Dr Cheneau Scoliosis Brace

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Philosophy of the scoliotic deformations and of the processes of correction

In scoliosis, there was for a long time a great vacuum of knowledge. There are still many false ideas which formerly justified the qualification of "opprobrium of orthopaedics" and caused many "bitter reflections". But the truth comes little by little, and results in an increasing effectiveness of treatment, in particular of the orthopaedic treatment in the range of its own indications.
Everyone raises the question of the **causes of scoliosis**.
True scoliosis, is an autonomous disease which can be very serious. It has nothing to do with a too heavy school bag. All the causes of bad attitude lead only to deformations which never exceeds the margin of movements. These attitudes, even fixed, do not show the aspect of the true scoliosis-disease. They show no osseous deformations with of wedging. No specialist is mistaken.
The known causes of scoliosis are very numerous and varied. They are out of the framework of this study. For the scoliosis known as "idiopathic", i.e. without any detected cause, a lot of assumptions were and are advanced. Here are some of them.

"**Idiopathic**" scoliosis could have as their origin **a neuromuscular pathology**. Eychenne (4) and collaborators would have found concordant signs on eight studied patients out of fourteen. They insist on the need for seeking an aetiology which would let move back the proportion of the idiopathic scoliosis.

Gueth (5) had sought to detect at various scoliotic patients which is the proportion of those the origin of which should be a cerebral palsy. He had used electromyography and many tests. Among others, the scoliotic patients with cerebral palsy show more active concave-sided muscles. The opposite is true for idiopathic scoliotic patients. A simple test was the stretched arm with load conceived by Matthiass. It was disturbed by scoliotic patients with cerebral palsy, and normal by the idiopathic ones. It is not necessary to say that it is strongly positive in the peripheral paralyses. Gueth concluded that the scoliosis by cerebral paralysis are very different from the idiopathic ones.

Karski (6) says and writes that the "idiopathic" scoliosis would have as origin a **spasm of one half of pelvis.** I had already heard this assumption during informal conversations about fifty years ago. But on one hand I badly understand the genesis of the single thoracic scoliosis. In this type 3 of King, the lumbar rachis is strictly rectilinear, vertical and balanced. Pelvis is neither deformed nor deviated nor buckled on the right or on the left. In addition, is this spasm of a half pelvis a cause or a consequence of scoliosis? Karski says that a scoliotic patient always stays on his right foot. I often observed the opposite. All these worth a more thorough study .

Does the scoliosis have a genetic component? I know that this question is being studied, but I am unaware of it and to what this study led.

Which is the **genesis of the multiple deformations** which one observes in the scoliosis?

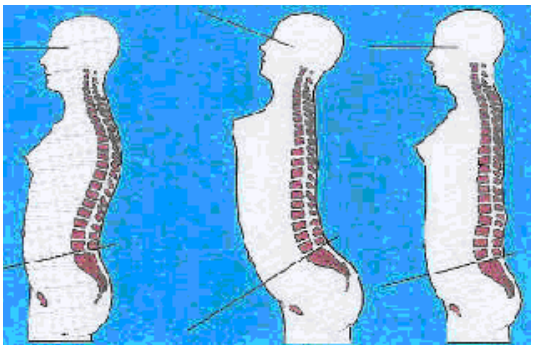
Vertebral rotation does not have any valid explanation until our times. It does not follow the direction of the joint facets, which are very much deformed in scoliosis. With Madam Doctor Engels (3) and teams of Turin and Barcelona (in many oral presentations), I proved that the osseous deformations of the scoliosis regress in an almost total way when the corset is well made and carried.
One evoked **a stronger growth on the level of the convex side of the vertebral body**. But this explanation points out that of the sleep-inducing virtue of opium.
Seen **of front**, within the limits of the indications of a corset, a scoliotic patient presents shows **only tiny deformations**, hardly detectable. It is a result of self-correcting possibilities in front of a mirror where the scoliotic patient does not fail to look at. But any spontaneous self-correction, not directed by a physiotherapist, increases the deformations of the posterior face of the body, invisible with the mirror.
Why is the apex of the **cervico-thoracic counter-curve often in D4**? Perhaps simply because the scoliotic patient uses to look in the mirror. He places his girdles, scapular and pelvic, roughly (but only roughly) in correct ratios of verticality one on the other. One wonders how are the scoliotic patients in the countries where any image, any mirror are prohibited.
An **alleged lumbar hyperlordosis** would be related to scoliosis. Here is one of the most enormous errors. It however reigned in much teams and reigns still more in our times. Actually, there is no lumbar hyperlordosis. At the beginning, the normal lordosis, orientated upwards by the hollow back, resembles a hyperlordosis. It is accompanied by a projection of the buttocks which is non aesthetic and is soon perceived as such by patient. This one tries to correct, but instead of putting his hollow back in a normal kyphosis again (Thoracic lordosis is rigid), he creates a lumbar kyphosis (Figure 1 and 2.
Repetition is the base of teaching).

Figure 1

A. Scoliotic patient. Marked hollow back, lumbar, angular kyphosis in L2. Lower, flat lumbar region. In spite of the compensation of the hollow back by subjacent kyphosis, the patient is leaning ahead.

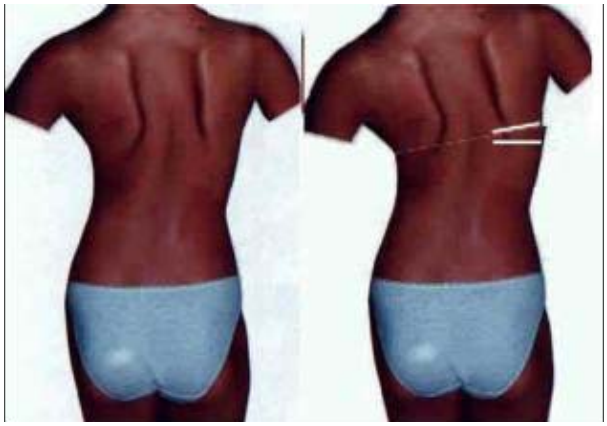
B I overworked the silhouette to give him the form which it should have if patient were not scoliotic.

Figure 2 Genesis of lumbar kyphosis



A Normal spine side view.
B. The hollow rejected the lumbar region and the buttocks backwards and orientated again a normal lumbar lordosis upwards. That looks like hyperlordosis.
C, the patient tried to correct the non aesthetic projection of the buttock created an angular kyphosis with the apex as scoliosis. Note. It restored the horizontality of its glance at the price of angular kyphosis C7-d1

Where is the hump located? In vain I requested it several times almost two decades long from Professor Hieholzer. With Professor Drerup, this scientist developed an optical explorer of the surface of the body. To tell the truth, the marvellous apparatus of Drerupt and Hieholzer explores only the two medial thirds of the body. The lateral portions are dubious. Thoracic humps, however, the high one Th.4 and the middle one Th. 8 to 12, hardly encroaches on this line of limiting precision. The Italian authors of a similar apparatus, the auscan, said to me that they would examine the question, that the thing was easy and fast, but, year after year they did not it. The hump would be located lower than the apex, say the Americans. Hump would be seated at the junction of the higher third and the middle third of the apex rib. But this alleged seat is much lower than the apex, and this statement is obviously false. At this level is a concave flat part.



Scoliosis with three curves

On right-hand side, I made swivel of 10° towards left side the higher part of the body above the apex.
The mark of the top of curve went up. But the ribs have between them bonds which are flexible, but inextensible. They maintain the rib apex on the level of the apex of the vertebral curve while verticalising it according to the importance of the curve

Place of the hump. As high as the apex, higher or lower? Logically, the gibbosity should rise above the apex, as the photography of this scoliotic young person would show it (Figure 3). B, I bended 10° centred on the apex the curve, by a simple process of data-processing drawing. The apex was marked by the white band. The band went up. It should be the same for the hump. But the ribs, interdependent to each other, compensate this rise. The ribs are verticalised in proportion to the importance of the curve and bring back the hump to the height of the apex. After years of hesitation, I think I am able to affirm that the top of the hump is at the level of the apex. That marks a limit in the accessibility of the

average thoracic hump. Above D7 included, the arm is an obstacle to the pressure part. One can press there only while letting the arm to go up, practising a "bending" (Figure 4).

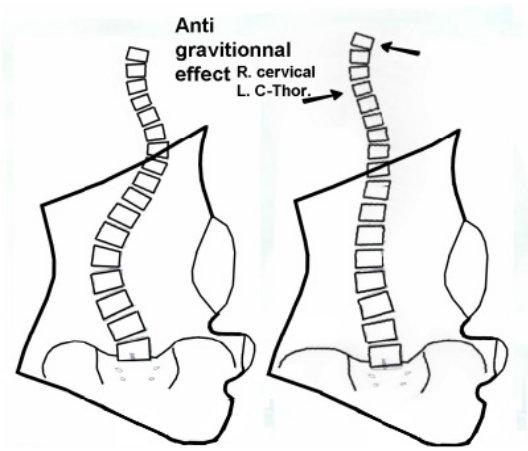


Figure 4 Case, of an apex inTh6 or 7, until very recently considered as very difficult.

A high pressure part is placed, tightened in order to cause a "bending" and thus to raise the shoulder.
Impossible to make a left support 3-3 ', the left arm prevents it. A left cervical half-ring could be placed, but it is badly accepted and we had poor or bad results. It is better do a short corset like herewith, and to hope that anti-gravitational effect will work. We did it with an excellent result.

Figure 5 Leather and iron strip

Phantom schematizing a thorax and its ribs. When the phantom “spine” was put in scoliosis, the convex sided "ribs" became more vertical and those concave-sided became more horizontal. Correction occurred when the phantom “spine” was rectified again.

Somebody (heard in a postgraduate learning session) supposed that the ribs are neither verticalized in convex side, nor horizontalized in concave side. It would be an optical illusion due to the rotation which presents the spine, being visible in oblique on the stereotypes front views. In this incidence, the ribs would be more oblique.
Then I looked at my computer and let swivel the three-dimensional image of a normal, non scoliotic skeleton. The ribs obliqueness was identical, even measured on the oblique incidences with 30 or with 60° and on the front view. Moreover, many clinics have a scoliotic skeleton in their library. With a simple look, one can be convinced that the convex ribs are actually verticalized and the concave ones horizontalized. Please just evoke the non extensible connection between two contiguous coasts and it is easy to understand the mechanism. The allegation the pseudo-verticalization and the pseudo-horizontalization is not valid.
The **apex-seated concave sided rib** becomes convex in front of the vertical line under the middle of armpit. It is the left front hump, much lower than the spine apex because of the obliqueness of the ribs. The convex sided apex rib has an opposite situation, convex behind and concave ahead. These two ribs draw the oblique oval thorax. To treat such a deformation with brace, it is necessary to crush the larger diameter “in clamp” and to leave

much, much room for the expansion of the smaller diameter, in front right and back left (Figure 6).

Figure 6

Already in 1982, the larger diameter of thorax, stretching from the right thoracic back hump to the front left bulge 4, was taken “in clamp”. We have done that without being aware of this “clamp effect”. We note that pressure part 4 is prolonged upwards to left muscle pectoralis major.
Notice the interaction of the relieves of the body under various influences, in particular of the pelvis. In the **scoliosis with three curves**, that thoracic is extended in height. There is much place in height for the migration of tissues, as well convex as concave. Thus, behind on the left, there are three superimposed relieves. They are the high thoracic hump, the middle thoracic concavity ("rib valley" of the Germans), and the low lumbar hump (Please re-examine figure 3).
The latter is accompanied and underlined by a left projection of the iliac crests. There is a reduction of the lumbar lordosis which even can become a kyphosis with a relatively large radius.

In the **scoliosis with four curves**, the middle thoracic one is shorter. The tissues are hustled in height and are reflected more or less on pelvis. That makes that the lumbar hump is posterior and the rib valley a little higher than it, but also a little ahead. There is often an angular lumbar kyphosis as high as apex (Please re-examine figure 1). The lumbar hump is angular, here in L2, and is prolonged downwards by a simple disappearance of the normal lumbar lordosis. That can be called: “flat lumbar region”.

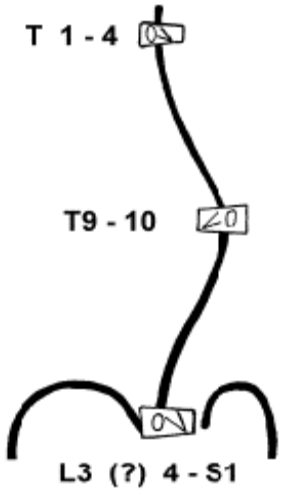


Figure 7 Scoliosis with three curves, the thoracic one being extended in height. The crests are bulging left.

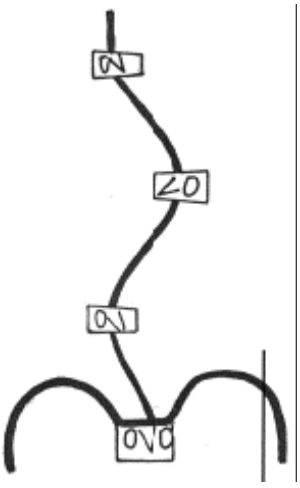
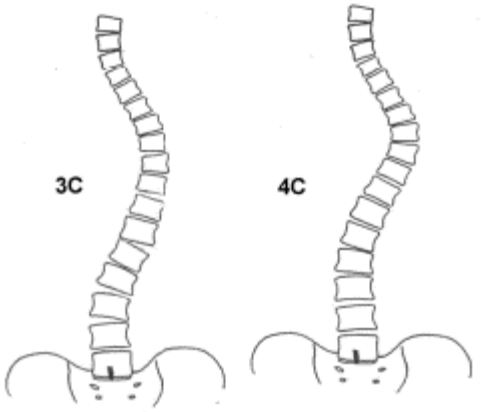


Figure 8 There is one more curve, four in a The lumbo-sacral curve has its apex in L5- right side. The iliac crests are bulging right



Type 3 of King, thoracic pure

Pelvis balanced. At left side is a relatively wide thoracic curve in height. L3 is already tilted towards the thoracic curve. The pressure of support 1 will cause a scoliosis with three curves. It should be anticipated by pushing the crests towards right side. On right-hand side, the inflection of the vertebral bodies starts only in L2. The thoracic curve is short. Pressing part 1 will create a scoliosis with four curves. It is necessary to push the lumbar apex from left towards right and the crests from right-hand side towards left one.

