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Publication/Creation

London : H. Bailliere, 1845.

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OR, THE

Treatment and Cure

OF

SPINAL CURVATURES

AND

OTHER DEVIATIONS.

BY

A. M. BUREAUD-RIOFREY, M.D.

&c &c.



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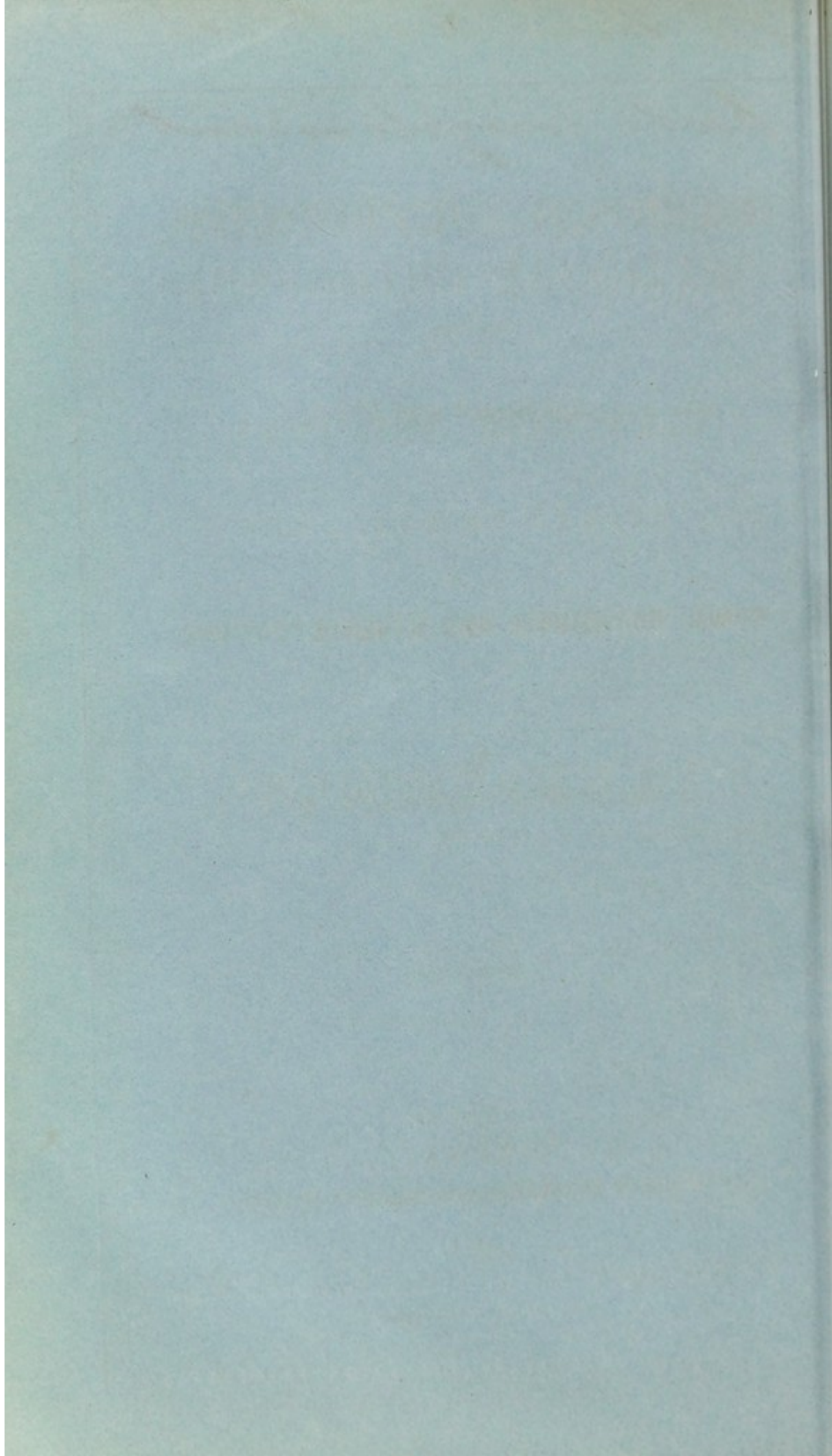
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1845.

