension (130 - 0 - 15). The second one is around the dorso-ventral axis with abduction or adduction (45 - 0 - 20) and the third one around the longitudinal axis with outer or inner rotation (45 - 0 - 45).

1.2. Current therapy forms

The hip traction treatment as well as the spinal extension treatment (targeted as the cervical and lumbar spine) has been carried out for many years at the local clinic. In this case, different methods have been applied, (see also the progress report by Mr. Wiemer, our in-house masseur and physiotherapist).

We have been using an extension couch with computer-controlled electromotor operation and a diathermy device for one year. The construction of the couch for extension, especially the construction for hip joint extension has led us to carry out several studies in order to prove the effectiveness of traction and extension. With regard to this, considering the subjective details of the patients, who could show no certain relaxation in the hip joint section in this arrangement for hip joint extension, in contrast to the hip traction that is carried out manually and medically, whereas the electromotor extension of the cervical and lumbar spinal usually brought about significant relief as well as improvement of the result.

The hip traction was performed so that the upper limb of the treated hip was flexed (approximately 90 degrees in the hip joint and also around 90 degrees in the knee joint) when the patient was in the supine position with the lower limb laid on a flexion footstool. The tension belt was fed through a guide pullet to a sleeve located at the upper link so that the tension is directed towards the lateral caudal side. A belt linked distally to the upper limb provides the corresponding counter-force.

The instructions on hip traction treatment in manual medical textbooks basically mention two different options:

a) Mobilisation occurs after one rhythm, which is considered as the so-called 7=second phenomena according to Gaymans. During mobilisation it is observed that after a few (approximately three) seconds of extension, the muscle line sags at one joint so that another increase in tension is possible and the extension is even intensified over another three seconds. When muscle resistance is reduced, an effective therapy is then brought about.
The mobilisation technique was then announced as essential if for example there are - complaints in the knee joint or in the ankle, lower limb region or in lying prosthesis material in the knee joint region. In this case, the treated leg was laid over the therapist's scapula with a flexion of 50 - 60 in the hip joint as well as around 50 - 60 in the knee joint. The therapist grips the proximal upper limb with both hands. The mobilisation was, during this process, in the distal caudal direction (Kaltenborn) or traction was applied in the lateral caudal direction of the femoral neck

(Lewit). In all difficult mobilisations, a fixation belt was attached to the patient either by the groins to the opposite hip or even across the patient lying down, using corresponding pelvic fixation.

Nowadays, the mobilisation technique is mostly more intensively used when treating the spinal column. (see also the literature on muscle facilitation and inhibition technik in manual medicine)

b) The manual extension of supine patients. The leg is gripped at the lower limb above the ankle (possibly also when reinforcement is brought about by a tension belt), the hip flexed at 30 degrees, abducted at 30 degrees and is rotated outwards at approximately 10- 20. Using the entire body, with resilience in the traction and slowly in the pre-stress, then it is awaited until the patient can relax and the hip is tractioned under forceful tension that it dislocates slightly in many cases with a snapping noise.

This is then also described as manipulation.

1.3. Indications

The indications for hip traction treatment are extensively placed in our clinic, ranging from the so-called functional coxalgia up to advanced coxarthroses. In this case, it is observed that the extension therapy shows excellent results especially in so-called functional coxalgia or even coxarthrosis in its early stages, whereas in advanced coxarthrosis (stage III – IV), according to Steinbrocker or in stages III – IV, according to Larson, there are no noticeably good results.

In this case, it results in irritation of the highly sensitive joint capsule rich in pain receptors. The irritated joint found in the dorsal position a so-called functional medial or resting position, fixed by different muscle groups: gluteal and ischiocrural musculature, directed ventrally: M. iliopsoas, M. rectus femoris, M. tensor fasciæ lataæ, M. satorius, the medial adductor (with characteristic knee joint pain) and the outer rotators moving laterally.

The traction treatment is predominantly reported in A. Bernau's work in coxarthrosis; precise graduation of individual stages was, however, not dealt with. The longitudinal traction was carried out by applying a muscle sleeve, which lay above the knee joint, which is, however, unconditionally required from our viewpoint.

1.4. Effects

Traction on a hip joint itself occurs in three phases:

a) Hip detachment under the surmounting pressure of the adhesion tension between the femoral head and joint socket.

b) Soft part tightening.

c) Soft part distension as a traction mobilisation or as a short manipulation caused by the short-term maximum traction tension already mentioned following by prestressing due to excessive rumbling of the surrounding hip musculature.