It is the simple and obvious consequence of the deviation of the foot of the curve. The self correction in front of a mirror does not compensate completely this left (Three curves) or right (four curves) bulging of the iliac crests. In the scoliosis type 3 of King (Figure 9), pelvis is symmetrical compared to the middle line. The low rachis is vertical, without curve. There are two possible cases.

Either the lowest vertebra which is tilted towards the thoracic convex side is L3. In this case, the thoracic curve is relatively long in height. Under corset, the push of a thoracic support will reject the iliac crests towards the left side. So will be formed a scoliosis with three curves. Or it is L2 which is the lowest tilted vertebra. The thoracic curve is then short. The thoracic pressure part will reject L2 towards the left and will let the crests bulge right. That becomes a scoliosis with four curves.

This classification has a cardinal importance when planning a corset. Indeed, for the "four curves", one leaves in the low lumbar area and the crests a left expansion room 14G-16 and for the "three curves", it is on the right, in 14D, that one envisages the expansion.

There are still cases, the treatment of which is not yet clear. When a very short curve has its top in L3 and when this kind of scoliosis happen to have a very clear deviation of the last three lumbar segments towards left, L3 cannot be pushed back by pressure part 14G independently of the iliac crests.

Since 2002, the solution seems to have emerged. One presses the left waist, very carefully, from approximately five centimetres in front of the vertical line under armpit to the small cavity above the upper back iliac spine. Below, one leaves free, in particular one does not need a support 41G. One simply build under the zone 14G an oblique wall, which creates a component of extension and a hinge for the correction of the small left curve centred on L3. This correction is carried out by the mechanism of the anti-gravitational self-correction

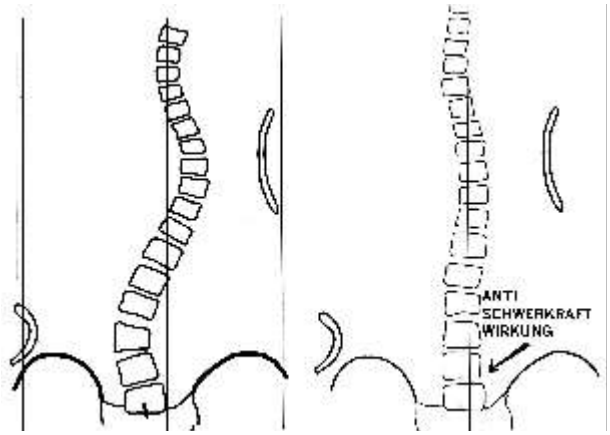


Figure 10

This scoliosis, intermediary between the "3 and 4 curves", can be treated as follows:
A very careful support around the left waist would push at the same time the apex and the crests towards right. But an oblique wall has been built in zone 14G, over the left iliac crest.
It is used as hinge for the self-correction of the small lumbar curve centred on L3. This corset can be very short.

Notice: Blount was the scientist who made me aware of the creation of secondary curves under the influence of the pressure parts. That was at the beginning of the Sixties, at the time of the Milwaukee brace. I translated this long communication, kept a double of my French text which I keep for the reader. But I gave the original to my chief and do not belong it any more. I ask the reader to excuse this incomplete reference

In the young scoliosis, many elements can vary in a split second. The hollow back, the projection of the crests, among others, appear and disappear in a very short time. It sometimes happened to me to detect an almost total stiffness in lordosis between D7 and D12. The measurement of the sign of Schober betrayed only one centimetre of distance. I took a camera, then again requested from the young patient to lean ahead. But in the meanwhile, the index of Schober measured four centimetres.
Any photographic demonstration had become impossible in a very short time.

In minor scoliosis, it is possible for a good expert to obtain an **self-correction thanks to an adequate use of the muscles of the patient**. Perhaps serious scoliosis had their progression stopped this way. But the proof could not be made. A scoliosis stopped in its evolution is not different from a non evolutionary scoliosis. Professor Dubousset shows a radiological image which has all appearances of an evolutionary scoliosis. But it had been straightened within a few years without corset. I suspect this patient of having had an excellent physiotherapist. It seems that the limit of the possibilities of self-correction by muscular action is around 25 degrees according to Cobb (figure 11).

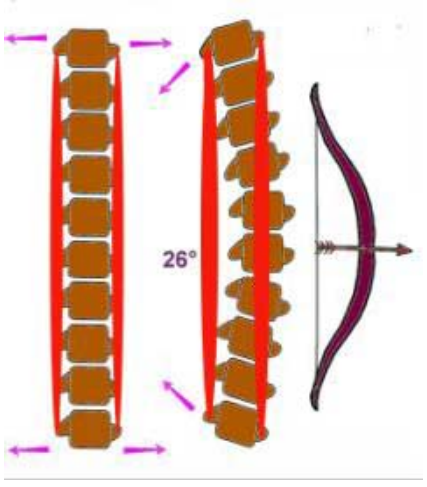


Figure 11

A Normal Rachis

B A scoliosis of Cobb brings many muscles to the limit of concavity. Beyond this angle, any spontaneous rectification is only possible if the patient is under corset or in a passive posture of correction. That straightens the curves below limiting angle.

Above this angle of 25°, all or almost all the muscles come beyond the limit convex-concave and become worsening muscles. It is necessary to carry out the rectifying movements even in corset or in positions which rectify the curves passively. These two situations bring back the angle below 25 degrees

Conversely, any significant scoliosis, even in a young person, appears by deformations which the patient cannot hide any more. He cannot correct himself any more in front of the mirror, even roughly. It seems that the limit is towards 50-55 Cobb degrees. That seems to be an indication for a surgical operation in the young person in growth when a (often bad) corset has failed.

Fitting

The corset is entirely a correcting device. It is no more a simple vest; it looks no more human. Each one of its portions is either a pressure part or a strip of connection between two pressure parts. These strips cover the smallest possible surface of a concave zone. They are at a certain distance of the skin to form a great space of expansion. A short time ago, when the patient had just put on his new brace, when he raised, nothing was right. The maladjustment appeared total. It was necessary to adapt the corset to the patient as one tests a new costume, in much more complex; lengthily to scan the zones with problems; to regulate such portion, 1, 3_3 ', 7_19, 37, 14D, and many others. A corset which would be calculated on the real size of the patient, without increase in size of the mould, would be too short. With corset, many portions of the trunk raise, in particular thorax. It is necessary to envisage all that at the stage of the work of the mould, but this forecast had limits. Any expert who was not perfectly accustomed gave up. He deduced from his inexperience that the corset had been badly made. He threw the excellent model which he had not been able to use and applied a rudimentary corset, covering the trunk without any electivity like a vest, without expansion rooms, therefore not very effective and generator of narrowed thorax, of respiratory restrictions and of different trouble of physiological functions.

That was yesterday. For soon two years, it is not true any more. The forecast at the stage of the work of the mould appears finalized. It seems that the problems are better and better solved. But this solution to an enormous quantity of problems which we have faced for more than forty years requires an extremely wide knowledge in plaster manufacture. We in practice only observe a so complete knowledge very exceptionally. Data-processing manufacture appears to have solved, or to solve the problem in a short future. Here is an occasion to discuss on the possible role the plaster cast before giving a plastic corset. We will see it following page. But if the burning ex-problem of fitting seems to be able to be combined with the past, the difficulty of maintenance keeps all its topicality and requires as much knowledge as what was plaster manufacture.

Dr CHENEAU: TREATMENT OF SCOLIOSIS BY MY CORSET

The model I present is the fruit of the experience of many people who preceded us and others which are contemporary to us. Initially, there was Abbott, our Master, whom we seek to equalize. Then there were those which taught me scoliosis, Professors Gaubert, Matthiass, Neff; Doctor Cotrel, Zielke, and others. Currently, there are many people I meet in my ceaseless rounds in the world.

Each one or almost each one added a stone to the building. I endeavour to quote as much as possible of authors of constructive ideas. So that a courageous anonymous reader reproached me for quoting people who had not published! My excuses to those whom I forget, they are numerous. I regard myself as a connection element between universities, clinics, schools and workshops. To all ones I try to transmit the best I saw elsewhere. In the other chapters, I evoke other schools, the most known ones. I try to describe the bases, the manufacture, the distorted ideas, the pittfalls, the maintenance and many other useful concepts. I do not admit the "hybrids". If somebody works out an alternative, let him show it to me. If it is valid, I will not miss, I never missed, to adopt it by quoting its author. If the alternative is major, I will be erased behind. I failed to do it at least once, in front of a technique which had appeared, with the first access, to be better:"The Chêneau is dead, lives the XXX" (I will not quote the school). But after a certain time, I realized that the concerned technique was very different and imperfect.

The treatment of scoliosis does not consist only in a corset (in the range of their usual indications), but also in a suitable gymnastics. It is the Schroth method which I had learned by fragments in the conversations in the corridors of congresses. Later, I observed it at his initiators, in Sobernheim. It moved a little, it is normal. We often discuss details with my friends of Sobernheim and Barcelona, and it seems that we generally comes to an agreement. Progress always implies a severe self-criticism of all and on all the levels. Concerning the gymnastics also, I do not admit that one practises a technique which different from that which I recommend, under penalty of a failure for which the phyiotherapeut is fully responsible.

CONTRIBUTING RECALL OF MECHANISMS A the ACTION OF the CORSET THAT I WORK OUT

Scoliotic deformations are extremely complex. I listed 54 possible, including little more than one half for the same patient. They group in humps (protruding compared to a standard silhouette) and in concave flat parts. The grouping of these zones is different for each type of vertebral deformation (Kyphosis, lordosis, scoliosis) and each clinical form (Apexes of the curves). The experience shows that the fact of reducing a hump by pressure and of leaving a huge free space besides a concave flat part of the body gets a correction of the curve, at least to a certain extent. Result can be measured on a radiograph. There are close interactions between the radiological data, the scoliotic deformations, the functions of growth and breathing, and the movements. These relations are worst things when the patient is delivered to itself without information nor treatment. They are best things when a valid corset is carried, and when a program of elongation, elective breathing and correct movements is organized.

MECHANISMS

The corset that I worked out after and according to Abbott acts according to nine mechanisms, complementing one another.

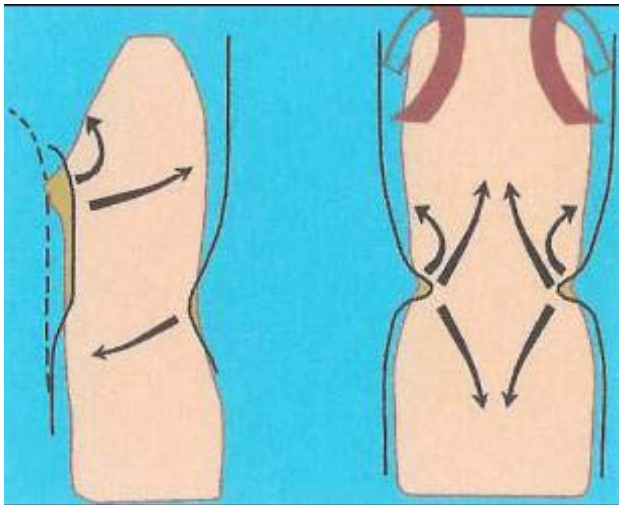


Figure 1 "Cherry-stone" effect. When one presses on a trunk, in whatever place it is, the tissues migrate in the directions which remained free. If only the high and low openings of the corset
are free, it is in these directions that the "leakage" of tissues is made. It is the direction of the normal growth. We call that the "cherry-stone effect". All the corsets kinds, ours also, use it. It explains why even the non elective corsets can have a small correcting effect on scoliosis. The condition is however that no obstacle should block this correct effect. A frequent obstacle is the stupid parts crossing over the shoulders (B, in top).

Figure 2 Tissue transfer by means of the complex pressures-expansions is much more elective. It consists in making migrate a tissue section from humps towards concavities. To facilitate communication, the surface of the body was divided and numbered into 54 zones, 23 with humps and 31 concave. Please see details in my former publications.

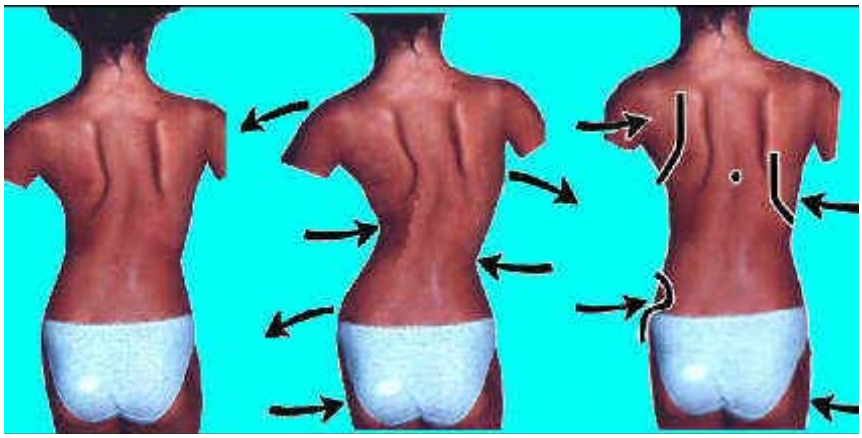


Figure 3 Growth, elements worsening when the scoliotic patient provided with corset, becomes an under corset. Each outbreak of growth correction, and moreover, render result already obtained.

Figure 4 Breathing it also is a factor of worsening without treatment. Indeed, the unbraced scoliotic patient breathes in electively with his humps, thus worsening them, slowly but surely. The pressure parts are opposed to this hump expansion. It would matter that the physiotherapist gives conscience of this compensatory concave breathing to the patient and incites him to practise it.

