

## ANATOMY, BIOMECHANICS AND SACROILIACUS JOINT TREATMENT

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### MENU

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### INTRODUCTION

Today's technological advance in ordinary life include all the areas in human development, and health sciences are not excluded from this improvement. This fact is specially relevant in physiotherapy. It wouldn't be possible to forget where we come from. Nevertheless, it is not always possible to have the more up-dated technology. It wouldn't be healthy either to forget the use of the most most useful elements we may count on: our hands and our brain. We are science and art, perception and analysis; therefore, we have to make the most our of our potential.

From these thoughts, our roots arise: the manual therapies. These techniques have years of history in Europe, but they are not common in our country. These manual therapies were initially pure empirism, but today they have become highly advanced arthrocinematic and biomechanical analysis through which we have been able to understand well-known elements little studied for years.

This is the reason why myself and other graduates from Universidad Nacional Mayor de San Marcos are engaged to relaunch manual therapy techniques which are extremely important as it has been demonstrated as a tool for the evaluating development and for physiotherapy treatment. Orthopedic manual physiotherapy (OMT) is a valuable field that enriches the professional who appreciates its concept, stimulating both perception and analysis.

I have decided to write this small summary of Anatomy, Biomechanics and treatment of the sacroiliac joint evolution (ASI) in the wide concept of manual therapies and in a practical way because there is a large number of cases that are seen everyday in the Clinic. I want to question the "inespecific pain" without a visible cause and, consequently, with a paliative treatment.

This willing is not a contradiction with McKenzie's theory. It is actually complementary because many backaches are related to the fibrous lumbar ring or to a ASI malfunction. Both factors, being isolated or together, have as a consequence a lumbar problem.

Even very similar syntoms may have their origin in different structures, as we will see by the time to travel in depth into the analysis. Sometimes, we can also achieve improvements in the treatment, without being 100% effective, because we undervalue certain structures apparently with low functionality.

In human structure, just like in mathematics, everything has a "how" and a "why", which isn't useless. Every single part in the human being, even though we think it has an insignificant function, is important and may cause huge imbalances if we don't pay attention to it.

It is not my personal will that this short document neither is taken literally, nor becomes a manual for treatment and evolution. I hope that the readers of this short, but jet intensive summary, feels motivated to research about manual therapies and makes his own judgement out of them. This is really the reason for this

piece of work. You will see in this virgin field a fascinating world which will open your mind and will give you excellent tools to increase your professional development. The invitation has already been done: just walk in.

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## **ANATOMY OF THE SACROILIACUS JOINT (ASI)**

The pelvic girdle is the base of the trunk. It is the structure that holds the abdomen and that joins the lower limbs to the trunk. It is an osteoarticular closed ring made up of three bone pieces and three joints.

The three bone pieces are:

- two iliacus bones, pairs and symmetric.
- sacrum, impar and symmetric,
- vertebral block, made up of five sacral vertebra fusion.

Some professionals think that this joint is a amphiarthrosis, therefore it is incapable of doing movements with the exception of woman delivery. It is really a false amphiarthrosis, since it is able to do light rotating and gliding movements.

Consequently, the pelvis has a large importance in the inestable balance of the vertebral column, because any discordance is the first will affect the second. This is the reason why we could consider it to be a functional unit. The sacroiliac joints are the relief between the vertebral column, which is flexible on the part, and the pelvis stability on the bottom part.

The articular sacrum surfaces and the ilium are described by the presence of elevations and depressions which difficult to stablish which articular surface is concave and which one is convex. Kalterborn creates a model on a practical purpose where the sacrum is a bed pan placed in between the two iliacus. Therefore, he considers the sacrum to be the concave surface and the two iliacus to be the concave one. It is considered that the sacrum belongs to the lumbar vertebra and that the iliacus belong to the lower limbs.

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## **MOVEMENTS OF THE SACROILIACUS JOINT**

- Iliacus movements over the sacrum

The iliacus wings present two principal mobilities: 1. the anterior-posterior mobility; and the open-close mobility.

Iliacus anterior rotation. The iliacus wing does a rotation around a point: the femur head. Therefore, there is an abaissement of the anterosuperior iliacus spine and a rise of the posterosuperior iliacus spine. A bilateral anteriority will provoke what is known as pelvic anterversion. Kaltenborn names the movement as a ventral rotation

Iliacus posterior rotation. The iliacus wing makes a posterior rotation around the femur head. Here it happens the opposite to the previous movement: a rise in the EIAS and an abaissement in the EIPS. In the bilateral addition of the movement, we will have a pelvic retroversion. Kaltenborn names it dorsal rotation.

Iliacus opening. Around an obliquous axis, the iliacus makes an opening movement that involves: iliacus crest moves outwards, forwards and downwards (according to the axis); ischio branch –pubis, moves inwards, backwards and upwards (according to the axis); sacrum verticalizes during the opening of the iliacus.