Causes for deficient hip traction capacity in bent hip and knee joints in the caudal or caudal lateral direction is addressed in our consideration: increased adhesion forces in the hip joint due to improved congruence between the hip joint and the socket, increased stretching of the ligamentum capitis femoris, increased hip musculature stretching, especially the distances caused by corresponding pre-distension (ischio-crural musculature). Other studies in this field are still required.

1.5. Investigations

On account of the different traction treatment results, once by the manual traction in the flexion, abduction and outer-rotation position mentioned above and by the instrument in the hip bending position accompanied by the opposite tension at the knee joint, we commit ourselves to review the results by means of the X-ray image converter control. The investigations have then been implemented at our X-ray department at the extension couch mentioned above. The first patient suffered from a bilateral unclarified aetiopathogenetic coxarthrosis with significant hip function restriction in all movement levels. The hip was, however, manually well tractable.

The hip joint was then investigated under different conditions using the image converter. The corresponding position was photographed by the image converter monitor and the diapositive later measured on the screen and corresponding corrections undertaken to standardise the proportions.

1.6. Investigation results

a) The joint line of 2.2 mm, which is visible in X-rays, is shown under the image converter control without traction.

b) The traction with the instrument operating at 30 daN in the first experimental arrangement brought about no in the joint line width of 2.2 mm.

c) At less than 40 daN, an expansion was then at 2.9 mm. Increasing the tensile force further was reasonable to the patient.

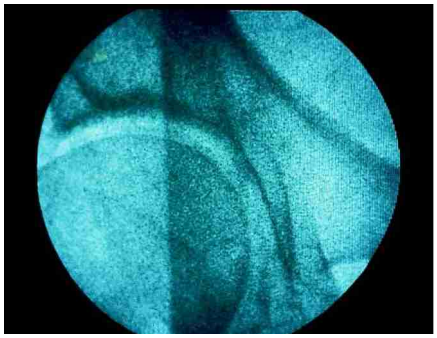
d) The manual traction at less than 30 degrees of abduction with bending and approximately 15 outer rotation in the longitudinal direction of the bone axis, thus, brought about a joint line width of 4.4 mm so that in this case, the hip joint could be distraction the *clearest result* .

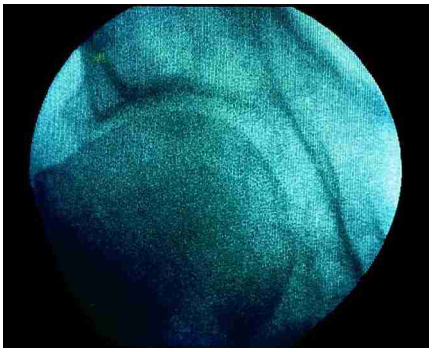
We have studied another patient who also had coxarthrosis, using the extension couch under the modified tension direction arrangement according to the second method. As already described, the tension direction in the patient in the supine position was approximately 25 degrees lateral, the hip was flexed by the elevated upper body by around 30 degrees and the leg rotated outward by around 15 - 20. The loading was successively increased in patients with advanced coxarthrosis and in joint lines that are laterally completely raised.

After the second experimental arrangement at a fixed point, the image generated the following joint line width:

Without a tensile force of only	0.5 mm
under 10 daN of tension, the expansion is	0.7 mm
under 15 daN of tension, the expansion is	1.0 mm
under 20 daN of tension, the expansion is	1.1 mm
under 25 daN of tension, the expansion is	1.2 mm