RAYSONAL OILHOPBY

OF THE

TREASURY AND COUNCIL

THE OILHOPBY

SPRING CURVATURE AND OTHER DEVIATIONS

IN THE OILHOPBY

WILSON AND OGILVY, 57, SKINNER STREET, LONDON.

R35638

INTRODUCTION.

THIS little Pamphlet was part of my last work
On Growth, or Health and Diseases of Youth.
Having practised fifteen years in London,
and attended many young ladies of rank,
I have had the opportunity of trying the
most celebrated systems. I found none so
successful as that which is the result of com-
mon sense and observation of the laws of
nature. I publish this little Pamphlet sepa-

rately, to enable parents to know on what principles I attend spinal deviations in my establishment in Paris.

BUREAUD RIOFREY, M.D.

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RATIONAL ORTHOPEDY,

&c. &c.

EXPERIENCE in orthopedy is the great school of knowledge, and the secret of success. There is no orthopedist who, having tried a plan, has not found its disadvantages, and who has not endeavoured to discover a remedy. Having practised in the two greatest capitals of the world, London and Paris, I have been able to put different systems to the test.

Alas ! how many deceptions exist ; but I could not perceive the defects of a system, without trying to find a remedy ; and having tried, and been disappointed, I placed all my hopes in the attentive observation of nature and of its laws. Nature, said I, keeps the vertebral column erect without stretching, without pressure, without iron bars and stays, merely by small muscles and sinews—is it not, then, possible to imitate nature ?

All orthopedists have pointed out the weakness of the muscles in supporting the human body, and they

attribute the deformation of bones to the undue traction of the muscles, and to bad attitudes. In that I do not agree. In many instances bad attitudes have certainly a great effect in producing spinal deviations, yet so many spinal deviations exist without any bad attitudes, that superficial observation of youth alone gives support to that opinion.

Spinal deviations, in the majority of cases, are produced by irregularity of growth. We so often see growth more or less stopped in infancy and childhood, that I cannot understand how medical men have overlooked that important phenomenon during youth.

If we pause one instant, and consider how many are the irregularities of growth in the renewal of the limited number of teeth, we shall not wonder that there may be irregularities of growth in the bones of the vertebræ, in the cartilages that separate and unite them, in the ligaments, in the muscles that are attached to each of the vertebræ, as well as to the vessels and nerves of the spinal marrow.

Parents are sometimes at a loss to understand the state of deviation of the spinal column in their child, and yet the same parents have never been astonished if the teeth did not come regularly at a particular time: indeed, they gave so little attention to the growth of the teeth when they did not ache, that they have never considered their relation to the general growth of the body. If among thirty-two teeth there are so many anomalies, so many irregularities in the growth, how is it possible that there

will never be any irregularity in the growth and development of the other organs?

Many deformities arise from a congenital inequality of the two sides of the body—the muscles, and in some instances the bones, are less developed on one side than the other. These cases are more common than generally supposed.

Sometimes the deformities are caused by the want of development of the lungs; for the cavity of the chest, like the cavity of the cranium, is moulded on its contents; and the proper development of the thorax depends on the proper development of the lungs and heart.

Sometimes deformities are caused by stopped growth of the nerves, or by the compression of some part of those nerves. This is a cause most commonly overlooked: indeed, when we consider the complicated and numerous functions of the vertebral column, it is difficult to understand how medical men have attributed the deviations of that axis of the body mainly to bad attitudes.

The head alone excepted, properly observes Mr. Beale, there is no part of the body, the functions of which deserve more attentive study than those of the spine and its contents.

The vertebral column is destined to carry the head, to support the ribs and thorax, as well as the upper extremities. It forms the only solid portion of the abdominal cavity, and through the medium of the pelvic bones it serves as a support, or *point*

d'appui for the lower limbs. In its canal is contained that important organ with which all the nerves of sensation and motion below the head communicate. Whether it supplies them with their material power, or merely receives their intelligence, certain it is, that when any portion of it is injured, or compressed, all the parts below are paralyzed. Many of the obscure, anomalous, and what are termed nervous cases, which so much perplex medical men, have unquestionably their origin in the spinal canal.