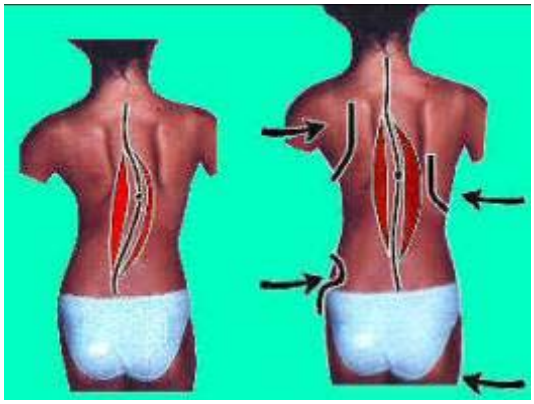


Figure 5 Any movement of any articulation of the body has a component on the trunk.
The concave muscles, which tend to worsen scoliosis, are shorter thus stronger; the arm of lever of these muscles is much better; the convex muscles (those ones which tend to improve scoliosis) tend to migrate in concave zone and to become worsening. That makes that any movement worsens scoliosis, if it is carried out without corset. The corset restores balance and a good arm of lever to a great extent.

Figure 6 A larger oblique diameter of the thorax extends from the right thoracic hump to the area surrounding left breast, which is bulging. The corset takes in clamp this large diameter. Let us take care to spare very vast spaces for the expansion of the smaller diameter. It extends from the right breast to the area of the hollow back behind.

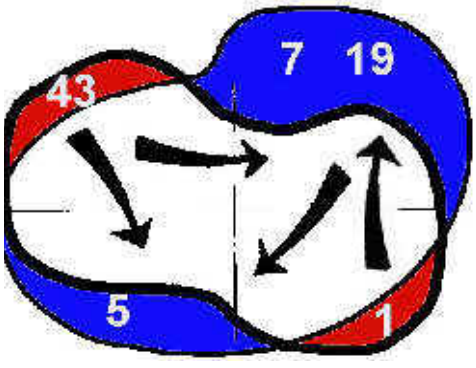


Figure 7 Secondary **pressure parts** 7_19 Transverse section at the thoracic apex. The corrective effect of the “clamp effect” on the hollow back is further increased by the secondary pressure part 7-19. The pressure in this area 7_19 surrounding the right breast is difficult to manage, but is comfortable and effective. This zone is concave. But under corset, this portion of thorax follows a derotation and an expansion. The patient leans then on the wall. He uses it as a pressure part to complete correction of his hollow back 5 dynamically

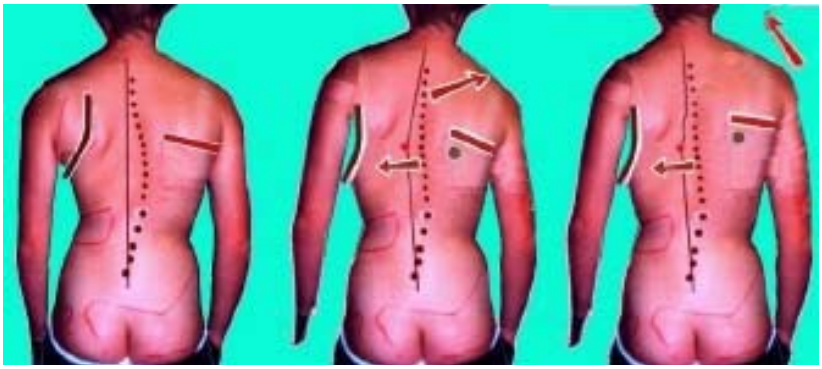


Figure 8 Bending. One strongly presses from left towards right under the left armpit, without forgetting to raise strongly the plate to follow the rise of the shoulder. That carries out an inflection towards right, known as "bending". The patient thus inclined rectifies himself spontaneously in the following minutes. That poses very complex problems of reorganization of the elements of corset subjacent at these zones. But that rectifies the thoracic curve strongly.

Figure 9 Anti-gravitational effects. It is a significant and active correcting effect. It relates to the belts, scapular (a) and pelvic (b).

Figure 9 a On the level of the armpits, the patient, who undergoes a pressure from left towards right, leans in this direction. The thoracic curve is corrected by this mean, but the cervico-thoracic curve remains without correction in an immediate future. The patient however straightens very quickly thanks to this marvellous anti-gravitational effect.

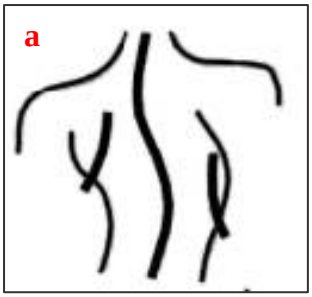
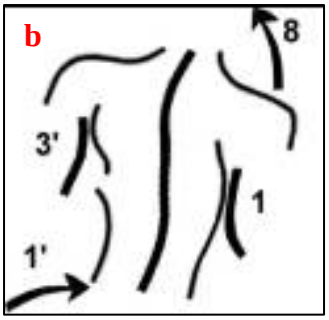


Figure 9 b. It is the same on the lombo-pelvic level, especially in the curves having an apex in L3. The pressure part in form of an arc of circle above the left apex around the waist contributes to correct the thoracic curve: It is the lower pressure part of the thoracic three points system. The lumbar curve, the balance and the right protrusion of pelvis are corrected very quickly by antigravitational effect. They take the arc of circle around the left waist as a rotation point. Note: The image shows a spine lengthened in height, on this diagram as in life, as a result of the straightening of the curves.



This was theory. In practice, manufacture, application and maintenance of the corset pose multiple problems. It is necessary to take account of the tolerance of tissues, the interaction of the ellipses of correction, the reflection of the forces on the osseous portions. It is necessary to seek the centrifugal force of concave expansion as far as the centripetal force of the pressure parts. Any correction by pressure must be enormous under penalty of being ineffective. Indeed, the pressure parts are exerted on the soft parts and there must they be exerted. By definition, the soft parts yield and are modelled on the pressure part. But in the

course of the life, multiple actions such as growth, breathing, movements cause active migrations in direction of concavities. This migration takes place only if concavities are free of any wall, or if the latter is sufficiently far away from the skin. I often insist on this need for leaving expand concavities of the curves. It was quoted by Abbott. But unfortunately this genius did not sufficiently insist on this essential point.

A word on the vanity of the attempts which have been made for many thousands of years to treat the scoliosis, by simple flexible bands.

Would one rectify a young tree without tutor? In scoliosis as in gardening, one relies mainly on growth to rectify a bad curve. Gardening is simpler, because the deformation is exerted only in one plan of space. But the complexity of the human material makes that other factors, breathing, movements, contribute to the correction.

The use of brace, an extremely complex tutor, is not possible without a very wide theoretical knowledge, and a considerable experiment. The flexibility that some teams seek in the strips, the corset-tutor obtains it in the soft parts, muscles, tendons, joints.

General bases of the treatment by corsets.

Scoliosis consists in many deformations of the body, including a vertebral sinuosity. This sinuosity is the feature by which scoliosis is known by a majority of people, owing to its radiological image.

At the surface of the body, there are bulging parts, called "humps", which correspond to the convex parts of the curves. There are hollow ones, corresponding to the concave sides of them. Insofar the corsets are currently indicated, the experience showed following fact: Pressing humps while leaving concavities expand in entirely empty spaces corrects, not only the corresponding relief of the body, but also partly or totally the curve of spine. The art, how much difficult, of the treating team, is to press exactly where the experience showed that it is needed, and to spare the concave sided expansion rooms exactly in the good place of concavities.

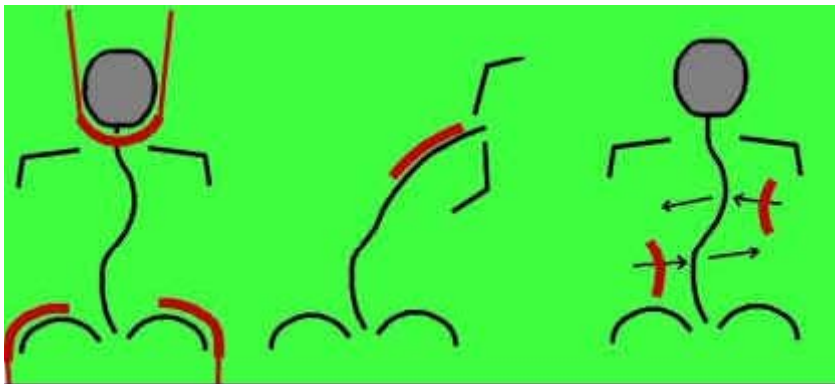


Figure 1
These three fundamental mechanisms used to correct the scoliotic curves can and must be combined one another, as far as possible.

The three points system.

Considering an abnormal curve of an unspecified bone-joint segment, it matters that the part which is intended to be straightened is in the age of growing. Actually, every orthosis is a "growth link" among other actions, in gardening as in the life of vertebrate souls. To straighten it, one spares two pressing surfaces in convex direction at the ends of the curve. In the middle, one presses by a third surface in concave direction.
In gardening, a tutor is enough. The deformation is never enormous; it occurs only in two dimensions of space; the growth of the shrub is enough to maintain the segment concerned in the wanted position, either the straightness, or on the contrary in form of a curve planned by the artist. In biology, the thing is less simple. Indeed, generally, several three points systems interfere in the three plans of space. It is the case in scoliosis where the number of three points systems at the same patient is considerable. It is necessary to combine the correcting forces between them. The best orthopaedic appliance is that one which takes into accounts the more involved three points systems.
A significant factor is the elasticity of the soft parts. Bones and joints are the ones that have to be straightened. But one should not press directly on the skin at the place where a bone is directly under it. If not, a scab should appear. The pressure has to be done on the contiguous soft parts, either interposed between the skin and the bone, or in the vicinity of this one. Among the soft parts suited to receive a support are muscles (Matthias). When a muscle is subjected to pressure, the contractions which constitute its function exert on the pressure part of brace a highly dynamic and intermittent action. That makes the difference between an orthosis which simply surrounds and presses the tissues, and ours. But the elasticity of the soft parts imposes a hypercorrection. A simple correction would hardly depress the soft parts, and in particular the muscles. Only beyond an intense hypercorrection of soft tissues can the real correction of the bony deformation begin.
An example is the pressure part 14D, above the right iliac crest, in the four curved scoliosis. If the brace wall there is oblique, it presses on the crest at the place where this one is directly under the skin. This will be sometimes tolerated by the carrier of a "modelling" orthosis, because then the pressure is distributed on the entire trunk. It therefore is less intense in a precise point. But an elective orthosis could not be tolerated with such an oblique brace part. The surface over the crest must be horizontal. It must depress the soft parts of the waist, which mainly consist in the muscles of the abdominal wall. Those then exert an intermittent action of support on the corset and of correction on the trunk. But that is often not enough to solve the problem of the hard point 14D. It is one of the reasons for which I recommend to exert a vast and deep abdominal pressure medial to the right anterior iliac spine, according to the school of Boston. The frequent contractions of the muscles of the abdominal wall exert on the corset a support effect, upwards and laterally. These two actions relieve a part of the pressure on 14D

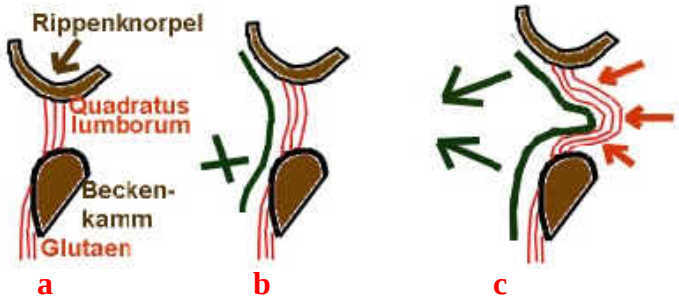


Figure 2. A. On the iliac crest (here left, Zone 14D) is inserted the muscle quadratus lumborum and in bottom the glutei. **B** An enveloping orthosis comes into contact with the skin and directly

below it with the bone, which is particularly vulnerable. **C**. The tonicity of the muscles deadens the support on the bone and pushes back the wall of the corset far from the bone and the rib cartilages.

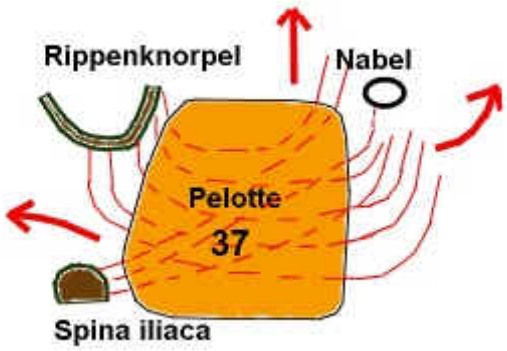


Figure 3. Support 37 exerts a pressure on the various abdominal muscles. The tonicity and the contractions of those muscles raise the support, i.e. the corset. That relieves the vulnerable zones as the iliac spine as well as the rib cartilages. That helps also to relieve the right iliac crest in the scoliosis with three curves (please re-examine figure 2).

Need for expansion rooms.

