The Reference Manual for the Lyon Scoliosis Brace is dedicated to the inventor of the brace: Pierre “Pieral” Stagnara (1917-1995)

History of the Lyon Bracing Management

The Lyon Bracing Management evolved since 1947 as cooperation between Pierre Stagnara MD and Bouillat & Terrier CPO. The Lyon management results of a reduction with a plaster cast from one to four months, before moulding the brace. It is a below arm adjustable brace without any superstructure. Very early braces were made from a combination of steel and leather.

After the second world war, Pierre Lecante CPO noticed that the cockpit of a Messerschmitt fallen close to his country house “La Douve” is made of very resistant plastic. The plastic allows tapping and direct screwing. The use of the plexidur™ was born and would replace leather.

There are many braces that are called Lyon Braces, but strictly speaking, there is not one Lyon brace but a Lyon Bracing Management with a plaster cast and a brace.

Now that the controlled study by the Scoliosis Research Society has shown that braces can be effective, it is even more important that the braces are designed so they can control curvature.

The Lyon Bracing Management for Scoliosis

The Lyon Bracing Management uses two steps. The first step is the lengthening of the concave soft tissue with a plaster cast in order to obtain a true CREEP of the structure. The second step is a custom made adjustable below arm brace to maintain the visco-elasticity of the structure.

Lyon Scoliosis Brace Terminology

Different curves require different pushes placements according to curve severity and location. In order to minimize confusion we utilize the following terminology based on the highest component of the brace:

**Lyon classical Thoracic or Double Major Brace**

It is composed of a pelvic girdle with two hemi shells and two posterior and anterior bars which allow the adjustments. A medial thoracic push (T7-T12), a high thoracic push (T4-T7), a lumbar push (T12-L4), a forward chondro-costal asymmetric push and an axillary balancing-scapular support.

**Lyon Lumbar Brace**

“Low three points from Michel & Allègre” (1971)

There are three components:
- An iliolumbar push (T11-L4) on the convex side
- A trochanteric hemi circle on the concave side
- A thoracic push (T6-T12) on the concave side.

**Lyon Thoraco-Lumbar Brace**

(‘High three points’)

Large thoraco-lumbar push (T6-L2), there is no lumbar shell. High thoracic push (T4-T7) The lever arm is maximal in the coronal plane.

**Soft Lyon Brace**

in polyethylene can be used for neuromuscular patients.

Terms integral to the Lyon Brace:

**Abdominal shell**

Refers to the anterior shell of the brace that extends enough laterally specially on the concave side to drive in derotation the anterior counter rib hump and cephalad to contain the abdomen and just barely cover the margins of the ribs and xyphoid process. This shell is a key point for kyphotisation and derotation.

**Kyphotisation**

It refers to the bending of the posterior bar to correct hypokyphosis.

**Axillary balancing support**

It refers to the upper hemi circle band on the convex side of the brace intended to balance the shoulders.

**Tight waist**

It refers to the special upper form of both hemi pelvic shells. Its function is to prevent distal or proximal migration of the brace, and to aid in positioning the pelvis in a posterior directed tilt (lordosis).

**Anterior and Posterior bars**

It allows adjusting the brace during growth. It is possible to lower the pelvic girdle and to drive up the axillary supports.

**Thoracic push**

It refers to the plexidur shell and sometimes pad extending along...
the rib hump and intended to contact laterally lower thoracic ribs.

**Thoracic stop**
It refers to the plexidur shell and sometimes pad extending along the axillary line on the opposite side of the thoracic push and intended to contact laterally upper thoracic ribs.

**Lumbar-abdominal stop or drive**
It refers to the plexidur lumbar shell on the opposite side of the thoracic push. Usually the lumbar stop and the abdominal shell are not separate. We use the lumbar abdominal stop when the lumbar curve is less structural than the thoracic one.

**Lumbar push**
It refers to the plexidur lumbar shell on the opposite side of the thoracic push. Usually the lumbar stop and the abdominal shell are independent. We use the lumbar push when the lumbar curve is structural like double major curves.

**Thoraco-lumbar abdominal push**
It refers to the plexidur thoraco-lumbar shell which goes on the abdominal concave side.

**Manubrial clower**
It refers to the triangular metal piece which maintains the upper part of the anterior bar, and both axillary shells.

**Principles of the Lyon Bracing System**

**Overview**
Each individual Lyon Brace should be conceived and constructed according to a basic set of principles outlined in this manual. By consistently using these principles, we believe that braces of the highest caliber will be constructed. We are convinced that all the orthesists can carry out a Lyon Brace. Each one can bring a final touch with the same effectiveness. The principles of fabrication of the Lyon Brace can be listed as follows:

- The plaster cast
- Custom plaster cast moulding or full electronically moulding like Orten™
- Brace blueprint
- Lumbar and pelvic flexion
- Active and passive curve correction
- Push pressure at the apex and below
- Relief opposite every area of force
- Force couples
- Coordinated physical therapy program
- Team approach

**The Plaster Cast**
It is carried out in an Abbott's frame of reduction allowing the elongation, derotation and flexion (EDF). This frame comprises in longitudinal axis, a system of pelvic traction independent for each hemi pelvis and a system of cervical traction with dynamometer. Laterally one has on the right and on the left 3 adjustable bars of inflexion and derotation, 2 low bars, 2 medial bars in the plane of the child and 2 high bars. On each bar, mobile cursors facilitate the fixing of the soft tapes. The child is prepared with the physical therapist by supplings.