All the organs composing the vertebral column, or connected with it, are subject to growth,—all of them being stopped in their development, can cause a deviation which, if neglected, soon becomes a deformity.

Bad attitudes have, undoubtedly, a great influence in producing spinal deviation. The errors of physical education during the period in which the intellectual education is followed, are so numerous that I do not wonder that authors have attributed spinal deviations to bad attitudes only.

It would be accounted great cruelty, says Dr. Arnott, to make a delicate young creature to stand all day, because the legs would tire, but this very cruelty is almost in constant operation against the backs, as if backs could not tire as well as legs.

When a girl is allowed to sit down because she has been long standing, great care is taken that the muscles of the back, which still remain in action as she sits, shall not be at all relieved; for, from the

idea that it is ungraceful to loll, she is either put upon a stool which has no back at all, or upon a very narrow chair with a perpendicular back, or upon a form.

The consequence soon is, that being first *weakened* generally by sedentary habits, and the back being still farther *weakened* by excessive fatigue, the spine gives way in some part and bends, and the curvature becomes permanent. In this bending the spine is sometimes partially rotated.

At other times the vertebræ and intervening substance merely become thinner on one side from the continued pressure and weakness; when a bend takes place in one situation, it immediately occasions an opposite bend above or below it, to bring the centre of gravity of the upper parts directly over the base again, and hence the curve becomes again like an italic *S*.

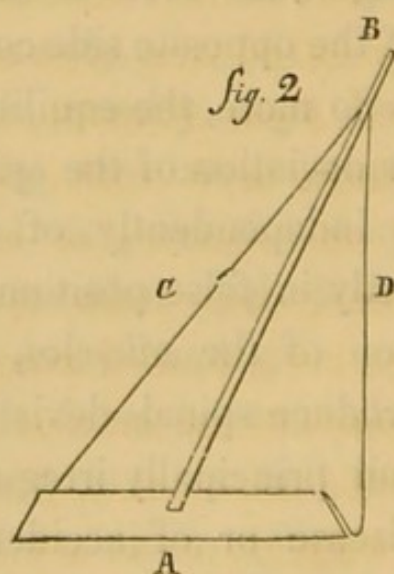
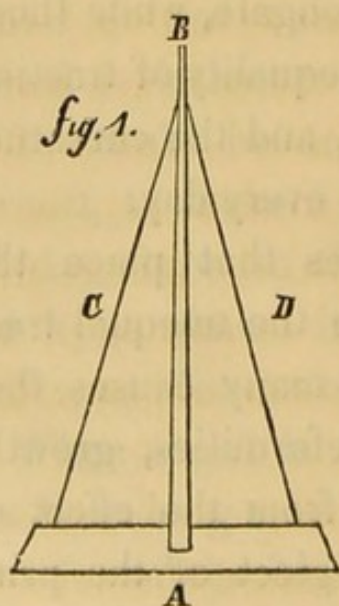
When the inclination of the back has once begun, the muscles of one side elongate, while those of the opposite side contract; the equality of traction is no more, the equilibrium is lost, and the curvature or deviation of the spine increases every day.

Independently of bad attitudes that place the body in false positions, and cause the unequal traction of the muscles, among the many causes that produce spinal deviations and deformities, growth, and principally irregular growth from the effect of disease or of accident, or of neglect of the principles of physical education,—growth is a common

cause, for it is during growth that the muscles are unequally exercised and unequally developed.

Inequality of power of the muscles is thus the most general cause of spinal curvatures. The question, how is the vertebral column kept erect, brings the secret of treating spinal deviations, for it is impossible to find a better manner of keeping the vertebral column erect than that ordered by Providence. The vertebral column that supports the head, the lungs, the heart, the bowels, is kept erect by many small muscles acting in antagonism; the vertebral column is incurved when some of those muscles are weaker than their antagonist.

Although the vertebral column is composed of twenty-four bones, they are so well articulated, and they act with so much *ensemble*, that we may for an instant consider it abstractively as a mast.



How is a mast kept up ?