A non elective orthosis, simply "modelling" can obtain a certain correction, moreover often in only one plan of space. It does it by exerting a moderated pressure on all parts and all sides of the trunk.
The mechanism of it is then the only "cherry-stone effect" (See lexicon).
To any support has electively to correspond at least one space of expansion in a concave zone. Actually, every pressure part admits a "dodging" of the driven tissues towards all spaces of expansion. But one to three among the latter receive electively the dodging of a given pressure part.
The expansion rooms must have a volume at least ten times larger than the volume of the tissues driven back by the pressure parts. Concerning the plaster manufacturing, the depth of plaster taken off from the humps corresponds to a refill in thickness on the concave sides at least equal. But the concave sides are ten times more extended than the humps. Humps are tiny islands in an ocean of concavities. A window is opened in the middle of the principal expansion rooms, but it does not have any value for the expansion itself. The term of "respiratory window" is the very great fault of appreciation of a school. I do not know to which we own the sponsorship of an expression which had an enormous repercussion because it sounds well, but which caused much evil.
What allows elective breathing, and besides it, what allows an active correction of scoliosis, is the space between brace wall and skin. It goes from zero to the circumference of the support up to two to five centimetres in periphery of the window. It falls to almost zero in complete inspiration or in the extreme corrective movements.
The supreme Master in fact of orthotic technique of scoliosis, Abbott, combined the three effects of axial traction, side bending and hump pressures. He laid the patients on an asymmetrical hammock. He carried out on them a traction which went from the head to the pelvis and represented a component of the weight of their body. He exerted tractions by linen strips, without neglecting a certain proportioning of thoracic inflection, ahead and on the right. Then he fixed the whole in a plaster cast. He did not neglect to interpose between the plaster shell and the skin of the concave zones a thick layer of felt. He removed the felt after hardening and drying of the plaster. He unfortunately did not sufficiently insist on this

need for “inflating" concave spaces, so that his successors neglected this fact although they affirmed they respect it.
Anger thundered in me when I read in 1979, under the feather of a Lyons author, a mention of "the failure of Abbott". The author should have written: "the failure which I had when I believed to imitate Abbott". Abbott cured scoliosis, even serious, even adult, but his successors did not know how to follow him. I try to do it while hoping to raise the more closes possible up to the height of the Master.

Figure 4. Corset of Abbott. Notice that Abbott did not seek balance. He did not have anything to do with that, and I have not, too, although we almost always carry balance out. Abbott had inserted thick layers of felt between concavity (here thoracic left) and the wall. Once the plaster hardened and dried, felts was removed. In fact, the concave sided tissues invaded this cavity and became convex. It was a hypercorrection, wanted by Abbott, and what we continue to seek.

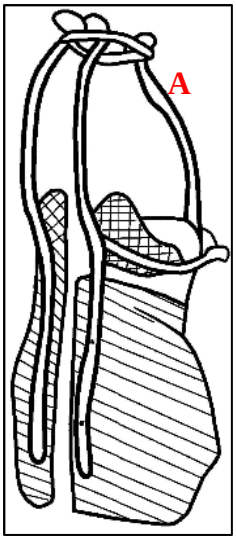


Figure 5 A. Milwaukee brace was an excellent apparatus of post-war period. But it was heavy, badly supported and not discrete. Intrinsic defects limited its action and caused a certain iatrogenic effect. Moreover, knowledge of then did not make it possible to avoid some iatrogenic effects which we do not cause any more now.

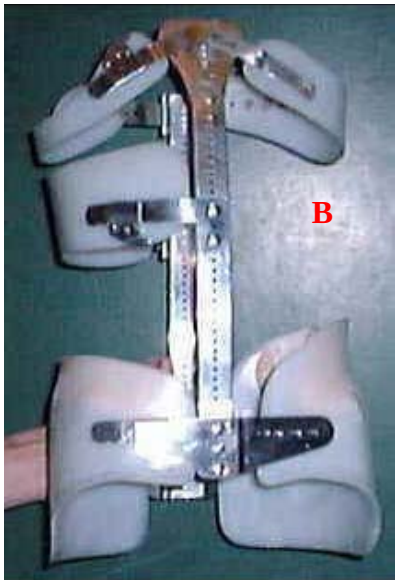


Figure 5 B Corset which uses the elements of the **Lyonese**. It succeeds the plastered apparatuses built according to Abbott. It is composed of a metal framework, on which are fixed plastic parts that the team would be maintaining ones, and other parts intended to exert side pressures.

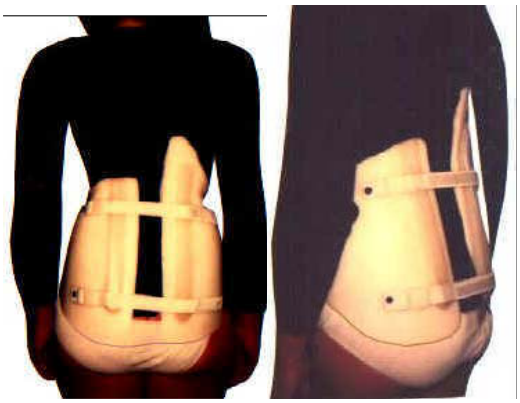


Figure 6. Corset of Boston old style (here, workshop Kerkoc, Vienna, Austria, 1981). The models of to-day are close to mine. I adopted myself some excellent information of Boston, and I have excellent relations with the team of this place.

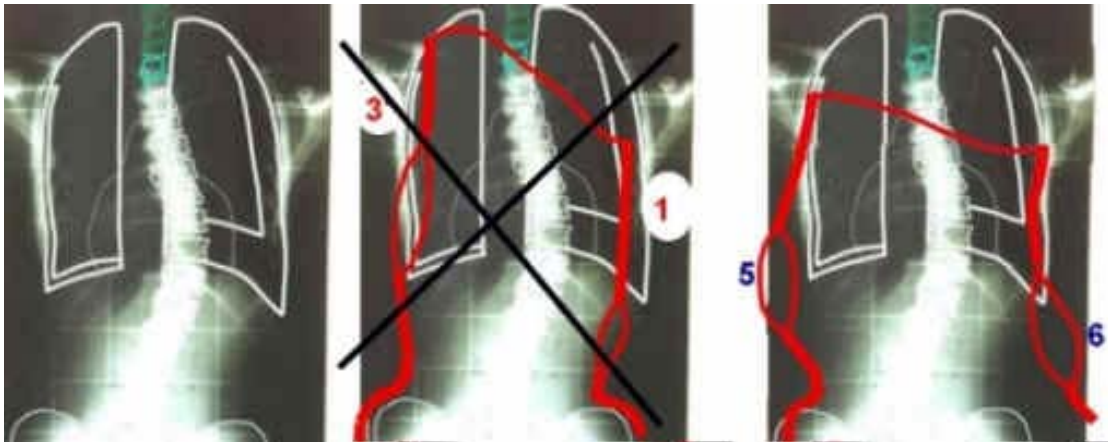
Figure 7 Corset of Charleston. On this photo, there is no patient, but the nice daughter of Mr. Frohnauer, Master Technicianof Munich. She agreed to make this demonstration.

FALSE IDEAS AND BAD HABITS

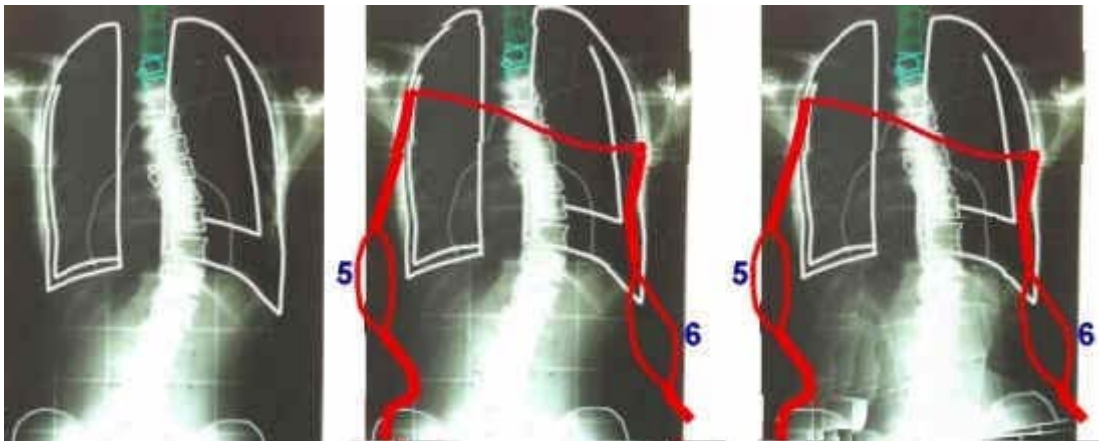
The false ideas and theories, therefore harmful, are numerous if not innumerable. I will try to refute initially the most obvious ones, while keeping for the most stupid one, the abdominal pressure, for the end

1- A window which would be "respiratory".

Which school could sponsor this expression, which was universally adopted because it sounds well, but which did so much evil? How could this expression make accept to many teams, and especially to its author, that the small hole opened at the middle of a wall covering a concavity of the thorax allows an air intake?
The ribs are much longer than the hole is broad. Ribs can in no case make a hernia outside the "hole". Then, generations exempted themselves to spare expansion rooms whose walls deviate from the skin around the periphery of the hump until that of the window. So were narrowed millions of scoliotic trunks.



A B C



A C D

Figure 1 Radiograph of a scoliotic patient with three curves, 48°.

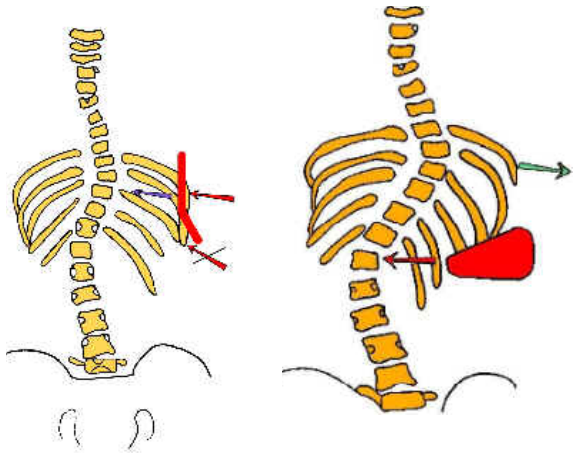
B: Orthosis which I name "equipping". The majority of the experts press on the humps, often suitably, but almost nobody respects spaces of expansion on the concave areas.

C. With orthosis as we did it, with an expansion room 5 to correct and to allow elective breathing. The right pelvic cover has been built rather far away from the iliac crest to allow the migration of the pelvis.

D. Correction to 16° and migration of the pelvis towards the right-hand side. This is a data-processing assembly, but it is exactly what occurred for this patient. The windows, in particular the one in zone 6, plays no role neither corrector nor respiratory. They are only gaps of control.

2- False idea: do not press on the top of the hump in order not to worsen the convex sided rib verticalisation.

It seems to be true that a pressure on the top of a convex rib worsens its verticalisation, when there is no, corresponding concave space of expansion. Let us recall that it is the fact of approximately 70 to 80% of the corsets, even among those which claim to use my system.
But for a well done corset, dodging in concave direction occurs in all the thickness of the body. The pressure is no more a pressure, but a caress. The ribs are placed again into their normal orientation insofar as the deformations are not too old. Or else, the soft tissues around should be too narrowed, too inextensible. I many times measured the angle between the ribs and the body of the vertebral apex, according to Mehta. So I always found improvements under corset, in the short and long term.
Recent statistics confirm that, visible in this site. Moreover, what propose those one who emit this error? Their first council is to press on the lateral part of the corresponding rib, upwards. That is much lower than the hump, especially owing to the verticalisation which has to be taken into account. Here is another argument. The doctors who manipulate joints know that a rib can be moved in a centripetal way, or to the top or bottom, all this being perpendicular to its axis. But it cannot be mobilized to the top nor bottom following its axis, even by the skilful and sensitive hand of a manipulator. Any pressure of corset is exerted perpendicular to the surface of the skin. That succeeds; I observed it many times, with an increase in the verticalisation and with an aggravation of the lumbar curve, subjacent with that which one would like to treat. Another strategy of support promoted by holding of the idea would be to press close to the spine, from back forwards, higher than the external part of the coast, lower than the hump. Perhaps this manoeuvre causes a derotation; I am not sure (see two lower paragraphs). But that worsens enormously the hollow back. Lastly, the true way in which the partisans of this false idea turned the problem was to make go up the hull up to the level where I recommend pressing. And as the corsets of these schools are narrowly applied to the skin in all points, this zone constitutes a pressure part, the same one as mine. But room for expansion is missing below where at right side the lumbar region is concave.



A **B**

Figure 2. I recommend to press on apex.

The old school advised to press on the external part of the apex rib, imagining that the pressure would be propagated along the axis of the rib towards the apex. But the pressure is exerted perpendicular to the skin, i.e. exactly in the direction of the aggravation of the lumbar curve.

Figure 3*. Corset made in Dresden. Very good reduction of the angle of Cobb, but many iatrogenic effects due to many errors: hollow back, crushing of the trunk, etc. The pressure is supposed on the external portion of the rib, but the hull is prolonged until the height where I recommend seating the pressure part. It is thus effective, but there misses the left lumbar expansion, where there is seated an inert pressure part.*

3. Pressing on the convex apex rib at its external part, along its axis.

I have just shown the inanity of this belief, but it had to be quoted separately because the supporters of the false idea often do it.

4. Pressing relatively high, right under the apex, from back forwards.

I had just shown that in a preceding sentence. The result is often not a derotation, nor a correction of angle, but a frontal flatness of the body.

5. Concave elective breathing should not be practised: That would increase the horizontality of the ribs.

This objection had left me almost without voice so much little I expected it. Actually, it is not only the concave half thorax which is mobilized in the good direction during the concave elective inspiration, but all the width of the thorax. It would absolutely be necessary that somebody studies seriously by quantitative electromyography of surface which muscles are activated during this invaluable elective breathing. The final result of elective breathing is a certain degree of correction. And the direction of the coasts is standardized and does not worsen.

6. Perforate?

Perforate a pressure part can obviously be harmful. The skin would be corrugated. Perforate an overflow of a support is as much harmful, because the overflow is precisely there to be used as a pressure part in case of modifications of the body during the duration

of wearing the corset. Perforate a bridging between two humps is useless because bridging is far from the skin: this region of the skin is thus ventilated a same way with or without perforations. It is infinitely better reduce the width of the bridging insofar authorized by stability. Moreover, the perforations obstruct the adjustments of the corset during periodic revisions. There are only pressure parts, overflows and bridges in a well done brace. Any perforation proves that the Technician is unaware of the nature of the part which it perforated. A perforated corset is a poor one.

Figure 4 A. Alleged corset of Boston, seen in Poland. It is not even symmetrical, but is bulging at the humps! The perforations were quite useful to make this harmful carapace a little less uninhabitable.