Iliacus closure. Around the tense obliquous axis of the sacroiliac on the pubis, the iliacus does a closure movement where the following elements are involved: the iliacus crest inwards, backwards and upwards (according to the axis); the ischio-pubic branch outwards, forwards and downwards (according to the axis); the sacrum becomes horizontal during the iliacus closure.

- Movements of the sacrum over the iliacus

For Kaltenborn, the sacrum has movements on three axes:

Movements around the front axis. They are produced basically on the superior pole of sacrum. When the sacrum base moves in ventrocaudal sense according to both iliacuss, the movement is known as nutation. The

opposite movement of the base in dorsocraneal sense, is known as counterrotation.

Movements around the sagittal axis. They are produced on the sacrum inferior pole and they are known as side flexion to the right and to the left. During the right side flexion, the sacrum right superior pole moves in caudal sense, and the left pole moves in craneal sense.

Movements around the vertical or longitudinal axis. They are basically produced on the sacrum superior pole and they are described as a left and right rotation. When the right side moves in ventral sense, the left side moves in dorsal sense.

## **PELVIS IN STATICS**

The pelvic girdle, considered as a whole, transfers forces between the raquis and the lower limbs: the weight that stands the 5th lumbar vertebra is divided into two equal parts towards the sacrum for continuing next to the cotyloid cavity through the ciatic spines. At this point, the resistance of the floor against the body weight that transfers the neck of the femur and the head of the femur is recieved; a part of this resistance is cancelled by the opposite resistance to the symphysis pubis, after crossing the horizontal branch of pubis.

## **PELVIS IN DYNAMICS**

Even though the sacroiliac joint has minimum movement itself, this joint is extremely important in the body movements. If we do an analysis during walk, we will have:

At the lower limb at stand:

The reaction of the floor, transmitted by the carrier member, lifts the corresponding hip-femoral joint. At the same time, this joint promotes a iliacus posteriorization. The weight of the rest of the body that falls onto the lumbosacral charnela promotes a sacral horizontalisation.

This is where the sacrociatic ligaments enter as an opening of the coccygeus angle takes place. These ligaments must keep harmony during these glidings.

At the lower limb at tipping:

The opposite action takes place. The weight of the suspended limb has a tendency to move the opposite coxofemoral downwards. As a result, we have an iliacus anteriority and a sacral counterhorizontalisation.

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## **DYNAMIC IMPORTANCE OF THE STATIC ELEMENTS**

Functional physiology requested by the organism makes that the posterior ligamentary movement is the responsible for the mechanical value of this region.

Under the effect of these up and down influences, a separation of the sacrum inferior extreme and of the tuberosity is registered. The sacrum inferior extreme moves backwards and the tuberosity moves at the front. The opening of the coccygeus angle highlights the importance of the major and minor sacrociatic ligaments.

These ligaments absorb the forces in order to preserve the ASI physiology.

All the conjunctive structure (ligament, tendon, sheath, aponeurosis, etc.) has many sensitive receptors. These fibrose structures won't accept a bigger stretching than its physiological maximum tension. Moreover the tension threshold, the sensitive recievers will send all the stretch and pain information. These informations, in a reflex way, will start a muscle defense response (spasms). In this particular case, the pyramidal becomes tense when it sees that the first defense barrier (sacrociatic ligaments) are being defeated. This is an answer to the preservation need of the normal physiology of the joint itself.

We must bare in mind that this is done without involving other zones and even going against the organism economy and comfort laws. If we follow the analysis of the specific case, we will find that any sacroiliac joint disfunction will produce a reflex spasm in the pyramidal muscle which, at the same time, due to its anatomic relationship with the sciatic nerve (see picture), will also produce sciatalgias because of the compression neuropathy.

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## MECHANICAL PROBLEMS OF THE SACROILIACUS JOINT

In osteopathy, we mention many rules of body organization. One of the basic ones is that the structure mobility loss (joint) must be replaced in other sectors (joints), so that general mobility is maintained. Two terms are born from here, which could describe the sacroiliac pathology: hypomobility and hypermobility. It would be repetitive to define each one, the name describes them already, and they are related if we bare in mind what was said in the beginning of this paragraf: the first one brings as a consequence the second one.

A hypomobility, blocking or fixation of the ASI, may occur in any of the final positions of all the movements which have been described previously. Therefore, there are sacrum and iliacus blockings.

The ASI fixations are one of the major factors of restrictions in the lumbo-sacral joints and in the low lumbar disk degeneration. They may also be responsible for a lumbosacral hypermobility, which is the cause of the disk protusion and, consequently, of sciatica. Pain arises on the hypermobile joint segment as a general rule. This is why it is unusual to find that the area where pain appears is the same area where the joint fixation to correct is found.

### **Examples:**

- An ASI fixation can be the responsible for a painful hypermobility of the opposite ASI or of the symphysis pubis.
- A fixation of the symphysis pubis may be the origin of a painful compensatory hypermobility of one of the ASI.