Two or more forces are in equilibrium. When acting against each other, or against the same obstacle, they do not overpower each other, nor overpower the obstacle, and they remain stationary, notwithstanding the action of the forces against each other, or against the obstacle which arrests them, and which is called *support*.

If the column *B*, is vertically in equilibrium on its basis *A* ; if the strings, *C* and *D* are of the same force, and equally stretched, each of the strings exercises in turn a very slight effort to retain the column in its right position ; but if the column is inclined, the string *C*, is forcibly lengthened, and the string *D*, is left at liberty. The string *C*, bears the weight continually, and the more it gives way the less it is able to resist.

A few words on the structure of the spine will serve to elucidate my subject.

The human skeleton, (says a learned author,) with its naked ribs, is so associated in the common mind with ideas of death, and loss of friends, and all the terrors of doubtful futurity, that to most persons it is an object of abhorrence ; but to the philosophic mind, the admirable and evident adaptation of all the parts to their purposes, makes it an object of the most intense interest.

To respect the delicate susceptibility of my readers, I willingly omit the picture of a human skeleton ; and

I will try to explain the mechanism of the movements of the body by an incomplete comparison.

Let us suppose we wish to represent a man standing, by draughts, we must put the draughts upon each other, form two columns, then, if we place a third column on a transversal draught, the third column must have each draught placed perpendicularly.

If one of the draughts forming the column be moved, the whole fabric falls. On the contrary, to make it steady and firm, connect each draught; the more the draughts are tightly kept together, the less they will deviate to the right or left. It is easy to understand that the higher column could not stand on the moveable basis unless that same column be so connected by strings, ligaments, or glue, so as to make a whole *piece*. Such is the vertebral column, which is placed upon two moveable pillars.

But it is not an unconnected piece, or a standing pillar alone, it is also the central pillar of the body, the support and chain of all the other parts; it is also a canal containing within it the prolongations of the brain called the spinal marrow, more important to animal life than the greater part of the brain itself. In my comparison of the draughts I place them on each other, but the twenty-four bones that compose the spine are separated and placed on cartilages, or on elastic tissues, that act as so many springs, so that the spine is elastic, and the head rests on that elastic column as the body of a carriage rests upon its springs.

The spine is not only elastic, it is flexible, and each vertebra is like the ring of a chain ; the twenty-four bones are all joined together by smooth surfaces, and they allow motion in all directions ; they are kept in their places by numerous antagonist muscles ; and notwithstanding the heavy task it has to perform, the spine is a stronger column than a single bone of the same size could possibly have been.

It must be admitted that each vertebra is in itself a small column kept standing by antagonist forces, while the basis is in motion ; or in other words, each of the parts or bones of the vertebral column is like the mast—each vertebra is supported in equilibrium by opposite muscles, forward, backwards, and laterally. When one of the vertebræ, or many of the vertebræ, are inclined, the muscles of one side are stretched and lengthened, and those of the opposite side are rendered, not useless, nor relaxed, but *contracted*. In deviations, one of the muscles of each articulation, or many muscles of the inclined vertebræ, bear alone and almost incessantly the weight of the body ; the more the muscles are lengthened by the efforts of the bones, the more they induce elongation ; while the muscles of one side are distended and weakened, those of the opposite side contract, and that contraction becomes a new difficulty in the cure of spinal deviation.

In the inclined mast the string that is on the inclined side becomes useless and relaxed, not so

in the human body ; the muscle that is shortened, becoming contracted, opposes a resistance to the straightening of the column.

What would the most common sailor do to redress the inclined mast ?

If the cord that is drawn be too weak to bring the mast in the perpendicular line, the sailor would undoubtedly employ an auxiliary cord. Such is the first object of the rational method of orthopedy in incipient deviations.

When there is alteration in the cartilages, if it be supposed that the muscles alone will surmount the material obstacle caused by the cuneiform development of that cartilage, more is expected than nature can perform ; for we must overcome the weakness of the muscles, the obstacle of the unequal development of the inter-vertebral cartilage, and the constant attraction of the body to the earth. In a confirmed deviation, with alteration of the cartilages, the upper part of the column is placed on an inclined plane ; and that inclination of the mast, while the basis does not change, will produce the elongation of the muscles on one side, and consequently the inequality of forces.