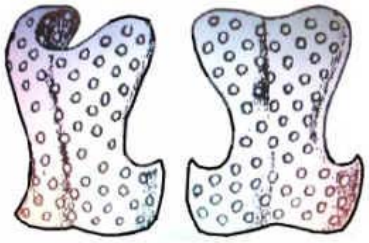


Figure 4 B Armour for scoliosis of Ambroise Paré, 1634. Have progresses been made since that time?

Reinforcements

The metal reinforcements compromise the marvellous property of polyethylene, at the same time resistant, rigid and a little flexible. They definitively condemn any upgradeability of a corset during the evolution of the scoliosis. The Technicians generally hesitate to reorganize a corset when it has become unsuited. If in addition metal "reinforcements" are fixed there, it would be necessary to withdraw them, to reorganize the corset, to reorganize or replace the reinforcement, to bore new holes; to fix again the whole worked again part in a dubious and always no aesthetic way.

Nobody did it. Reinforcement by creation of a linear relief at the time of the forming is perfectly useless. Indeed, polyethylene is almost as flexible as aluminium; it keeps the fold when it is presented in plate without relief; but it is indeformable when it is bent in three dimensions of space.

And all the portions of the corset are bent into three-dimensional. And the reinforcements by "veining" obstruct remoulding by heat. Morality: Never try to reinforce by metal bars nor by "veining". But it is not prohibited, if necessary, and especially in situations of maintenance, to reinforce any portion of the corset by means of a polyethylene bar. One will take only care to heat before this bar, in a two-dimensional way (See lexicon), before fixing it and modelling it on the corset. Such a reinforcement can be modelled again if need be, with or generally without previous disassembling.

Risser, osseous age

These elements have a small prognostic value insofar one can observe them at occasion of radiographies made in order to visualize other data. But practising special stereotypes in order to determine Risser or osseous age, hypnotizing oneself above those data, and making a guide of therapeutic of them, it is an exaggeration which it would be necessary to get rid finally of First, Risser sign is often not visible on the stereotypes. Radiologists deliver to us often a minimal surface in order to reduce the X ray dose on patient. Moreover, the scoliosis often appears before Risser does. Finally and especially, one should not hold any account of Risser to cease the port of the corset. How many patients did it, at eighteen or nineteen years, and regret it! It is enough to read the electronic mails of the newsgroups Internet: "I had 23 degrees under corset. My orthopaedist said to me to leave it at 18 years. I have 53 degrees now ". The following lines do not concern the scoliosis of the child of less than 10 years. The conditions of the "weaning" of corset are particular there but can be done early. See another chapter of these pages. Let us consider only the scoliosis of adolescence. When the teenager is fifteen years old; when scoliosis has been stabilized below 25° for more than six months; when a spurt of growth intervened meanwhile, it is reasonable to try the simple night port rather quickly. But this one must be prolonged until the age of twenty-one years. Even after the end of the growth, the muscles, tendons, capsules and ligaments need to be maintained in relatively long position on the concave (and their short) side. Moreover, many specialists admit that the growth then is not entirely finished. For the old corsets which were very hard to live with, one conceives that their wearing had to be stopped as soon as possible. But those current are comfortable when are well adjusted and the patient is accustomed to them. The wearing of night does not have any disadvantage.

7. Leaving free the anterior right half-thorax.

Build a hook 11 in front of the right great pectoral muscle.

We used to leave the anterior right half-thorax free until 1984. But I had noticed that all the braced patients presented a true hump of their right half-thorax, this hump included the right breast and subjacent area. The right clavicle part which existed still then did not prevent this protrusion. These bulging tissues however represented an unfortunate dodging of support 1, made ineffective. Moreover, hollow back, worsened. The young fellow-scoliotherapiists who accept or who preach the freedom of the right half-thorax did not yet notice that. They seek to mitigate the fall of the shoulder by this hook 11. This hook presses on a concave zone, on the muscle pectoralis major. Since 1970, I took care to leave room for the expansion of this zone while keeping the pedicle away from it. This zone 11 is regularly the seat of redness and of brown marks which sign the inopportune pressure when the manufacturer places inopportunely a hook there. I can only condemn very firmly this too easy practice, which consists in leaving free the right breast and the subjacent area 19 and to put a hook 11. Result is always a blocking of the concave sided muscle pectoralis major. See following paragraph Moreover, hook 11 is in "contre dépouille" (See lexicon. I

beg the pardon of the reader. Nobody could say me and no dictionary contained the corresponding English expression). This expression indicates in a mould the fitting of the opening intended for the release from the mould and which would have a diameter smaller than the largest diameter of the casting. If mould and moulded object are rigid, any release from the mould is impossible without breaking one, the other or both. At the scoliotic patient, corset can be compared to a mould and growth, breathing or any movement can be like a release from the mould. With the hook 11, there is a"contre dépouille".

Figure 5 A

Boy, two years old, scoliosis of 50° thoracic and 36° lumbar.

Figure 5 B 5 years old, Scoliosis brought back to 20° thoracic and 0° lumbar. There is no crushing of the left rib cartilage.
He probably will have to be operated, but much later, and under excellent conditions. Notice: The corsets of today do not bulge that way now.

Abdominal pressure

This torture device had very much surprised me at the time of my first visits in Germany. I pay homage to the French authors in particular to Salanova who did not accept this detail in the corset of Milwaukee which he imported in Toulouse. I will try to enumerate the reasons

that the American author emitted. His name is lost in the mist of time. And I shall try to refute them.

1- The abdominal pressure pushes back the tissues of the trunk in direction of the pressure parts which it would optimize thus. Actually, I prefer an elective action, located at the precise place of a hump, to that of the abdominal pressure, brutal and without nuance, such as it was prescribed last century.

Moreover, any non-elective action becomes exhausted rather quickly by crushing of tissues.

2- Abdominal pressure should reduced lumbar lordosis. The lumbar hyperlordosis would be at least an essential component of scoliosis if not a cause of it. I answer that there is no lumbar hyperlordosis by scoliosis. Initially, lumbar lordosis is normal, but is reoriented upwards by the overlying flat or hollow back. It resembles a hyperlordosis. It is accompanied by a bulging of the buttocks. The patient becomes aware of this non aesthetic projection and tries to correct it. But instead of kyphosing again the hollow back, (it is rigid), he creates a lumbar kyphosis. That made that abdominal pressure makes the lumbar region very easily in kyphosis position, since that would have arrived in any case. But this state is pathological. The abdominal pressure, not only is a torture, but is harmful.

3- The fact of putting lumbar region in kyphosis would open the articular facets and would thus make it possible that those facets slip the ones on the others into the direction of the correction of rotation. Which ignorance could be that of the author who believes that a true scoliosis is constituted by a slip of the posterior spinal facets between each other? Please try to produce a lumbar rotation at a skeleton. You hardly mobilize the five segments. Kapandji and Delmas evaluate lumbar rotation around a degree per segment. Most probably rotation is not done by slip of the facets one on the other, but by the elasticity of the ligaments. Rotations are done, in scoliosis, by deformation of the bone and among other of the articular processes. Derotation also is done, by a favourable remoulding of these processes. Moreover, why would an over-bended vertebral segment be easier to derotate than a segment even in normal or in hyperlordotic position? The tended ligaments would be opposed to the derotation in the same ways which are the bones in a hyperlordotic position. Lastly, after a few weeks of lumbar kyphosis, a new balance would be created which would solidify as much the rachis in its scoliotic position.

The abdominal pressure in the corsets has practically disappeared from the publications. Almost nobody now believes in it nor does practise it. But it was necessary to say that for the latecomer teams.

Manufacture of the corset

There are two possible modes of manufacture: over plaster forms, and with data-processing assistance. Both have as a common result a mould, which must be absolutely identical in the two manufacture modes. Then the Technician forms on the mould a rough corset, then after finishing a corset fit for use.

A- Plaster manufacture

One has to make a mould known as negative, while rolling up bands of plaster around the body of the patient. One removes the mould, one reconstitutes it and one pours plaster at its interior, and obtains a rough mould. It is necessary to modify this true statue of the scoliotic patient in order to make a mould which is scoliosed in an opposite way. The so got mould is very different from the initial scoliosis and of what would be its reversed silhouette

Preparing a negative mould.

The patient is placed in the most natural possible attitude. Please take care that he does not put himself in a lumbar lordosis, which is usual if the treating team does not pay attention to it. A lumbar or thoracic lordosed mould must absolutely undergo a gypsotomy in order to get rid of lordosis. Or else the corset will be unsuited. Between 1979 and 1981, I had tried to make the moulds in three successive positions of "bending". The result had been excellent, but at this time, nobody had understood it and I had to stop. At present, since the technique of Charleston has become current, everyone is well-informed and could understand. But to adopt this process of moulding, and to adapt it to the corset 2003, it would be necessary for each team to suffer a period where many corsets should be re-formed before being well adjusted. There would be much waste of material and time during the first weeks. I insist on the marking of the waist. It is done by a plaster band twisted, tended forwards and downwards. Moreover, shortly before the hardening of plaster, one reinforces marking with the medial edge of the hands. At the same time, the Technician marks the iliac spine with three fingers. The marking of the armpit must be done with hands slightly divergent downwards.

Figure 1: marking the waist with a twisted plaster band. The Technician locates the spines by marking around them three prints of fingers.

Figure 2: marking the armpits, symmetrically.

The quite right fingers diverge, as the corset wall will do it later. One does not seek to reproduce the armpits in an anatomical way, but to mark them. To mould the armpit anatomically gives a curve which makes hazardous to determine height of this armpit.

Working the positive mould. Starting with the scoliosis with four curves

(the most frequent ones)

At the thoracic level, the modifications of the mould are nearly identical for all the categories of scoliosis. The seat of the thoracic pressure part 1 varies a little but very little, according to the height of the apex, from Th8 to Th10. The cervico-thoracic apex 3-3 ' must then be regarded as sitting in Th4. For an apex in height of Th11-Th12, the pressure part is seated on apex, as the general rule recommends it. But notice that in that case the cervico-thoracic apex in zones 3-3 ' is lower, Th6.

Let us now consider the modifications of the mould **in the lumbar region**. They are radically different for the scoliosis with three curved and four curved scoliosis. The former have one apex cervico-thoracic, one thoracic or thoraco-lumbar and one lumbo-sacral. The latter have one apex cervico-thoracic, one thoracic, one high lumbar and one lumbo-sacral.

I will try to show the discharges and refills of plaster which have to be done for the typical scoliosis with four curves, then for those with three curves. Later, I will show the particular cases of "three curves with low apex", Th11-12, of the single lumbar curves without thoracic sinuosity, finally of the particular and difficult case of the lumbar apex in L3.

Taking plaster out of humps

This can be only a recall, because the thing is so complicated that only the presence in my lectures makes it possible to seize it. Here are some general principles. The pressure parts are flat (Neither convex nor concave) in at least one direction of space, the width. They have their top at the level of the corresponding apex. The pressure parts under the left armpit, and those above an iliac crest, either right or left according to the clinical case considered, are directed in a strictly transverse way, from right towards left or from left towards right. The right thoracic pressure pad is initially directed of approximately 40° towards medial and forwards. But derotation, changes this position. The lumbar pressure part is rather posterior, to counter the tendency to kyphosis. It is a pressure part of high importance, but which it is practically impossible to describe. Zone 20, stretching from the front left apex 4_43_21, around left breast, to the lumbar pressure part 1' has to be discharged it enormously, some five centimetres. It corresponds to the front part of the

apex-seated concave rib, which, on this level, is a hump. It is far below the thoracic apex because of the obliqueness of this coast. Many teams work this zone incorrectly. The exact place of the discharges, i.e. of the pressure parts, is the result of an experience of more than 40 years with ceaseless problems, slowly solved one by one with an audacity that no other school approaches, as well as I am informed.

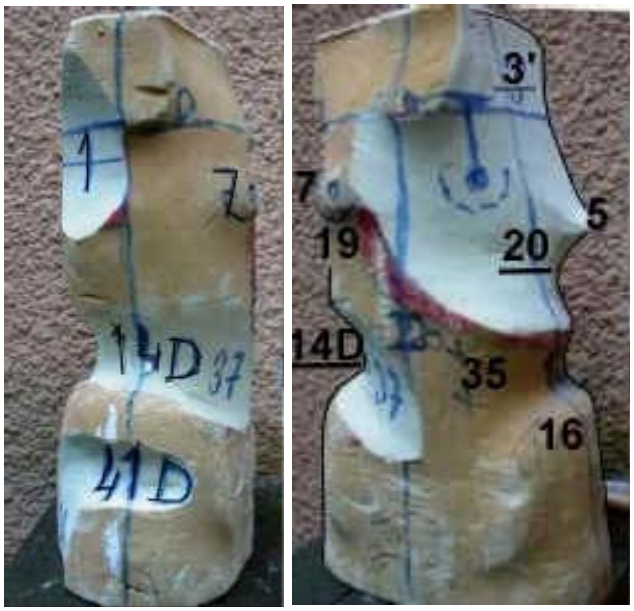


Figure 3: Discharge from the positive mould supposed to be of a scoliosis with four curves.
(Actually it is a symmetrical model from the enterprise IPOS).

A. Right profile a little oblique. Notice flatness in width of the pressure parts 1, 14D and 41D.

B. Left back oblique sight. Zone 3 now is less oblique than in 1999, and perfectly rectilinear in width. Notice the enormous discharge 20, very often neglected by the teams.

Figure 4 A: Left profile.

Let us underline again zone 20, lower end of the apex concave rib, but which here, is cartilaginous and which bulges. It has to be discharged enormously, but the pressure on this cartilaginous rib is only light, because the expansion rooms, in particular 16 and 35 (see further), offer a sufficient dodging to release it.