- The thorax of the child is covered with 2 jerseys; the first jersey of 20 cms is wider to cover the edges, the 2nd jersey of 15 cm encloses the child well and makes it possible to avoid the creases.
- One slips at the pelvic level between the 2 jerseys 2 beveled 20 cms is wider to cover the edges, the 2nd jersey of 15 cm en
- The child is placed in the frame lengthened in a lying position on a strong removable ticking band.
- A transverse metal bar is placed at the lower end of the sacrum, and another under the head of the child.
- Pelvic traction then is installed and one sets up the cervical traction. Axial traction is controlled by a dynamometer. This traction will always be weak, approximately 12 Kilograms (twice the weight of the head). An excessive traction makes lateral bending difficult, derotation and especially kyphonatisation; it is interesting only for one important angulation exceeding 40°.
- Installation of the ticking tapes: If we take the example of a right thoracic and left lumbar double-major scoliosis, the technique with 4 tapes is used.
- The first tape from 20 to 25 cms wide is placed under the thoracic rib hump, its horizontal lower segment leaves on the left concave side, it is rolled up upwards i.e. from the spine towards the anterior part of the thorax, it is reflected in an oblique way on the higher bar of the frame on the left concave side.
- The second tape, about 20 cms wide is placed on the level of the lumbar rib hump in reverse order, i.e. that the lower horizontal segment leaves of the right concave side and is rolled up upwards, carefully marking the iliac crest and the fold of the waist protected by the pelvic felt. It reflected at the level of the abdomen in an oblique way on the higher bar of concave right side of the frame. It can be also reflected vertically if one seeks a lordosis effect.
- The third tape, about 15 cm wide is placed on the axillary right level; it produces a counter-push and rebalances the spine. It is symmetrical with the lumbar tape.
- The fourth tape, about 5 cms wide is placed on the level of the pelvis. It is essential each time there exists a coronal pelvic tilt. It is a tape of purely horizontal shift which surrounds the right hemipelvis. One makes a node on the level of the left trochanter for reasons of facility of rolling out the tapes and one fixes it on the left medial horizontal bar.
- One puts in partial tension the ticking tapes to balance the child, and then we place 2 beveled longitudinal felts of 5 cms thickness, 25 cms broad and 60 cms length under the ticking tapes. The felts must largely overflow on the axillary level.
- Then one carries out the setting in final tension while being progressive, by alternating inflexion-derotation and axial traction without exceeding 12 kilos, and while making sure the spine is kept balanced in axial plane.
- When the spine is well balanced, the plaster tapes are unrolled in a derotation way i.e. like the ticking tapes. One uses initially 2 circular tapes of 20 cms broad to cover completely the ticking tapes. Then, 4 plaster splints of 30 cms broad are placed forward, backward and laterally. We cut out the circular tapes carefully all around the ticking tapes. 3 Circular tapes of 20 cms stabilize the braces definitively. Making the plaster cast, one carefully models the counter anterior rib hump on the left and one try to improve kyphonisation on the level of the rib hump by raising a little the shoulder girdle, this is why we prefer on the axillary level a ticking tape reflecting itself on the high bar. One can also raise a little the bar of cervical traction to carry out an effect of hammock.
- The plaster cast dries in the frame during approximately 10 minutes, then the child is standing up and the first cuts are carried out in upright position.
- The physician delineates trim lines according to the X-rays.
- On the level of the pelvis, one largely releases the inguinal fold to allow a 90° flexion of the thighs.
- On the level of the shoulder girdle, cutting is asymmetrical to release the right arm of the child and to allow him more functionality, but especially to facilitate the re-horizontalisation of the upper limit vertebrae.
- On the level of thoracic and lumbar concavities, one cuts out a window intended to facilitate maintenances of skin and to allow a possible felting of the rib humps.
- At the abdominal level, a triangular window with xiphoid peak facilitates maintenances of skin and makes it possible to check the stomach in the event of gastric dilatation.
- At the thoracic level, one releases the chest by reinforcing the stabilization of the chondro-costal band and the sternoclavicular support.

We will insist particularly on the completions:
The symmetrical pelvic girdle and its tight waist ensure a perfect lumbar and pelvic flexion, allowing a much more accurate design and placement of shells. This choice between a push, a drive, or a stop allows for a blueprint that focuses on the structurality of the curve to be efficient. A brace blueprint does not require the patient's x-ray. The brace allows the orthotist to convert the medical prescription to an individual orthosis based on the individualized design. A brace blueprint is performed for each patient. The blueprint allows the application of Lyon Brace principles to the individual patient and allows the orthotist to convert the medical prescription to an individual orthosis based on the individualized design. The brace blueprint does not require the patient's x-ray. The brace blueprint focuses on the structurality of the curve to ensure a perfect stability. The ante version of the pelvis gives lumbar lordosis and will allow thoracic kyphosis. We don't use pelvis pads to avoid pelvic intrinsic deformation during growth. Active as well as passive correction is a fundamental principle of any brace, especially during night time. Due to the symmetrical construction of the Lyon brace, it's the plexidur rigid structure of the shells which allows a spontaneous active correction. The brace forms a rigid structure. If the patient carries out an active auto correction, the pressures decrease, more than a polyethylene structure.

**Push pressure at the apex and below**

Empirical evidence and mathematical modeling dictates that push pressure should be at the apex of the curve and below for thoracic and thoraco-lumbar deformities. In the thoracic spine this is interpreted as pressure in the midaxillary line at the apical rib and below. With the lumbar level, the pressure is carried out on the level of the transverse processes centered on the apex of curve. Lumbar lordosis improves lumbar correction and derotation.

**Relief opposite every area of force**

Lyon brace principles dictate that opposite every force there should be an area of relief so that the trunk may shift. A good example is the thoraco-lumbar and lumbar Lyon brace. For the thoracic Lyon brace, we must maintain a stop on the concave side to avoid an excessive rib horizontalisation.

**Custom plaster cast moulding or full electronically moulding like Orten™**

We think that “custom made” is better than prefabricated standardized symmetric modules. The full electronically moulding advantages to the orthotist in terms of saving time, space and fabrication are obvious. Perhaps more importantly, the oriented moulding is carried out immediately after the weaning of the plaster cast. The scoliosis was already corrected in the coronal plane and one can then release the plaster cast at the time of the realization of the window. For the first hours, the exothermic reaction causes a puffiness of the skin identical to a heatstroke so that any maintenance of skin is not recommended before 3 days.

**Brace Blueprint**

A brace blueprint is performed for each patient. The blueprint allows the application of Lyon Brace principles to the individual patient and allows the orthotist to convert the medical prescription to an individual orthosis based on the individualized design. The brace blueprint focuses on the structurality of the curve to choose between a push, a drive or a stop and we believe allows for a much more accurate design and placement of shells. Lumbar and pelvic flexion, the symmetrical pelvic girdle and its tight waist ensure a perfect stability. The ante version of the pelvis gives lumbar lordosis and will allow thoracic kyphosis. We don't use pelvis pads to avoid pelvic intrinsic deformation during growth.

**Active as well as passive correction**

Passive correction is a fundamental principle of any brace, especially during night time. Due to the symmetrical construction of the Lyon brace, it's the plexidur rigid structure of the shells which allows a spontaneous active correction. The brace forms a rigid structure. If the patient carries out an active auto correction, the pressures decrease, more than a polyethylene structure.