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## EVALUATION OF THE SACROILIACUS JOINT

There are many tests to verify the ASI mobility. They differ between authors and complexity and each test can also be addapted by the physiotherapist himself. This is the reason why a same test may demonstrate different situations. Let me introduce you some of them. On my personal opinion, these ones can provide us with a trustful guide of the patient´s problem. We should highlight the importance of an anamnesis before these tests, it could even lighten our work. There is no better information than the one collected from the person who feels the pain directly.

### **ASI mobility Test**

Even though it may be general, we must consider the initial test to evaluate the ASI. It has no specificity, but it gives us information on the structure itself

Patient position: dorsal decubitus position with the lower limbs at 90°.

Evaluator position: at patient´s feet with his hands on his ankles and his thumbs exactly beneath the tibial maleolus.

Maneuver: we ask the patient to sit up. In the mean time he sits up, we exert an aduction with external rotation without removing neither the hands nor our sight from the initial position. Finally, when the patient ends the sit up position, we will follow the lower limbs back to their original position.

Conclusion: we will have a general idea about the movement symmetry of both ASI, at the maleolus height. If you observe that one limb is higher than the other, you can suspect of a block in any of the ASI, without knowing exactly which one it is.

### **Test de Downing**

This test is used to determinate the different anterior and posterior iliacus injuries and to stablish the difference between the total or partial deficit of iliacus bones movement over the sacrum. Limitations on these movements or their exagerations will give us precious information.

#### *a. Stretching Test*

This test tries to bring the iliacus wing forward and, consequently, to evidence a back side possible block.

Maneuver: Aduction (tension of the Bertin Ligament and ASI aperture) plus outside rotation (more tension on the Bertin Ligament + iliacus front movement).

Fysiologically, there must be a stretching of 15 to 20 mm.



#### *b. Shortening Test*

This test tries to make a backwards movement on the iliacus wing, and therefore to show a possible front block.

Maneuver: Abduction (tension on the ischiofemoral ligament) plus inner rotation (ischiofemoral overload + iliacus backwards movement).

Fysiologically, there is a shortening of 15 to 20 mm.

In between each test, you must cancel the effect produced by a maximum flexion of the leg over the thigh and of the muscle over the trunk. These tests must be done bilaterally.



#### *C Fysiological Test on lateroflexion*

The evaluator palpates at the same time both sacral hemibases. When the patient does a trunk lateroflexion: the sacral base comes forward at the lateroflexion side. If this action isn't produced, the sacral base is fixed backwards. On the opposite side to lateroflexion, the sacral base moves backwards. If this action doesn't happen, it is fixed frontally.

#### **Gillet hip Flexion Test**

The patient stands in front of a wall where he places his hands. The evaluator places his thumbs on the patient: the first one on the EIPS of the first side and the second one on the sacral base of the same side. Next, we ask the patient to flexionate his hips and his knee.

If the iliacus thumb doesn't go down when the patient rises the iliacus side leg, it means that there is an ilium fixation. If the sacrum thumb doesn't go down when the patient rises the opposite side leg, it means that there is a sacral base fixation.

#### **Gliding from sacrum to ventral**

If the evaluation ability is high, he could test the existence of a block trying to glide the articular surfaces. They are also important the symptoms that the patient may describe during these glidings according to the increase or decrease in pain during their practice. Here we present only one type of gliding, but you can evaluate all the ASI glidings.



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## TREATMENT

### • **ASI Unblocking**

The manipulation or ASI unblocking may be very helpful and may have immediate effects. The maneuver must be done when the patient is relaxed. The physiotherapist gently takes the leg exactly by the ankle. He relaxes with oscillations the limb and, suddenly, he pulls the leg over almost the same plane as the patient.

As it was said in the beginning, it may produce immediate relief. But you may not abuse of it as of any manipulative maneuver. This type of movement must always be practised together with other techniques, such as the following: coadyuvant to a complete treatment and not only a temporary reduction of the symptoms.

### • **Glidings**

According to a thoughtful evaluation, we will identify what glidings we should apply to the patient. You must bear in mind the concave-convex law and the reducing or increasing in the symptoms (pain) whenever exerting glidings: if there is any maneuver that increases pain, it is not included in the treatment. On the other side, you must insert those glidings that reduce the symptoms.

### • **Stretchings**

With the Jand technique, you will gain elasticity on the contractile structures. It is very important to increase general elasticity in the ASI (psoas, abdominals, quadriceps, ischiotibials, gluteus), but it is even more to recover elasticity and relaxation of the piriformis.

### • **Reorganization of the neuromuscular chains**

Due to the classical decompensations generated by strength, resistance and coordination and due to the particular predominances of the chain aperture and (mostly) of the closure, we achieve a harmony and neuromuscular balance.

### • **Postural care**

Through a study of the occupation, working activity, sports or hobby practice of each person, we will know his predominant postural habits. These will guide us towards the situations that produced the problems that we have found.

Simple corrections such as the way we sit down, the continuous use of a thick wallet in the back pocket of the pants, the computer position, the way we sleep, the way we perform ordinary exercises or even the car's seat are points to consider in order to improve mechanical problems like this one.

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