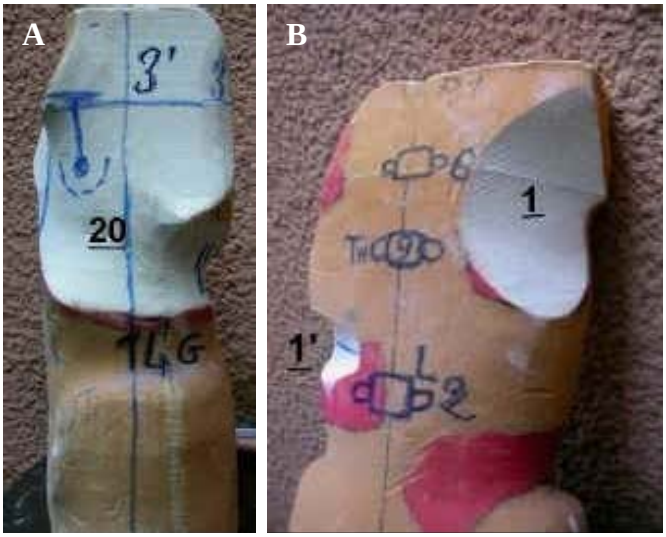


Figure 4 B: **Posterior oblique right-hand view.**

Notice the height of the lumbar support, a stage above the L2 apex. Goal is to previously compensate the fact that the patient will rectify himself around the rotation point D11-12, and will lower the pressure part. It will be advisable however to control later, and to possibly place a foam pad, higher or lower.

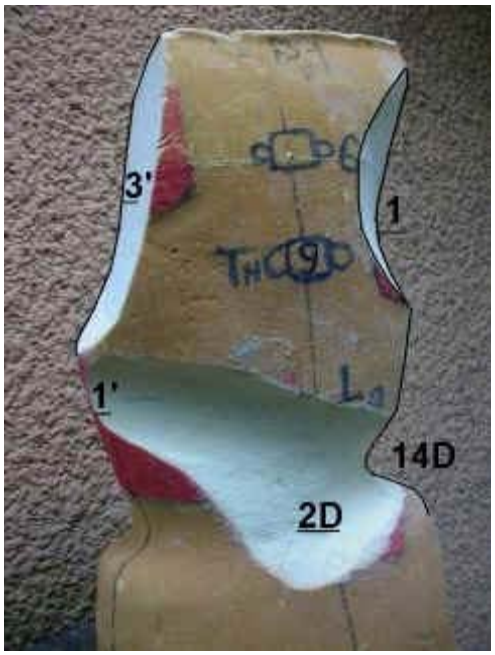


Figure 5: Back sight, slightly oblique left.

Pressed surfaces 1 and 3' are seen on oblique light. Here was the largest diameter of the oblique thorax. It became the smaller one.

Refills.

The refills must compensate for at the same time the "leakage" of tissues driven back by the supports, the growth, the breathing, and the margin of free movements left in the corset because they are actively correcting. That makes that the volume of expansion created is ten times larger than the volume of the crushed humps. The height of reloaded plaster is often identical to that is discharged, but the humps are very small and concavities very wide. That explains this ratio from one to ten.

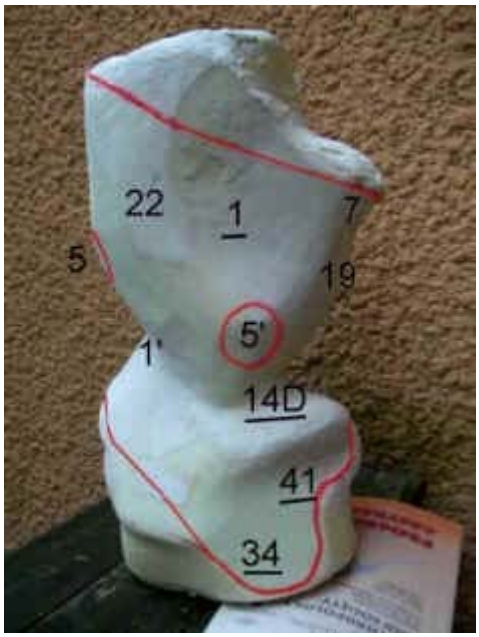


Figure 6: Mould of a scoliosis with four curves fit for forming, in oblique slightly back right view.

Here was the small oblique diameter of the thorax; we strongly increased it.
Notice broad space managed behind 22 for the expansion of the hollow back

Figure 7: Mould ready to be formed over, left front oblique sight.

Notice the regular obliqueness of the plate under the pressure part 1'; notice the fact that areas 35 (under discharged zone 20 to be pressed), as well as zone 16 are, strongly charged. There is no waist cinchier above the iliac crest. Zone 38 was left neutral neither discharged nor refilled, because currently, we prefer to insert a plastic foam half-ball after fitting. This sight was the smaller diameter of the oblique thorax. It has become the larger diameter.

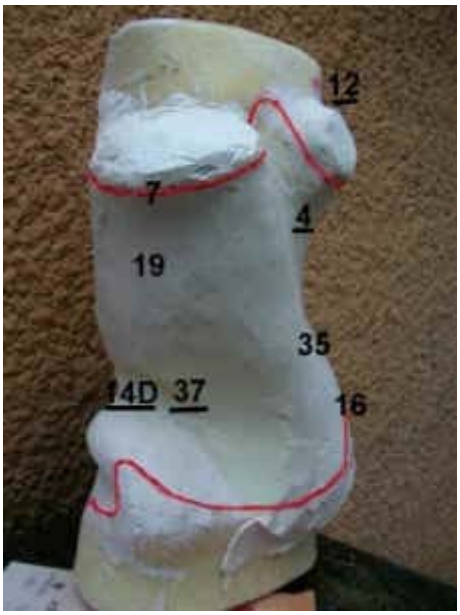
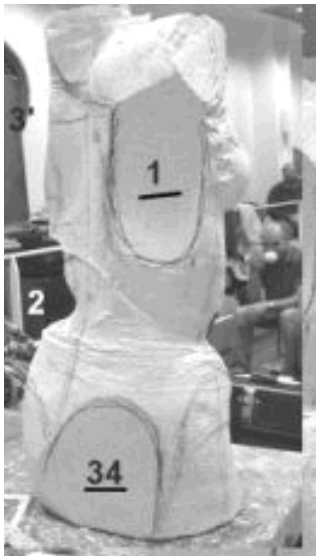


Figure 8: Mould "4 curves" fit for being formed over, right front oblique sight.

Between zone 4, (to be pressed under the left breast), and that 35, very much refilled as well as contiguous zone 16, there is zone 20, not numbered here, very much discharged. Notice the extent of zone 37. I have been convinced for two years on the doctrines of Boston on this level. Notice also the space of expansion, very generous, in zone 35. There was formerly the furrow along the waist.

Work of the positive mould for the scoliosis with three curves Th8- Th9 and Th10.

Compared with the word of moulds of scoliosis with four curves, the work of the mould is appreciably the same one in the thoracic area. Simply, the right thoracic pressure part 1 is easier to apply because the obstacle of the arm is not met. Here are a series of views of moulds, discharged from layers of plaster on humps, then charged with plaster on concave sides, for three curved scoliosis. Figure 9.



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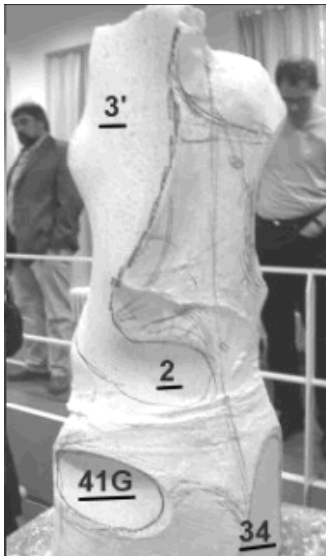

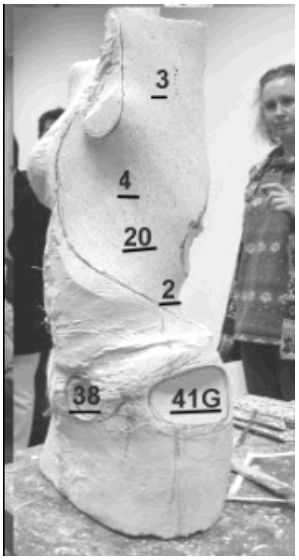

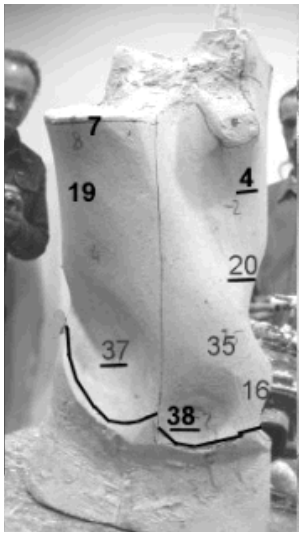

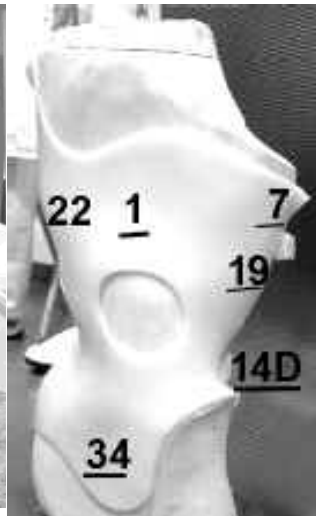

Figure 10: **Notice,** The patient treated by the corset whose mould is represented above had a thoracic scoliosis with three curves of 36°, very rigid. She was rectified completely, as a stereotype under corset arrived to my mall testifies it.

B- Manufacture assisted by data processing

Principles

It consists in working a mould by milling a block of tender material, usually of hard polyurethane foam. The software which orders the cutter has a three-dimensional virtual image of the mould such as the one which is wished to be produced. It was slowly worked out, initially by the team of house
IPOS, in Lüneburg (Germany). The team included in addition to the State Major of IPOS Professor Neff from Berlin and me. Owing to the enormous Problems met and the caused sterile expenses, house IPOS gave up the study of the corsets of scoliosis.
As well as I am informed, two companies began again, with the complete information coming from IPOS and from me. One of it, Regnierorthopedie in Berck, Northern France, collaborated narrowly and very honestly with me. The Technician Orthopedist, Mr Hoeltzel, first of all sought to carry out the three-dimensional virtual image of the mould by virtual construction. On the basis of the most faithful possible image of a silhouette of the biotype and age of the average of the patients, he reproduced the successive stages of the correction of a mould. After some time, the complexity of this process appeared too large. The mould, once milled, still required a certain number of changes which weighed down the workload of the customer.
At present, house REGNIER collects the shape of moulds fit for being formed over, records them in the form of three-dimensional images in the computer and adapts to each clinical form a certain number of biotypes of patients. I have the firm hope to see the full success of this process for which such an amount of people have so hardly worked, in the few years or months which remain me to live.

Figure 11: Lectures in Berlin, October 2003.
(Organization Doctor Matussek, Clinical Von Behring, Mr Nahr and me).

On left, two moulds of a scoliotic patient with three curves. On right-hand, a mould reproduced by data processing. The immediate future, I hope, is moving.

Future and utility of data processing

I am persuaded that data processing will be, in a future perhaps very near, decisive progress in the orthopaedic treatment of the scoliosis. The memory of the computer has gilded already for a decade an invaluable leading thread which exempts the Technician to reproduce for each patient a new prototype.
I address my thanks, my regrets and to a certain extent, my excuses at house IPOS. The impediments against which we came up were numerous. They were the machine (Hardware). They were partly the software. Huge problems were consequence of the choice of pubic symphyses as a basic element of body's measurements.
This anatomical element had appeared rational to us, but it is variable in space according to positions of the patient. The patient being in lordosed position, the distance between symphyse and iliac crests was positive. When in the kyphosed, the distance was negative.
No computer can take that in account. It would have been necessary to choose as bases the waist. It is and remains the base of the corset. Both trochanters can also be chosen for becoming marks. A series of impediments was represented by knowledge in fact of biomechanics of scoliosis, which progressed to step of giant since 1987. Data processing was blown to follow. I present once again my excuses at house IPOS, but it was impossible for me, when an important problem was solved, not to introduce it in practice, i.e. in the software. I remain of the same opinion, data processing it is the future. But I had hoped that the future would be carried out more quickly.

Maintenance and its extreme importance

Attention, once data-processing manufacture perfectly in perfect running order, application and maintenance will remain and continue presenting problems. The application seems to be now up to scratch since about sixty corsets carried out in this second half of 2003 needed only negligible final improvements. But maintenance is of extreme importance, and requires as much knowledge in biomechanics of scoliosis under corset as manufacture and application. Especially; please not to neglect to count the vertebrae, to compare the red spots on the skin with the theoretical height of the pressure parts, and to raise this parts accordingly. I see many failures resulting from this negligence.

Forming

Forming is done on the mould, even plastered or assisted by data-processing, with a polyethylene plate. For the small sizes, three millimetres thickness are enough. For the large ones, one needs five of them. The majority of the teams mould with vacuum, but I saw, in particular in Bytom (Poland) excellent manually formed corsets, without vacuum. There, the skill of the Technicians allows a saving time and nearly 50% of raw material. One welds the matter ahead, along the range of a zone refilled with plaster. One cuts to three centimetres and one inserts a metal bar which will be used later as stabilizer. It prevents the shifts of the lips of the corset in height, width and direction. All these operations appear easy but require skill and synchronization without fault of both or three Technicians who practise it

Removing from the mould

Removing from the mould is done a few hours after forming, so that a stabilization has intervened. It is much faster in manufacture without vacuum. One opens two windows, the role of which being monitoring (and not: respiratory). One polishes the edges to avoid discomfort while fitting. It is very important to roll up zone 27, behind the left shoulder. If not, there are discomfort, maladjustment, and bad first impression for the patient. One places the corset on the patient upright, then one lays him flat on a low bed, hanging legs (see chapter "techniques of adjustment", figure 1). It is towards this chapter that we return the reader for periodic application and adjustments.