**Force couples**

Rotational deformity is an important component of scoliosis. In addition to emphasizing lateral curve correction, the Lyon Brace emphasize correction of rotational deformity. We believe that the application of rotational forces is potentially much more effective when “force couples” are used. Thus, for every rotational force applied another force opposite the desired center of rotation, in the same rotational direction, is applied to enhance the rotational force. Thus an anteriorly directed derotating force in the lumbar spine is counter balanced by (coupled with) a posteriorly directed force in the anterior abdomen. At the thoracic level, it's possible to add a pad on the medial side of the rib hump.

**Physical therapy and Sports**

An individualized exercise program is recommended for patients wearing braces. Exercise selection is based on the results of an individual evaluation. A well designed, realistic home exercise program helps patients to successfully wear her brace, continue to participate in activities and help to improve the overall positive outcome of the brace program. Some individuals have asymmetric hip abduction contractures, or other abnormalities such as thoracic hypokyphosis that require specific attention. There are some limitations for sport according to rib asymmetry and rotation.

**Team approach**

The team approach is emphasized in brace construction, brace application and especially management of the brace and patient over time.

**Summary**

The Lyons brace initially used for the thoracic infantile rachitic scoliosis is now adapted to the thoraco-lumbar and lumbar curves. The brace is:

- **Adjustable** on seven centimeters of growth, it's efficient. We do not need to change the brace every six months.
- **Active**: Because of rigidity of the plexidur structure, the child is stimulated. The active axial auto correction decreases the pressures.
Disc decompression: It is the consequence of the "Adjustable". The effect of extension between the two pelvic and scapular girdles decreases the pressure on the intervertebral disc and allows a better effectiveness of the pushes.

Symmetrical: In addition to the aesthetic aspect, the brace is much easier to build.

Stable: The stability of both shoulder and pelvic girdles facilitates the intermediate corrections.

Transparent: Usually, it is not necessary to use the "pads", we can thus control directly on the skin the pushes, stops, drives and reliefs.

Patient Evaluation by the Orthotist

Background
Idiopathic scoliosis usually occurs as a painless deformity in the pre-adolescent child which has been noticed on routine screening evaluation at school or by the pediatrician. The incidence of idiopathic scoliosis requiring brace treatment in girls is approximately eight times that of boys. Frequently the family history will reveal first degree relatives also with scoliosis which requires treatment. The age of onset of scoliosis is variable but the major period of worsening of the curvature is correlated to the major adolescent growth spurt. The high probability of the curve progression with the adolescent growth spurt is often an indication to initiate a bracing program.

Physical Assessment

Review the patient clinically. The physical examination of the child with scoliosis should always involve the presence of a parent or same sex chaperone. Have the patient undressed enough to really see the spine, hips and trunk - a bathing suit is ideal- or stockinet can be used over underwear to make the patient comfortable, yet allow an examination. Stand back and observe for asymmetries. Are the iliac crests, waist, arms and shoulders level? Place your hands on the iliac crests to assess pelvic obliquity and leg length discrepancy. The alignment of the pelvis can be determined by palpation of the anterior and posterior iliac spines; the pelvis should be level to the floor while the patient is in double leg stance. Pelvic obliquity can also be assessed by the use of measuring blocks placed under the short leg until the iliac crests are level. Pelvic obliquity can have many bony causes: a flat or small foot, a short leg, or an underdeveloped or malformed pelvis on one side. Pelvic obliquity can also be caused by asymmetric hip flexion contracture, hip adduction or abduction contracture, or even an ilio-tibial band or knee flexion deformity. Pelvic obliquity due to infra-pelvic deformity (leg length discrepancy or joint contracture) or infra-pelvic deformity (sacral hemiagenesis or iliac dysplasia) may require the use of a lift (if there is true leg length discrepancy), physical therapy (if there is a hip flexion or abduction contracture or same sex chaperone. Have the patient undressed enough to really see the spine, hips and trunk - a bathing suit is ideal- or stockinet can be used over underwear to make the patient comfortable, yet allow an examination. Stand back and observe for asymmetries. Are the iliac crests, waist, arms and shoulders level? Place your hands on the iliac crests to assess pelvic obliquity and leg length discrepancy. The alignment of the pelvis can be determined by palpation of the anterior and posterior iliac spines; the pelvis should be level to the floor while the patient is in double leg stance. Pelvic obliquity can also be assessed by the use of measuring blocks placed under the short leg until the iliac crests are level. Pelvic obliquity can have many bony causes: a flat or small foot, a short leg, or an underdeveloped or malformed pelvis on one side. Pelvic obliquity can also be caused by asymmetric hip flexion contracture, hip adduction or abduction contracture, or even an ilio-tibial band or knee flexion deformity. Pelvic obliquity due to infra-pelvic deformity (leg length discrepancy or joint contracture) or infra-pelvic deformity (sacral hemiagenesis or iliac dysplasia) may require the use of a lift (if there is true leg length discrepancy), physical therapy (if there is a hip flexion or abduction contracture), to correct the deformity. Anatomic leg length is measured from the anterior superior iliac spine to the medial malleolus. A leg length discrepancy of greater than 2 cm usually requires a shoe lift to level the pelvis prior to bracing. Less than 1 cm is regarded as physiologically. Between 1 and 2 cms we will compensate if the lumbar rib hump decreases.

Check the patient’s tissue tone and postural habits. The general body shape should be observed for height/weight proportionality. Are there any prominent bony areas that must be relieved of excessive pressure? The physique of the child may present brace wear problems. For example, obese children are difficult to fit due to soft issue impinged in the brace and failure of the brace to control the pelvis while the excessive slender child presents a challenge in dealing with body prominences such as in Marfanoid patients. Bony prominences at the sternum (pectus carinatum), posterior ribs (razor back deformity) or at the iliac crest should be noted so that the positive plaster cast should be reload on the level of the bony prominences. Observe for cafe au lait spots on the skin that may suggest that the scoliosis is related to neurofibromatosis. Unusual skin malformation such as with vascular malformation syndromes may require alteration in the standard brace design. Foot deformity, such as a cavus foot or unilateral clubfoot, may be a manifestation of intraspinal lesions like spina bifida causing muscle imbalance. Neurological examination of muscle strength, sensation, and reflexes should be performed by the physician.

Particular attention should be paid to the examination of the hip muscle. Hip flexor tightness will impede proper brace wear and requires a physical therapy stretching program. The extension of the hip while lumbar flexion is maintained by ipsilateral hip flexion is the standard test to assess for hip flexor contracture (ilio-psoas). Similarly, the ilio-tibial band and the hamstrings should be examined for tightness (refer to physical therapy section).