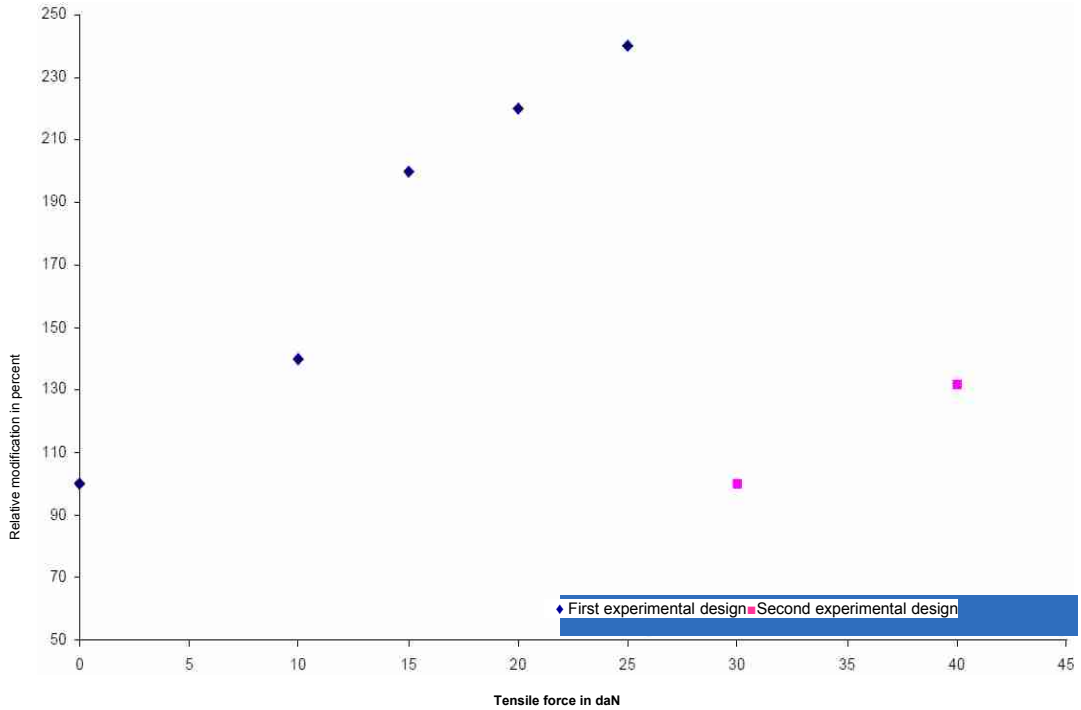
Under the control of the image converter in hip joint traction, in the "most loose position“ with 25 lateral abduction, 30 flexion and approximately 20 outer rotation, an expansion of 0.5 mm to 1.2 mm is determined.





1.7. Diagramme

Relative Hip Joint Modification as a Function of the Tensile Force



Greater extension forces were not possible in this case. However, it could also be clarified here that when using the experimental arrangement, an effective traction treatment is also possible in advanced coxarthrosis with corresponding hardening of the capsular structures

Since the new experimental arrangement involves the knee joint during traction, also controlled by the image converter, an excessive elongation of the capsular ligament is expected due to corresponding joint distraction with loadings on the knee joint. This led to the following result:

The joint line width of the knee joint without tension was 6.5 mm, with a further loading of10 daN - 6.5 mm, at 20 daN it is also 6.5 mm, at 30 daN 6.6 mm and first when the tension is 45 daN the expansion is only 7.6 mm.

Since we do not apply such an intense tension in the hip with the instrument, the fact that an excessive elongation or severe damage of the capsular ligament is not expected in regular knee joint proportions is then excluded. For a knee joint, which could not be loaded, as a result of destruction, implanted prostheses, false position or with bending contracture, a corresponding sleeve could still be constructed, which predominantly involves the upper limb or only surrounds the knee joint as the so-called supporting capsule.

The entire result shows that the hip traction produces a significant clinical effect proven by X-ray if it occurs in the longitudinal direction of the bone axis with abduction, flexion and outer rotation position mentioned above. However, only weak or no effect is shown if it is carried out in bent hips and knee joints at the caudal position in the direction of the body longitudinal axis. The current instructions for this second method also appear to be the causes for the respective construction of the extension instrument, which is ineffective from our viewpoint.

The unhindered and modified traction treatment, thus, also brought significantly better results. The functional and anatomical causes for this effect are until now unknown to us. The resting position of the hip joint was empirically established by experienced physiotherapists and by considering the position already mentioned on many occasions of 30 degrees flexion and 30 abduction and 15 - 20 outer rotation. In this case, the capsular ligament structures of the hip joint are found to be in a maximal relaxation and the agonists and antagonists of the musculature are in equilibrium. The hip is found in the so-called "most loose position“.

In the mean time, we have studied a patient with activated coxarthrosis using the image converter. In this process, we first reapplied the traction method in the longitudinal direction of the axis of the lower right extremity. It was shown that under increasing loading, there was a significant distraction in the region of the hip joint column. The hip adjustment during bending in the hip and knee joint and with traction was in the caudal direction as given in the introduction of Kaltenborn. We could not record any significant expansion of the hip joint column. The hip traction in the lateral-caudal direction of the femoral neck axis produced no certain evidence of a gaping opening in the hip joint column, not even when the maximum tension is approximately 45 daN.

We, therefore, wished to show that in many forms ot hip joint complaints, the so-called coxalgia, functional coxalgia and onset coxarthroses as well as advanced coxarthroses, the traction treatment or even hip traction manipulation is possible. It is also required to position the patient correctly and occupy the correct traction position.

The traction configuration in different instruments viewed so far is expected to be reconsidered by these results, as well as instructions in different physiotherapy textbooks, which always show that

traction treatments should also be possible in severely bent hips (almost 90 degrees) and in bent knee joints.

1.8. References

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