Techniques of adjustment, initial and periodic

1. FITTING

The rough corset has been cut out and its edges polished. It is not advised to fix the straps before fitting, because among other disadvantages, they would be opposed to a possible remoulding, in particular in zone 7_19.
Please roll up zone 27 before any fitting. I insist and will repeat it because nobody does it. A non-turned up zone 27 makes that approximately three centimetres are lost. The left shoulder is pushed forwards and the left breast pressed a very uncomfortable way. See figure 9 where the Technician did not roll up zone 27 before fitting. It is vague and very uncomfortable for the patient. The psychological effect is deplorable. I repeat: Please roll up zone 27 before any trying on.
The corset is placed on the patient while standing.
Then the patient is requested to extend, the knees in end of table and bent, with hanging legs (good practice seen in Bytom, Poland). That makes the closing of the corset much easier and comfortable

Figure 1

To adjust the corset, patient is placed in end of table with hanging legs. Image has been taken in Bytom, Poland

One fixes with sticking bands. Take care not to leave the lips shifted in the front opening of corset, because its left edge

tends to be lower. Then the patient rises. He is asked whether all is well. If necessary, he is asked to specify what is wrong. Balance is checked. It generally is perfect, or is reversed, which is wished (It is the always sought hypercorrection).
One looks in which direction, right or left, the iliac crests are bulging. It is necessary that it is on the opposite side as that where they were bulging before bracing. A short location of the front iliac spines informs about the good place of the covers of these zones. If the corset has turned, the right iliac spine comes to a painful contact with the wall, and several supports and spaces of expansion are made unsuitable.
Please not to press on the left buttock 33. That would be opposed to the correction of the pelvis twisting. That would cause an untoward clamp effect with the zones 2G (Scoliosis with three curves) or 1' (with four curves). It is on the level of these zones, either 2G or 1', plus on zone 37, that the pressure must be increased in the event of a right rotation of the corset.
Once these points have been checked and corrected, one looks at if the left armpit 3' is rather tight. Please make the test of a forced right bending with left arm raised close to the head. If the skin of armpit can move away from the wall at a distance of more than two centimetres, it will be important either to push this wall toward right hand by the means described lower Figure 9, or to increase the right thoracic pressure part 1 by a foam pad.
Once these points checked, one examines the difficult area 7_19. It is necessary to give carefully a proper curve to the brace wall under the right breast. This operation is always delicate.
The left breast then is looked at, and if it is higher than the corresponding pressure part, one will choose between a hot remoulding and the addition of a foam pad.

While patient is sitting, one checks the distance between the seat (the base of this seat must be horizontal and hard) and the edge of the corset. It must be close to three centimetres. Future cutting is drawn.

One then asks the patient to remove corset and undergarment.
One checks the heights of the red spots which must be exactly those of the vertebral apexes. It is necessary to count the spinous processes. Most teams neglect doing this simple examination. There could be then some discussion about introducing a foam pad 1, on the thoracic right-hand side. The hump 1 having almost always risen, this additional pad will consist in a polyethylene plate moderately heated a two-dimensional way (See lexicon), upholstered with plastic foam. When this rigid pad is fixed on the upper part of zone 1, it tops it as high as the apex vertebra which even has been located by the red spot on skin. So is the new middle of the pressure pad higher. One will seek also the height of the support 1' and will stick to it a foam pad with a proper thickness, if necessary. Please notice that we do not place a foam pad without reason. The seat of the supports is selected so that the tolerance of polyethylene is perfect there. In fact, the muscles are used as padding, and it is an active padding (Matthiass, congress of Münster, 1983).

At the end of the examination, one replaces the corset on the naked skin. It is a little unpleasant and excuses are presented to the patient, but it is preciously useful for the last checks. The corrections to be brought after fitting are as follows:
a- Upper and lower edges of corset have been cut according to the drawing. It is often necessary to model the right breast. But Technicians begin now to make primarily a mould

which can receive the lower part of the breasts so precisely, that no further remoulding is necessary.
b- If the pressure parts seem to be too tight, it is almost always better to remould with heat the walls of the windows around the corresponding concavities, on the other side of the body, but never symmetrical, neither in height nor in width. That kind of manoeuvring is less and less necessary now, owing to the precision acquired at present time
c- The thorax went up under the influence of the pressures. I call it "cherry-stone effect". If this rise were badly envisaged at the stage of the work of the mould, the cover is insufficient. It could be adjusted only by riveting of plastic parts. This manoeuvre needs much time, is complicated, non aesthetic and often imperfect. It is better to modify the mould and to reform a new corset better adapted.

The precision obtained these last months in the preparation of the moulds allowed us to make only minute final improvements during the fitting, so much in Berlin (Mr Nahr), and in Bad Sobernheim (Messrs Borrnstein, Werkmann and the team) Those improvements consisted in cutting out very small pieces of brace wall overflowing in bottom and ahead. Some times we had to give curve to the right breast 7_19. What a saving of time for the teams!

2. MAINTENANCE OF the CORSET DURING SA DURATION OF PORT

The goal of bracing is to reorganize the body: Pressing the humps aim at depresses them; managing wide concave sided free rooms aids to the tissue transfers and to the repletion of the concave flat parts. The spine follows, more or less completely according to the age and seriousness.
This replanning of the body, the corset does it very quickly and very well, but in a limited way in time and space. It is hardly possible to envisage during manufacture a correction which remains still valid afterwards a year.
Let us recall that Abbott renewed his plasters every three months. When the "cruising speed" is reached, those three months are the time which generally is agreed to respect between two adjustments.
The first adjustment, however, will be made at the end of one month, because it is within this time that the first changes in form of the body are most marked. But, doctors, attention! It is absolutely necessary to re-examine and improve the corsets in cruising at least every three months, or else a poor result is inevitable. When you re-examine a patient periodically, please do not satisfy to say: "There is no worsening, patient will be re-examined in three months". It is necessary that the technician re-examines the corset and adjusts it.
The examination before periodic adjustments is appreciably that of the fitting. Rapid interrogation on comfort or discomfort, Balance, Direction of bulging of the iliac crests, place of the front iliac spines in their corresponding gutter.
If there is then a right rotation of the corset, it is necessary to glue foam pads on the zones 2G for the scoliosis with three curves and 1' for those with four curves. It is also significant to control and almost always to increase the pressure of zone 37. One will see the tightening of 3' while making achieve a forced right bending, left arm raised close to the

head. If the distance of the skin to the corset exceeds 2 centimetres, then it is necessary to tighten either 3' or 1 (see further figure 9).
Pressure parts 1 and (or) 3' will be raised if necessary: often. That can be made by riveting a plastic plate, possibly upholstered.
The "wonder bra" under the breasts, right and left is controlled. If necessary, it shall be raised by reinforced foam pads or by remoulding.
Then patient will be asked to breathe deeply. Meanwhile the Technician looks at the back to see whether the hollow back is corrected or not when patient breathes in. The need for this space must be pointed out with the mother as well as the efforts which the patient must make to fill it when breathing in. If space is insufficient, it has to be increased by hot remoulding. If it is very insufficient, a relatively easy manoeuvre consists in splitting vertically the back brace wall in its middle part and to widen material by a plastic bridge (not of metal) slightly heated. The two edges have also been heated and readjusted.
Then all is riveted with a few centimetres between both edges. I see complete series of hollow back everywhere where this space misses behind the back. This failure is due either to the insufficiency of the teams (ignorance), or for fear of the protests of the mother. But if the mother is informed before the fitting, she does not protest.
After all those adjustments, the patient is examined either without corset or under clothing to check red spots. It is then important to count the vertebrae. If red spot is located lower than the vertebra top, it is necessary to raise the pressure part by hot remoulding or by addition of a polyethylene plate. Then the whole is covered by a thin layer of plastic foam.

Above all, I would like to describe the two techniques of hot remoulding of polyethylene, because they are at the base of many adjustments.

Techniques of hot remoulding of polyethylene

I noticed that many Technicians practise remoulding very badly; Polyethylene can be reorganized in two manners:
If the modification simply seeks to re-orientate the part, as one would do it for a page of book that one turns, it is enough to heat in the "two-dimensional" mode. In fact of corset, the page is turned only partially, a few degrees, and a certain contour always should be added. If the modification to be made is significant, it is necessary to heat in "three-dimensional".

Remoulding a two-dimensional way

Only one side has to be heated, either with the flame, or above a hotplate, or with the gun with hot air.
It is necessary to heat triple of the surface to be reorganized, in a way decreasing from the centre towards the periphery of heated surface. It is checked that the reheating is at point by looking at heated face at oblique light. This face and it only, became transparent.
One then exerts a very strong traction on the two ends of surface heated to ensure the contour, then one formats. No mould is necessary. It is the face which was not heated which is used as mould.

One can make use of one or two plates of foam (tepefoam or other), between 10 and 18cm broad, and one centimetre thick.
Cooling can be accelerated by cold air or by water. Replanning a two-dimensional way is limited in amplitude, but does not bring any non aesthetic effect and does not weaken the remoulded part.
A particular case of two-dimensional replanning consists in tightening the part 3' while heating according to three lines. Another advantage of this mode of adjustment is to increase the space of expansion of the hollow back. See further figure 9.

Three-dimensional remoulding

Each one of the two faces is heated, one and the other alternatively during about thirty seconds repeated until transparency of area to modify.
Heating shall be careful on the edge, which should not contain opaque zone. The circumference of the zone to be reorganized also has to be heated on 2 to 4 centimetres, but not until transparency.
Limits of the modification are only those of the future resistance of material. The area is stretched, often in a considerable way, before being bended.
Then it is formatted. It is then important to maintain this form between two surfaces forming mould until been opaque. Both surfaces used as moulds can be plates of tepefoam or similar, chalked. Slightly heated by the surface which has just been softened by heat, they acquire automatically the form the Technician wishes.
In certain circumstances, it can be better to have a set of rigid moulds for each part which has to be reorganized. The rigid mould is placed opposite concave and a plate tepefoam opposite convex.
Please not accelerate cooling, neither by water nor by air cold. Remoulding a three-dimensional way is relatively long and difficult. Irregularities can occur.
The effect it is non aesthetic and the solidity of the unit can be affected by it. One can often mitigate them by sandpapering or reheating and taking between two surfaces of tepefoam, but it is long. The reorganized part can also be doubled for aesthetics or resistance by tepefoam or (and) thin polyethylene (see further figure 3, in top on the right of the figure).
Remoulding in a three-dimensional way can also often reinforce the reorganized part, thanks to the skill of the Technician.
In many occasions, he can benefit by the possibility of increasing the thickness of polyethylene at the heated level. In other cases, Technician can fold up on itself the material while transparent. Then the material is formatted. After cooling, the surface of the window has increased considerably, and local resistance is quadrupled.

1. Making the brace wall longer in height: Increasing the size and raising certain supports.

The size of certain parts of brace pressing on patient’s humps can be raised by various means. Best is to rivet a parts coming of the test corset that many Technicians manufacture before the final orthosis. One shifts this coin or these coins in height (Figure 2. Idea of Mr Nahr, Berlin).

Figure 2

It is easy and fast to lengthen a corset by riveting and shifting upwards one or more parts of a test corset preserved by the family. It is enough to heat a two-dimensional way (no transparency into) the lips as well as the corset part to be shifted and fixed. The corset preserves all its properties of semi-flexible rigidity. Its weight practically does not change. It is quite as solid. The so formed setting is adapted in the three plans of space and in very fine details. The part of a test corset is an idea of Mr Nahr, Clinic Von Behring, Berlin. The corsets containing uprights and bars can be made roomier only in two plans of space, height and width, and not at all in details.

It is also possible to cut the three bridges, each of them binding two humps in the middle of trunk, and to bind again the two parts (upper and lower) of brace with plastic parts after having shifted those brace parts in height. I prefer that the bridges are out of polyethylene rather than out of metal, in order to preserve the marvellous quality of semi-flexible rigidity of polyethylene Figure 3,

Figure 3 Corset of reject which was useful to me for tests and demonstration, seen in front left oblique position.

I tried to lengthen it by polyethylene bridges. They swear by their colour, but it is easy to colour them in the same drawing. I know that some teams have made such changes, but I could not obtain an image. It is appropriate then, but it is easy, to build a pressure part 20 by means of a reinforced plastic foam pad.
In addition, I raised part 7, under the right breast. It was too low. I fixed a low temperature mouldable material upholstered by two thin layers of plastic foam. There is also in top a reinforcement of a part, the rigidity of which being not sufficient. Please not to take account the white bar of bottom, only fixed for the rigidity of the unit during the demonstration.
I tried on a corset of reject to lengthen this way the height of brace. I know that Technicians did it successfully since, but could not yet get images of it. See also on this figure for demonstration a reinforcement of a too fragile bridging (in top on the right). It is so discrete that it hardly is visible on the image. This test corset was also the first attempt to raise the part 7 over the right breast. I modelled a material fusible at low temperature and then stuck two layers of foam. Since that time, I practised that on patients. The part was moulded

directly on their chest covered with a simple jersey, and I obtained eloquent images (see further figure 5).

Since always, I meet resistance for these lengthenings of size on behalf of many teams. They are essential and irreplaceable. Well there is a tare of technical orthopaedics, and not only in France.
There is always somebody who prefers an ineffective apparatus provided that it presents well on photography, but especially, that requires little work. Which non aesthetic effect has four or five rivets? Would the already old apparatus be uglier with this heightening than the less modern orthosis with uprights, bars and numerous bolts and nuts? Those loosen in the variable term, and often emit more or less cracklings. Please, Misters "purists", have a little common sense. Let us prefer the effectiveness with comfort to any other consideration.

The breasts tend to go up, amongst other things by the effect "cherry-stone" (See lexicon), the width of which is not always foreseeable. In the event of maladjustment, it is important to raise the part which is too low. This raising can be made by heating it a three-dimensional way and stretching it, in height and width. For that, a sufficiently thick material is needed (Figure 4).