Palpate the spine and observe the suppleness of the curves. Note the rib hump in the thoracic area and/or of the fullness in the lumbar area at the transverse processes at the convexity of the curves. Spinal examination is carried out to observe the sagittal shape (lateral view) and the coronal (frontal) shape. The normal sagittal shape of the spine is characterized as cervical lordosis, thoracic kyphosis, lumbar lordosis, and sacral kyphosis to balance the head and shoulders over the pelvis. Alterations of the normal pattern are seen in spinal deformity such as idiopathic scoliosis where the thoracic spine becomes relatively lordotic (either hypokyphosis or true lordosis) and the cervical spine has a diminished lordotic curve. The hypokyphosis is compensated by bending the bars.

Excessive kyphosis associated with scoliosis is an atypical pattern. Coronal plane deformity of the spine (scoliosis) is the prominent feature of idiopathic scoliosis. This is noted on examination of the spine by a lateral shift of the thorax from the normal position (directly above the sacrum in the erect position). For the right thoracic pattern of scoliosis, which is the most common pattern, the pelvic shift is accompanied by shoulder elevation on the same side and a waist crease on the opposite side. Deviation of this pattern suggests the presence of additional spinal curves so that the double thoracic pattern will have shoulder elevation opposite of the right thoracic lateral shift and the double pattern of thoracic and lumbar curves will show minimal waist asymmetry. The lateral deviation of the spine in idiopathic scoliosis is associated with rotational deformity characterized by a rib hump in the chest or paravertebral prominence in the lumbar region. The rotation deformity is best seen during the forward flexion test (Adam’s forward bent test) and can be quantified with a scoliometer as the asymmetric trunk rotation angle or with the plumb line in millimeters.

The findings of the physical examination of the spine should be compared to the radiographs to assure correct identification of the location of the curves and correct labeling of the radiograph (this is particularly important for the atypical left thoracic curve which requires brace construction opposite to the usual positions). Evaluate the patient’s and parent’s attitudes toward bracing.

X-RAY

The x-ray is an important tool for the orthotist when treating scoliosis. It is far too easy to be misled by palpation of the spine. Exact curve apices can only be determined by the use of x-rays. A full complement of initial anterior-posterior and lateral and follow-up films under plaster cast must be available whenever the orthotist sees the patient. Radiographs should be made without a breast shield so that the ribs may be seen to plan and observe the location of thoracic pads of the brace. Radiation exposure can be minimized by the use of the posterior-anterior projection and the use of "fast" radiographic film. It is optimal to have the entire spine on a 30x90 cm cassette radiograph. Flexion-extension and lateral bending films are not used for the construction of the brace.

Anterior-Posterior (or PA) View

The 'standing' anterior-posterior x-ray is placed in a view box with R on your right and L on your left, viewing the x-ray as if you were looking at the patient’s back. The rotated pedicles demonstrate rotation of the vertebral body and are most important when analyzing for proper shells placement. Differences in the size and shape of the two iliac crests must be considered when reviewing
Brace Prescription

Indications for the use of the Lyon Brace

Curve Magnitude

The goal of the Lyon bracing management is to allow non-operative treatment of scoliosis by preventing progression of the scoliosis in the growing child. A better understanding of the natural history of idiopathic scoliosis has refined the indications for brace treatment. Brace treatment is begun when the likelihood of progression of scoliosis is high. The patient with a mild curve near the completion of growth is unlikely to have further progression of the scoliosis and probably does not benefit from brace wear. The preadolescent with a moderate scoliosis (curvature > 30°) is at significant risk for progression of the scoliosis and may derive great benefit from brace wear. The adolescent with a 45-degree curvature and growth remaining may achieve curve control with bracing or can be served by surgical treatment. In general, for the adolescent with a curvature 25-45 degrees and growth remaining, Lyon bracing management is indicated and will stop progression in 55% of patients, improve curvature in 35% and curve progression will continue in spite of bracing in 10%. Bracing large curves in the younger child may delay surgery and allow further spinal growth before fusion. In juvenile idiopathic scoliosis, brace wear is initiated when the curvature exceeds 20°. In the adolescent or late onset idiopathic scoliosis, the following guidelines are suggested by SRS:

APPROXIMATE GUIDELINES FOR BRACE TREATMENT OF ADOLESCENT IDIOPATHIC SCOLIOSIS (Juvenile curves should be braced much earlier- probably if over 20°)

<table>
<thead>
<tr>
<th>Curve Magnitude</th>
<th>Indications</th>
</tr>
</thead>
<tbody>
<tr>
<td>0° - 20°</td>
<td>Observe for progression</td>
</tr>
<tr>
<td>20° - 25°</td>
<td>Brace if substantial progression documented and large amount of growth remains, otherwise observe (night time bracing)</td>
</tr>
<tr>
<td>25° - 30°</td>
<td>Brace if progressive and growth remains</td>
</tr>
<tr>
<td>30° - 40°</td>
<td>Brace if growth remains</td>
</tr>
<tr>
<td>40° - 45°</td>
<td>If growth remains, consider bracing if all prognostic factors favorable.</td>
</tr>
<tr>
<td>&gt; 45°</td>
<td>if family refuses surgery</td>
</tr>
</tbody>
</table>

Curve Location

The Lyon brace makes it possible to treat all curves, except primary high thoracic curves for which we advise the use of the orthotic devices of Milwaukee. Fortunately this pattern of scoliosis is less evolutive than others.

Hypokyphosis and Thoracic Lordosis

The restoration of thoracic kyphosis requires:
- The stability of the lumbar spine in lordosis,
- The anterior xiphoidian stop,
- Bending of the posterior and anterior bars

Contraindications to bracing

Severe thoracic lordosis (thoracic kyphosis < 0°) is a contraindication to brace treatment of adolescent idiopathic scoliosis. All braces that apply transverse forces with lateral pressure push the spine via a rib articulation and may worsen the lordotic spine. Surgical treatment is recommended for progressive curves with true thoracic lordosis.

The Lyon brace remains an elitist treatment. When the child and his family accept the plaster cast, (approximately 2/3 of the cases) the brace which follows the plaster cast will be well accepted. It appears useless to us to spend money for a brace not worn, and when the scoliosis evolves, it is better to consider surgical treatment.

Massive obesity may make effective bracing for scoliosis impossible. The brace is designed to grip the pelvis bony prominences and...
apply corrective forces on the spine with asymmetric pushes. Obesity diminishes the effectiveness of the pushes and the bony prominences may be impossible to deflate. However good short and long-term correction has been achieved with bracing obese patients, a trial of bracing with assessment of short and medium term in-brace correction is advised. The inability of the patient to actively shift the trunk away from the lateral pushes may lead to severe skin ulceration. Alternative bracing systems such as the Soft Lyon brace in polyethylene may be of benefit for the non-surgical treatment of scoliosis in the neuromuscular patient.

Choosing the correct brace
The reductibility in plaster cast is the guide for choosing and constructing the proper brace to treat each type of scoliosis. The brace is named according to the highest curve being treated by the brace. Single curves with an apex superior to T-6 or the upper curve of a triple spinal deformity may not be effectively treated by a spinal orthosis.

The Lyon Lumbar Brace (3 points low) is used for curvatures with apex below L1. The stability requires a particular iliolumbar shell, with an horizontal part upon the iliac crest. The Lyon Thoracolumbar Brace (3 points high) is used for single curves with apex at T-10 to L-1 or double curves with a flexible upper thoracic curve the upper half of which will not be braced. The Lyon Thoracic Brace is used for curves with apex of scoliosis from T-6 to T-10, or double curves. This is the classical brace with a lumbar and medial thoracic push. According the Lenke classification, we can remove the axillary balancing support for the Lenke 3 pattern (double major curve with thoracic curve with heightening of the right shoulder.

The Soft Lyon Brace in polyethylene may have a role in treatment of selected patients with paralytic scoliosis. The material of the brace requires that the patient have sensate skin and sufficient neuromuscular function to withdraw from the pressure points at the sites of push placement.

Brace Design

Principles of Brace Design
The goal of “Brace Design” is to convert clinical and radiological data, to an individual orthosis fabricated for the specific needs of one patient.

In the manufacturing of most objects, the availability of a “blueprint” facilitates the transition between an abstract design and a finished product. Likewise, in the fabrication of a Lyon Brace it is helpful for the orthotist to have a “blueprint”. Using the Cobb method the physician measures the patient’s initial x-ray and the degree of curvature is documented on the x-ray. Both radiological and clinical assessments will now become the “blueprint” for the fabrication of the brace. The PA x-ray should be sufficiently long to include the entire spine and the femoral heads. It must extend laterally beyond the rib margin (rather than be collimated to show only the spine). It is important that the cassette is mounted vertically so that the lateral margin of the x-ray can be used as a true vertical. Alternatively, a metallic plumb line can be incorporated in the x-ray behind or beside the patient. It is important that the patient stand erect when x-rays are taken. A length discrepancy of more than two centimeters should be corrected with a lift before x-ray. The gonads should be properly shielded.

The Brace Blueprint
To create a “blueprint” an orthotist must do the following:
1. Measure curves with Cobb’s method. Determine the Lenke type
2. That’s all

The bending of the bars in the sagittal plane will be suitable according to the sagittal pattern.
BRACE FABRICATION AND FITTING

Positive Plaster Cast Preparation

Final improvements of positive plaster cast (five steps)
Step 1 Erase with 90° on tight waist for a Lyon lumbar brace
Step 2 Erase the lower part of the breasts to increase the surface on the lower ribs
Step 3 Surfacing with the grater
Step 4 Reload of plaster cast on the iliac crest
Step 5 Smoothing of the surface area before thermoforming

Establishing Initial trim lines and Thermoforming

1. Initial trim lines should be drawn on the plaster positive cast. See the blueprint guidelines for the location of these trim lines.
2. Check out your blueprint trim lines with your clinical findings. You may need to make alterations.
3. Thermoforming of all the shells on the positive plaster cast. The shells must exceed the trim lines drawn on the positive plaster cast.

First Assembly on the Positive Plaster Cast

1. The thermoformed shells are fixed on the positive cast with nails.
2. The metal bars are curved and a first provisional assembly is carried out.
3. The final trim lines and the final adjusting of the shells will be carried out at the time of the initial fitting.

Initial Patient Fitting
Shells Placement
The goal of brace treatment is to prevent progression of the scoliosis by:
1. Correcting the lateral curve
2. Correcting the malrotation
3. Returning the torso to a balanced position over the sacrum
4. Properly aligning the spine in the sagittal plane

These goals are achieved by appropriate trim line or shape of the shells and then shell placement.

1. Check that the iliac crests are equal (if not, ask if the child uses usually shoe lift and fit with the compensated shoes).
2. Sit behind the patient and fit the shells from the pelvic girdle to the axillary support. The shells can be fixed with an adhesive tape or the provisional metal bars.
3. Draw trim lines on the patient according to the blueprint and the definitive positioning of the shells. You can ask the child to carry out a corrective bending for better positioning the shells.
4. Remove the shells from the patient for intermediate trimming of excess material.
5. Patient and parent may now take a break while the final fabrication of the orthosis is being finished.

Final Patient Fitting by the orthotist
1. Ask patient to sit on a firm chair with hips flexed at 90o. In this position there should be one finger width space between the anterior inferior trim line and the thigh, and posteriorly four finger width between the brace and the sit of the chair.
2. There should be no impingement of normal flexion or rotation of the hip joints.
3. Supine, there must be a space between the abdomen and the anterior shell.
4. The breasts should not be compressed by the anterior shell.

Final Fabrication
Aerate shells
In some parts of the world any apparel is uncomfortable due to extreme heat and the wearing of an appliance becomes intolerable. Aerating the module helps make it tolerable in most areas.

- The number of 3 mm holes will depend on the climate in which the patient lives.
- No holes should be placed within 2 cm of the edge of shell.
- In high stress areas of module, fewer holes are drilled.

In the usual case of a flat back, the bars are bent in Kypho-lordosis.

Physical Therapy Management

The principles
- No complex material. All the exercises have to be repeated at home.
- No sportive counter indication. The sport practiced by the child must be continued:
  - By adapting if necessary the sportive gesture ( avoid the deep quick inspiration, and the flexion of the trunk forward)
  - By completing if necessary the sportive activity thanks to physiotherapy.

The exercises are symmetric in the frontal plane.
- No chapel and miracle exercise. Choosing the best technical way for every child, at every age, and every therapeutic sequence.
- No revolution, therefore but an evolution in the exercises which are repeated few minutes a day at home.
- We treat a child and not a scoliosis or an X-ray. The look of the child is fundamental. Sometimes asymmetric with plagiocephaly, it evokes a juvenile scoliosis, but most of all it expresses a mood: worry, scare, anxiety, despair, indifference, disappointment, aggresiveness. It is our role to change this look to reliance and complicity.