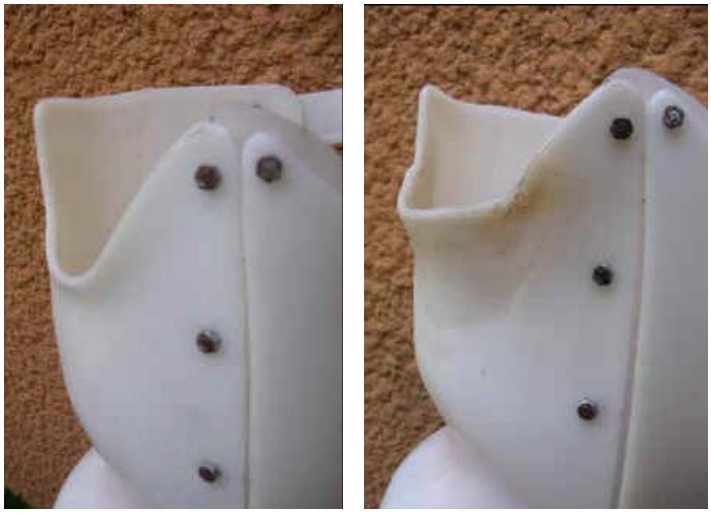

Figure 4 Raising the hull in front of the right breast.

The most natural process is to heat a three-dimensional way, to stretch and bend between two layers of foam of cmX12X12. Better, a rigid mould prepared in advance can be used at the concave face and a small piece of plastic foam at the convex face. After having been formed, the remoulded part is sand-papered for aesthetics.

I already showed a corset of test and the way in which it is possible and even rapid and easy to model above the lower part of the right breast. A product mouldable at low temperature can be used. After having fixed the new formed peace to the corresponding part of brace, the whole reorganized part is covered with two layers of plastic foam. I did that in a patient, with full success (Figure 5).

Figure 5 Corset the part 7 of which was too low.
The whole right breast was uncovered. I fixed a part of low temperature mouldable material, modelled it on the patient herself and then stuck a thin layer of plastic foam on each face.
The colour was chosen by the patient.

It is also possible, it is easy, fast and sure, to cut out fine vertical strips. Then those strips are formed with the hand directly on the patient, while adding if it is necessary other strips or a product which can be remoulded at low temperature. The whole reorganized parties are fixed with adhesive or (and) rivets. Then the two faces of the reorganized part are covered with polyethylene foam.

Figure 6 How simple is it to cut out vertical strips, then to form them directly on the patient.

This forming can take place when strips are cold, or after having reheated them moderately. The wished form is the one of the contour and the height of the breast. If it is necessary, other strips can be added. So it can be the brace wall is lengthened. Another possibility is to fix a product mouldable at low temperature (see preceding figure). Two thin layers of plastic foam are then stuck. Any later modification will be easy and fast. The image of the demonstration was taken in the private clinic of Von Behring, Berlin. Head Doctor Matussek. Master Technician Mr. Nahr.

When the breasts, right or (and) left, are only a little uncovered, it is enough to place a foam pad (Figure 7).

Figure 7 There was a small incongruence: the left breast had gone up than previously envisaged. A bent pad was simply stuck. But then, the right breast, also, went up. One will make an adjustment identical at this level. Image taken in Bytom, Poland.

2. Reinforcing the supports. Fixing plastic foam pads

Paradoxically, in our system, we do not often reinforce the pressure parts, because the growth plays this role: The corset is among other functions a "guide of growth". More often, almost always, the humps at which those pressure parts have to press are gone up (Please re-examine all the preceding figures). It is often also necessary to increase support 37 by a triangular pad with large thickness (2 to 3 centimetres) at its medial and lower parts (Figure 8).

Figure 8 Positive mould front view, to show zone 37

Here in bottom on the left of the figure, on the right of the mould. It must be discharged liberally in-depth as in surface. It goes from the right high front iliac spine to therib cartilages and to the navel. I hesitated during a long time for this area.
Currently, I adopted the indications of the school of Boston on this subject. In the event of insufficiency of pressure, it is enough to stick a broad foam pad. It seems not possible to show the pad with a photograph. The Image was taken in my course of Berlin, October 1004, Dr. Matussek, Mr Nahr. The patient straightened completely, from 36° very stiff to 0° (See chapter “Manufacture”).

Figure 9 The pressure part 3' is not tight enough.

During a right side bending, it moves away from the skin. It will be brought closer while being heated a two-dimensional way (transparency of only one face) according to three lines marked here. This small modification also has the advantage of giving more space to the hollow back. One could also tighten the right thoracic pressure part (small depression visible here on the corset, right side). Image taken in Peking, centre CHICOT, in 1999. I received news last year, that is to say four years afterwards: The boy is cured with only some 16° residual.

3. Increasing the expansion rooms.

It is the most frequent, most essential and most difficult remoulding. The expansion rooms being centred each one by a window.
The first temptation is to increase the surface of the window. It should be done at of the end of the first month after providing with brace, but it is never sufficient. It is moreover necessary to increase the volume of the expansion room. To increase it a little, the circumference is hammered. It is often insufficient, and it is necessary to heat it out a bi- or three-dimensional way and to widen it. Most important is to widen the window on its entire surface until the limit of the hump. That makes a width to be widened which often is four centimetres broad, and not a single centimetre, as I see it made almost everywhere. The modification is appreciably that of figure 3, there valid for the right breast. If the material is too thin, one increases the window while heating a three-dimensional way and turning over the edge to double it, then while widening. If needed, if the edge of the window is really too weak, after having increased the volume of the expansion space and after cooling, please double it with a small plastic part moderately heated and riveted (For this doubling, please re-examine figure 3, in top on the right of the image).

A particular case

A zone which have a problem of 14D, for the scoliosis with four curves and 14G for those with three curves.
We evoked it in a diagram in the chapter of the general bases. Let us recall that if the wall of the corset touches the iliac crest obliquely, there is a hard point. It is necessary to press deeply on the soft tissues of the waist. Thus the lateral muscles of the abdominal wall are depressed. Thanks to their tonicity and their contractions, they are used as shock absorbers. The processes of moulding obtain an oblique wall in general. In the event of a hard point, it is necessary to open a window and to reform the wall in a three-dimensional way, so that it becomes horizontal (Figure 10).

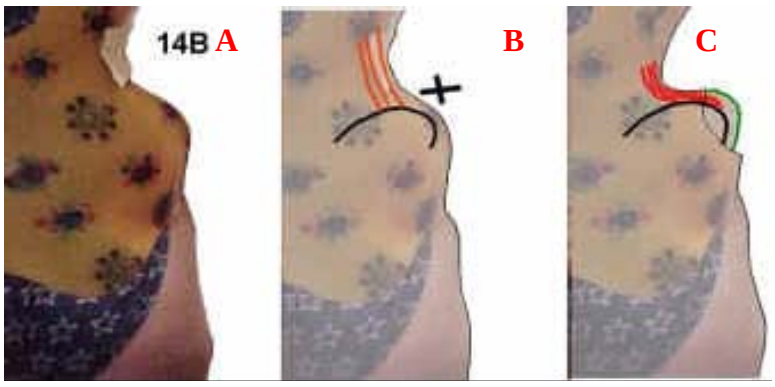

Figure 10

A. The wall 14D is oblique. If there is no hard point, it may remain so.
B There is a painful contact between the bone and the wall. This one is only separated from the bone by the skin.
C The wall has been made horizontal so that it depresses the muscle quadratus lumborum. It will support the corset and will be used as a shock absorber. If needed, a small foam pad can be added on the level of the medial angle.

Particular case Insufficiency of space for the expansion of the hollow back

The posterior wall can be cut in "V", but that harms the solidity and the night correction: When resting on the back, there is no more distance between the posterior wall (It is no more present) and the back of patient. When this wall exists, the gravitation exerts on the thorax a force which optimizes the pressure parts. So that the hollow back tends to drop and be correct with a great effectiveness. The true remedy for the insufficiency of space of expansion is to move away the wall from the skin. Best is to reorganize this wall by remoulding in three dimensions. If the material of the corset is not solid enough, one can turn over the edge on 4 to 5 centimetres and then widen it. One thus reinforces material by conferring a three-dimensional form to him. If this material is not even solid enough to be changed that way, just split it vertically from top to bottom until a few centimetres above the waist. Then draw aside the edges and rivet a rather rigid plastic part, slightly heated, largely overflowing. The part could be recovered from the test corset of the patient.

Particular case: The mother does not want to understand the major interest of an open space behind the hollow back.

During the fitting, she persists in her protests. Then the Technician incises the wall vertically while following the posterior middle line, until a few centimetres above the waist.
Then it heats slightly, superimposes the two lips and poses some rivets. One month later, during the first revision, space is obviously too narrow, thorax is crushed. Technician then demolishes the rivets and replaces the two lips of the split wall in opposite. They are solidified with one another by means of a small polyethylene plate slightly heated then riveted. Technician profits from it for calculating precisely the needed space of expansion.

L E X I Q U E

Any new system implies an adapted vocabulary, It is formed, on one hand, of words and expressions already of use, but whose precise direction is new and adapted with the system. It must then be defined like such. In addition, it is necessary to create real expressions or new words, neologisms the direction of which should be specified.

Cage: Tension fields of the corset on which are grafted correcting pressure parts. All and sundry can be separate in uprights, bars and pad, or be amalgamated in a single hull.

Contre dépouille: (I could not find any English corresponding locution) French term used by the specialists in the moulding, which indicates the state of the diameter of release from the mould of a mould which would be smaller than the largest diameter of the moulded object. The corresponding German expression can go by "neck effect of bottle". If mould and moulded object are rigid, any release from the mould is impossible without breaking mould, moulded object or both. In orthopaedics of scoliosis, let us consider that

the corset is a mould, the scoliotic body a moulded object and that correction, growth, breathing and movements are as many processes of release from the mould. Never create a "contre dépouille" in the scoliotic relation corset-body. Each pressure part must comprise at least an expansion room avoiding that a "contre dépouille" occurs.

Overflow: Action to overflow, or result of this action. Why isn't this short, simple, univocal and irreplaceable word in the majority of the dictionaries? I ended up finding it on Internet. In my system, it qualifies with precision the small surface of wall of the corset which exceeds each pressure part of brace. Its role is to be used as a pressure part in the event of displacement of the hump under the influence, among others, of growth and correction. While waiting for this occurrence, the overflow must be far away from the skin in an expansion room.

Cherry-stone effect: A fresh cherry stone, pressed between two fingers, spouts out. The trunk of a scoliotic patient, when pressed by the pressure parts of a brace, does like it. It is necessary that the tissues, driven back in a centripetal way by the pressure parts, migrate somewhere. They migrate towards spaces of expansion and upwards. Thus, the armpits, the shoulders, the apexes, the breasts, the pressure parts 1 and 3-3 ' go up of some ten centimetres. The "growth" (see below) of the patient is less full, initially one or two centimetres only. It is due to the growth in the long term, and in the immediate future to the straightening of the curves**.**

Growing (Neologism): Increase height of the patient who is due 1. to the cherry-stone effect: The tissues driven back by the pressure parts migrate where they find place, it is in particular in height. 2. To the correction; a rectified curve is longer. 3. To the growth, which becomes again normal under corset, upwards. Without corset, the growth was done towards the humps

Lines of reference: This neologism indicated two virtual rings, one circumscribing the shoulders and the other the iliac crests. These zones, supposed not to be deformed, were placed during the manufacture of the negative mould in the most normal possible relationship between them. They were connected by "vertical lines" (see further) the whole forming a cage where the supports were grafted. The rings were materialized in top by the meeting of the parts circumscribing the shoulders and in bottom by the pelvic basket. The concept of "lines of reference" does not exist any more since one became aware owing to the fact that pelvis and shoulders also are deviated and deformed. So that girdles are not to be "immobilized" any more in normal ratios. They are to be pushed towards the proper direction, opposite to this one in which they are deformed. There is an aim at straightening and correction of the contiguous curves.

To migrate: This short, simple, precise and irreplaceable verb, relates to displacements of fluids or populations, animal or human. Why does it miss majority of the French dictionaries? I finally found it on Internet. It applies with precision to human tissues driven back by the pressure parts of the corset towards concave spaces of expansion.

Vertical lines: This term, due to Professor Neff, indicates the structures which join together the lines of reference one with the other and which maintain them in normal ratios. It can be uprights, in metal or in any other matter; They can be built-in in a single hull, as they are in our system. The whole forms a cage on which pressure parts are grafted.

To migrate: Why this verb, irreplaceable because deprived of synonyms, isn't in the majority of the dictionaries, even rather large? There are however migratory birds, immigrants and emigrants and their corresponding verbs. It means, for community of birds, for populations, for fluids, to move from a point towards another. We employ it for human tissues, compared here to fluids, which move from the humps towards concave flat parts or upwards under the influence of the supports. I ended up finding it on Internet, accompanied by literary references. It is thus not a neologism.

Two-dimensional remoulding: It consists in modifying rather little the shape of a polyethylene part with eventually only a minute increasing of dimensions. Only one face of the portion of part to reorganize is heated. It is necessary to heat on also some four centimetres around, but less heat. When the on-heated face is transparent, which can be observed on oblique light, then the edge have to be stretched if necessary while strongly pulling on each side. A certain curve on the edge and nearing part can be obtained while walking the part on the on-heated side on an anvil while strongly drawing. The remoulded part has to be maintained in position during a few minutes. No mould nor foam parts are necessary. The remoulded part can be cooled quickly by cold air or water.

Three-dimensional re-planning: The action consists in modifying in the three directions of space a portion of polyethylene corset. It should be heated either by flame, or above a hotplate, or by hot puff blowing **until it is transparent**. It is important to heat also a zone of approximately four centimetres around the transparent zone to reorganize. But this surrounding zone is heated less than the zone to reorganize. It is then necessary possibly to stretch the transparent zone, in height or (and) width, then to format it. To avoid the cosmetically bad wrinkles and other irregularities, cooling is made slowly between two foam plates. They will be of 12X12 or 15X15 centimetres, with 1 cm thickness and a force of 30 to 60 kilos per cubic meter. Never accelerate the cooling with cold air or water. Cooling has to be done slowly.