<table>
<thead>
<tr>
<th>OBJECTIVES</th>
<th>MEANS</th>
<th>DANGER-CARE</th>
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<tbody>
<tr>
<td>Modification of the spoiled body image of the scoliosis</td>
<td>When we first see the patient, back and vertical height difference pictures are shown to the child He has to be conscious of the deformity and to the mirror or a video tape</td>
<td>The cortical representation of the back is weak and damaged by the fast growths, but let’s be careful not to devitalize and depreciate the image of the body</td>
</tr>
<tr>
<td>Suppling up of the retracted elements of the concavity</td>
<td>Still posture (Mézières, RPG)</td>
<td>Manual modelling of the vertical height difference Be careful not to favour the empty back. The support has to happen on the internal side of the vertical height difference. A cushion is put under the left choordal costal ca-noopy and the transversal movement leads to exhalation.</td>
</tr>
<tr>
<td>Suppling up of the griddle</td>
<td>Segmentar and analytical correction of the deficit of the extension of the hip measured by Biot at 43%, since the youngest time of the patient</td>
<td>The rigidifying scoliosis curve may be a natural element of stabi-lity. An excess of the suppling up can lead to a progressive revival of the scoliosis.</td>
</tr>
<tr>
<td>Improvement of the vital capacity</td>
<td>Highering of the VEMS Blow a balloon every night</td>
<td>Manual modelling of the vertical height difference Be careful not to favour the empty back. The support has to happen on the internal side of the vertical height difference. A cushion is put under the left choordal costal ca-noopy and the transversal movement leads to exhalation.</td>
</tr>
<tr>
<td>Saving of the spine</td>
<td>Development of the compensation at the belt level and the members on a tru-nik which is still close to vertical</td>
<td>The belts have to compensate</td>
</tr>
<tr>
<td>Diminution of the mechanical constraint on the axis</td>
<td>Repositioning of the head on the gravity line in the frontal and sagittal plane. Exercise to carry big charges. We look for the global balance, the sand pack must stay on the head, the har-mony and the movement coordination. The walk must be synchronised with breathing. For lumbar scoliosis and thoraco-lumbar: learning of the shift.</td>
<td>The deep inspiration favours the rotation (Geyer) thus slow inspira-tion and quick exhalation.</td>
</tr>
<tr>
<td>Realharmisation of the static</td>
<td>Reinforcing of the fibres of the deep paravertebral muscle structure and muscles stabilizing the belt such as the psoas, the abdominals and the pectorals by power-ful slow static contraction supported in a corrected position.</td>
<td>A pelvic unbalance or of the sac-cular belt can compensate a sco-iosis, we have to respect them. All types « C » of Lenke, the opening of the ilio-lumbar angle goes in the direction of the accentua-tion of the lumbar curve. In the sagittal plane we have to avoid fa-vouring the lordosing vertebral rear.</td>
</tr>
<tr>
<td>Strengthening of the muscle in order to make the behavior in a corrected position easier</td>
<td>The brain ignores the muscles and only know the movement.</td>
<td>&quot; The brain ignores the muscles and only know the movement. &quot;</td>
</tr>
<tr>
<td>The 24 hours of the back : adaptation of the scoliosis to the enviroment and of the environment to the scoliosis</td>
<td>Control of the sitting posi-tion when listening and writing according to the morphotype Dealing with the school bag</td>
<td>In the frontal plane. The exercises are symmetric because we do not know the role of the asymmetry concavity convexity. In the sagittal plane, the anterior flexion increase the rotation, there-fore we have to strengthen in a neutral positions. No body build-ing which concerns the superfi-cial muscle structure.</td>
</tr>
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Résonances Européennes du Rachis - Volume 15 N° 47- 2007
Brace Evaluation and Critique

We show the results of 1338 scoliosis treated in France and in Italy according to the indications above. All the assessments have been done by the same doctor. The data are automatically written on the Excel table by the secretary during the check-up 2 years after the weaning of the brace. For two years, according to the SRS norms, we have included the scolioses treated previously thanks to Milwaukee brace. The failures with evolution towards surgery are included. Every scoliosis not checked at least two years after the weaning of the brace are excluded. Considering our recruitment, most of the scolioses are idiopathic. We have excluded the patients in Soft Lyon Brace and Elastic Lyon Brace.

We grouped all the scolioses according to the kind of Lyon Brace realized. The results are expressed according to Cobb’s angulation in percentage of reduction according to the Cobb’s angle of our series shows the important amplitude of indication, from the weaker curve to the most kyphoscoliosis from Risser 0. We can, thus, compare the results obtained comparing the average of the main and secondary curves.

We isolated a group of 174 scolioses, which treatments were initialised at Risser 0. We can, thus, compare the results obtained comparing the average of the main and secondary curves.

DISCUSSION

The Lyon braces have followed the progress of the technology while conserving the fundamental biomechanics principles. For 20 years, the Lyon Brace is realised and evaluated in the same way in some public and private structures either in France or in Italy. The results are coherent and the variations in time are linked to the screening and an early take in charge.

The initial reduction by a plastered cast enables a moulding on the spine already moulded. The X-Ray with the plaster cast is used as a reference to adapt the orthosis. This reduction enables a nightly wearing of the brace, which is very appreciated by the child, for the curves below 30°.

Riser’s classification seems to us well adapted to the prescription, the doctor just has, therefore, to classify the curve in order to help the orthotist to realise the most adapted brace.

In my opinion, it is the brace that must adapt to the child itself and we will use, according to the cases all the range of the actual braces. The best indication for the Lyon Brace is the puberty growth, when the constraints on the rib cage do not risk leading to tubular thorax. The statistics do not correspond to all the scolioses we treat, but to some patients that we select because we think the Lyon Brace will be more effective.

When a treatment has been done before, the initial angulation is the one before the plastered cast.

The realisation of a plastered cast at the beginning of the treatment may select the most motivated patients, who think compliance is the best. In the same way, we lose many tracks of the patients at the end of the treatment and only the motivated ones come to the check-up.

When a patient is operated, he is included in the statistics and we repeat the angulation before surgical intervention.

The important Standard Deviation of the Cobb’s angle of our series shows the important amplitude of indication, from the weaker curve to the most important: the only variable is going to be the time of wearing the brace during the day.

The best results are obtained for lumbar scoliosis. The brace is short, well tolerated and those curves are often painful at adult time. Those are the
Conclusion

Almost sixty years after the beginning of the Lyon Brace management, we can confirm its effectiveness. Little by little, we precised the indications related to the Lyon Brace and we managed to make the all treatment ambulatory even for the realization of the plastered brace. Nowadays, the electronic moulding enables a precise realization according to Lenke’s classification. The Lyon Brace management is a conservative orthopaedic treatment very effective and this fact is proved by the last results that we highlighted in this study. The ambulatory realization of the plastered cast and the Lyon Brace is cheap and enables the child to keep on going to school. The easiness of the prescription of the brace coming from Lenke’s classification is reachable for everyone. The easiness of adaptation of the brace during puberty growth enables a precise and optimal adjustment. It is a complement to other orthosis and must be included in the therapeutic range of the scoliosis specialist.

It is a product which allows the maximum chances to the child and it provides the maximum chances of success to the doctor.

References


APPENDIX 1

PRESCRIPTION FOR A PLASTERED BRACE OF THE TRUNK

1 – Make daily care of the skin with:
- Alcohol at 70°
- Band of crepes 10 cm wide Velpeaucrepê to change : ............

2 – Alimentary diet :
- Avoid the starchy food and sparkling drinks.
- Have 4 meals a day.

3 – In case of nausea:
- position knees against pectoral (seen during physiotherapy)

4 – In case of throwing up :
- Ask the nurse an injection of 1M of PRIMPERAN
- Call the doctor who will decide if a hospitalization, for a gastric intubation and a ionic balancing is necessary.

5 – Repeat every day the rehabilitation exercises: vertebral and respiratory taught and checked by the physiotherapist.

6 – Call the insurance : in case of the practice of a collective sport, or driving a car.

7 – The amenorrhea is frequent and there is no need of a systematic gynecological consultation.

8 – Call us :
- If a compress shows a blood stain during the cure
- If the plaster brace is breaking down
- In case of digesting trouble.

APPENDIX 2

Brace
Evaluation by the Physician

Evaluation with the brace
The child is asked to come to the check up with the brace on him and if possible the same kept from the former night.

1 In a standing position we check in the frontal plane the global balance of the occipital axis, and the mettalic core grid : anterior and posterior masts. We check, as well, the distance between the edge of the brace and the hollow of the axilla area; in the sagittal plane we check the Tragus Trachanter-Acrineon malleol alinement, we check the vital capacity with a spirometre. It must not be below 20% of the one measured during the first consultation.

2 In a standing position the inferior edge of the pelvic belt must not compress the inguinal fold and we check the sitting writing position feet behind, bottom in the front, before arms on the counter.

3 In decubitus the anterior mast must not disturb the thorax inhalation
and the abdominal pads must not compress the soft parts (+2cm). Lateral, the pads must be against the thorax. In this position we will check better the tightening.

2. Examination without any orthesis.
We will check if the redness, at the pads level, are regular, the principle being to spread as much as we can the pressure on all the pads. When the redness persist half an hour after the wearing of the orthesis, we have to untighten the pads.

3. The criterias of a child accepting well his orthesis
We are fully assured when:
- The orthesis is decorated with stickers
- The child is in place and can take off his brace by himself during the first consultation.

For the successive controls, we will appreciate the wear-out of the metallic pieces and the fastenings according to the time of the wearing of the orthesis. The practice of a regular sport is a compliance factor as well.

APPENDIX 3
Management of the Lyon Brace

1. protocol of the wearing of the orthesis
The protocol of the wearing of the orthesis is précised during the first consultation according to the angulation of the curves and is confirmed is the reducibility with a plastered brace is more than 50%.
The time of wearing of the orthesis is increased if the reducibility is less than 50%.

2. Practice of sport
The wearing is authorized without any time limitation for the practice of sport.
We generally advise the sports favouring the suppling up of the muscular ligamentar paravertebral structure during puberty growth: such as swimming, climbing. From the first period and at the end of the body growth, we advise sports with impacts such as running, dance, to favour the fixation of the calcium on the bone and the constitution of an important bony mass.

In a specific way when the ribs are asymmetric we recommend to avoid deep and quick inhalation which favours the vertebral rotation and therefore the breathlessness during the practice of sports.
For lumbar curves, we advise, as well, against the quick flexions of the trunk forward or the position extending with an anterior flexion of the trunk.

3. Body cares
The perfumes and colouring have to be avoided and we will use a neutral shirt. Like the one described are delivered with the orthesis.

4. Feeding
The straightening up of a scoliosis can modify the esophagus gastric passage through the diaphragm.
The inflation of the stomach has to be reduced by spreading over the day the meals, and avoiding all the sparkling drinks.

5. The sitting position
We have to dissociate the « listening » sitting position: feet forward, ischios behind the bottom, and back against the dorsal support, from the “writing” sitting position: feet backwards, ischios in front of the bottom, brace against the anterior edge of the counter, the two forearms lying on the counter.

6. At night,
The mattress has to be thick, a little pillow stabilizing the cervical spine. If the patient complains of a superior member falling asleep, we have to make the high thoracic counter-push or the little balancing crutch to avoid the “pull apart tyre” effect. If the swelling remains, it may be a costo clavicular compression and we advise a second pillow to move aside the arm in abduction.

APPENDIX 4
Some councils with the young people presenting this disease.
All starts one morning…
Miss vertebra wakes up very anxious. One has just discovered a scoliosis to her.
She seeks to get information.
It is really not simple, all is so new for her! Fortunately that Doctor Ortho is there to explain and answer her questions…

What is scoliosis?
It is a painless deviation of the spine. It can occur at any age. The physician poses the diagnosis by examining you then by making you X-rays of the spine.
You can have one or more curves on the level of the spine, which normally is right.
The side of curve is defined by its convexity which corresponds to the top of the deformation thus a dextro-convex scoliosis is a scoliosis deformed towards the right.
Claims with your physician show you that on the X-rays. He will also show you how the angle of the scoliosis is calculated, which enables him with other criteria to determine the best treatment for you.
It will be necessary to keep all the X-rays and to bring them each time in consultation so that the physician can see the changes and your progress.
This deformation is accompanied by a rib hump.
The hump is a hump in the back, due to the rotation of the vertebrae and the deformation of the ribs. It is sometimes difficult to see in upright position and it is better seen when one is bent forward.
The origin of this affection is not known, this is why it is qualified “idiopathic”. On the other hand, it is not due to a nasty attitude, nor with the carrying of the school bag.
On the other hand, it is known that it concerns between 3 and 4.5% of the children and that it affects more the girls. Often other people in the family have a scoliosis.

But why make a treatment if that is painless?
The scoliosis is likely to worsen until the end of growth and especially during puberty. It thus should be cured as soon as possible when it is evolutive.
If you do not follow your treatment correctly, curve and rib hump will increase and involve a disharmonious hump, and you will be perhaps constrained (pain, esthetics) in the life of the every day.
Perhaps this scoliosis will have a day to be operated.

How will it occur?
According to the case, you can have:
- a removable brace from the start, made after a moulding (Milwaukee or another brace…)
- or need a reducing plaster cast made on a frame who makes the best correction of your scoliosis. It is the best method when it is necessary to treat more extremely (at the time of a more important, or more evolutive, or stiffer scoliosis). The duration of this plaster cast, its renewal (one, two or three times) also depends on these other factors. This time is necessary to stiffen your spine in the corrected position.
Then, one carries out a moulding of your spine (a plaster cast which is immediately removed and makes it possible to manufacture your custom brace).
You will need a fitting, and with the delivery, test your brace with the orthotist who will explain you how to put it and carry out the last adjustments. X-rays are made with the orthotic device (another name of the brace).
The first technical control is envisaged one week after to check that all occurs well at the same time as the doctor visit. Of course if a problem occurs, return as quickly as possible. The physician will see you every six months. Put the questions which you want if there is anything that you do not understand.

In general, the X-rays are required at the time of the consultations every six months. They must be made before the consultation and are carried out without the brace (it should have been removed six hours before the X-ray).

If the correction is insufficient or if there exists an aggravation, one checks the adaptation of the brace, one modifies it, one modifies its protocol of wearing (one increases the time of wearing). Sometimes it is necessary:
• to remake a correct plaster cast,
• to change the brace when the precedent is considered to be ineffective or badly tolerated.

The physician prescribes you sessions of physical therapy to learn how the correct exercises to make with and without brace.

**When could I remove it?**

It is the physician who decides with you, but it is waited always at least until you finished growing. The wearing of the brace is progressive and increases two hours per day every fifteen days while passing from a protocol of 23:00 to a protocol of 20:00, until 16:00 with a control in consultation with three and six months.

**How to put my brace?**

You can put your brace upright, the spine against a wall opposite a mirror or supine, and you can do it all alone.

It is important to tighten the brace sufficiently so that it is effective, moreover it hurt it moves and if it is badly fixed.

In addition, the orthotist put reference marks of tightening at the time of the first check, then you cannot be mistaken. These reference marks are checked with you during the successive surveillances.

**Why must I carry it so a long time?**

The brace is carried permanently as plaster cast, from the delivery, and it is necessary to respect well the protocol of wearing prescriptions by the physician. Often it should be carried 23 hours out of 24, sometimes 16:00 on 24, and that for one period of time of 18 month at several years. It is only in this way that the treatment will be effective. The protocol is proposed according to the type of curve or scoliosis and according to its evolution.

The vertebrae are more delicate, they become deformed while growing and the brace is the stake which allows the spine to rectify itself, and less to occur, it happens if it moves and if it is badly fixed.

And if I grow?

The brace is changed if you grew much and because the brace is not suitable anymore. For example: you could increase from 7 cms and 5 kilograms. In fact, the need for changing the brace depends on the type of brace, of height and weight but also on the modifications of the shapes of the thorax and the pelvis.

**Must I carry my brace to the school?**

Yes if you have a protocol of port of 23:00 on 24. It is in sitting position that the vertebrae become deformed more.

**Will my friends make fun of me?**

“I have the look of a robot, the device makes me stiff, the contact is tough, I have the impression to carry a carapace, it is unaesthetic, it’s visible, I am not like the others.

But the brace protects me, I have the impression to be strong, I am held to the thorax and the pelvis.

And if I must be operate?

Sometimes, in spite of a treatment of well followed brace, the scoliosis worsens and a surgical operation can be necessary to the end of growth.

The surgical procedure consists in rectifying the deformation of the spine with metal rods, hooks, and a bone grafting which fix the vertebrae. The surgical procedure depends on your age, of your scoliosis. The purpose of it, is to block the spine in corrected position so that the deformation does not worsen anymore. The surgery rigidifies the spine. It is the surgeon who decides the method of treatment according to your own situation.

The surgical procedure proceeds under general anesthesia, before you will give a little of your blood so that one can give again it to you during the surgical procedure. After the surgical procedure, the brace is generally not necessary. The hospitalization is not very long. It is proposed if possible during school vacations and you can normally go back to school after surgery. The surgeon that you will see explains what he will do and why; All the questions should be asked to him.

To avoid the surgery, the treatment by brace is very important and this is why this treatment should be observed as well as possible. It also makes it possible to operate under better conditions when that remains necessary.

And here, it is finished, Miss vertebra does not need more her brace!

She already left for other adventures…

**Maintenances of hygiene will be daily, you perspire more with the brace, especially in summer. Then take a shower or a bath each day, or better twice a day, morning and evening.**

There too, you will take a neutral soap without dye and fragrance or a dermatologic product without soap if you have the delicate skin.

Be wary of the heatstrokes: use creams with total protection.

If a part of the skin is irritated or painful speak with your physician, you can all request from him; moreover is your tetanus vaccination up to date?

**Must I follow a food regimen?**

Yes, quite simply to prevent that your belly does not inflate too much, which would involve a compression in your brace which is not elastic. One should not eat too much during a meal but to eat more often, 4 meals per day for example, and the fizzy drinks are prohibited.

Certain food materials are to be consumed with moderation:
• Those which make the skin (all the cabbages (cauliflowers, Brussels sprouts, red cabbage, curly kale, broccoli...), lense, garbanzos, white beans, flageolets
• Fresh bread
• The starchy foods (rice, pastes, potatoes, semolina)
• Certain fruits like banana, cherries
• Pastries and Viennese pastries especially if you want to keep the line
And remember: no fizzy drinks, but water and always water, at least 2 liters per day, and even more if you make sport.

**Do I have to quit the sport?**

Especially not!

You can continue the sport or the activities which you had before the brace, and if possible start others of them. The contraindications with the sports practice are exceptional.

If the brace obstructs you, you will remove it for the strict length of time of the sport.

Do not forget that you need muscles to support your spine, now and also when one removes the brace definitively.

More over when you move, calcium is fixed better on your vertebrae which need some to grow and to solidify itself. And never forget to drink, during and after the effort.

**Must I make it in addition to kinesitherapy?**

The sport enables you to move, and kinesitherapy to better move. They are two complementary activities. It is also important to make each day the exercises of kinesitherapy which you learned.

These exercises are different according to the type of scoliosis which you have, the physical therapist and your physician check and control these exercises, some are to be made in brace, others without brace.

For the thoracic scoliosis, the shift is very important to make anywhere, as often as possible any time.

For the lumbar scoliosis, without the brace it is necessary to work in kyphosis because it becomes flat in its high part where you have the scoliosis.

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page 1988