What is here said of a cartilage is equally applicable to a vertebra. We find in practice and in spinal deviations frequent irregular growth of the vertebræ. If one single vertebra is unequal—if it is not level—as every vertebra serves as a basis to the vertebræ, or to the mast placed above, there

must be inclination : to correct which, it is not sufficient to draw on one side with the elongated muscles of the body,—the depressed side must be relieved from the weight above, while an auxiliary force must be employed to act with the elongated muscles.

It must be remembered that the body is constantly in motion ; that the basis supporting the vertebral column is not stationary, but constantly moving. It will be evident that it is necessary to give auxiliary power to the weak muscles, and to relieve the inter-vertebral cartilage or the vertebræ of the weight that presses above them.

Then it is easy to understand that if one auxiliary muscle could not suffice to bring the mast or the vertebral column to the perpendicular line, another supplementary force must be applied to some other point of the mast.

When the deviation of the column is caused by weakness of the muscles, which is the most common, auxiliary muscles must be employed.

When the deviation is confirmed, and when the cartilages that separate the vertebræ are unequally developed, then the weight that presses upon them must be alleviated.

In a few words, in incipient deviations caused by the weakness of some muscles of one part of the body unable to keep the vertebral column in a proper equilibrium, rational orthopedy consists in giving to the body an auxiliary muscle, or some auxiliary

muscles, to bring the vertebral column to a vertical equilibrium.

In confirmed deviations, when the inter-vertebral cartilages, or when the vertebræ are deformed, rational orthopedy will diminish the weight of the body and employ also the auxiliary muscles.

The weight of the body is the constant cause that aggravates deviation. So the system that helps the weak muscles, unable to keep the equilibrium of the vertebral column, and that which will alleviate the weight of the body that increases and confirms deviations, will solve the problem of curing spinal deviations without extensive stretching, without compressing the ribs and deforming the chest.

I must remind parents that the general causes which produce constitutional disorder and consumption are those also which produce curved spine and spinal complaints. I have compared the vertebral column to twenty-four draughts standing upright and connected by strings tightly drawn. Will not the spine incline on one side or on another during motion if the strings on one side are loosened?—Such is the first deviation of the spine. But if the strings are equally drawn, will not the spine incline on one side or another if the intervertebral substance becomes thin on one side and forms an inclined basis?—Such is the permanent deviation.

When we have present to our mind the natural conformation of the spine as it has been admirably formed by Providence, let us see if the systems

followed are likely to succeed, while they are in opposition with the laws of organization, and with the simple notions of common sense.

The three means or systems generally employed to treat and cure spinal deviations, are Extension, Pressure, and Gymnastics.

EXTENSION.

The nerves contained in the spinal column are so important to motion and sensation, that Nature has firmly protected them from external injuries, and in order that the spinal column may answer all the movements of the body, it is necessary that it should be composed of many bones ; but how many ligaments, how many muscles are necessary to render the complicated mechanism of the spine firm and secure? *Strong* muscles are spread over the posterior part of the vertebræ, to prevent the column from falling into a permanent inflection forwards ; numerous ligaments connect the joints of the vertebræ with great firmness and power ; bony processes and the ribs prevent the displacing of the vertebræ laterally. The more the organization of the vertebral column is observed, the more we see that Nature has given it all the conditions of strength and power, although the column was to be composed of so many parts ; it seems at first sight that the spinal column, being composed of so many different thin muscles and sinews, cannot resist the smallest effort, and yet this column is stronger than if it was

of a single piece. The vertebral column reminds us of the apologue of the reeds, but each of the small muscles of the vertebral column having a part to play, and a part that is balanced by another muscle, the bones that are placed between two muscles or two series of muscles, stand in equilibrium in their proper places as long as their antagonism remains perfectly equal.

One vertebra or many vertebræ may lose their equilibrium, and undergo a slight deviation, without injuring the whole column, and it is this circumstance that constitutes the temporary curvature of the spine.

Whatever may be the general or spinal cause of a deviation of the spine, certain it is that there is inequality of power or of traction in the muscles that have the charge of keeping the vertebræ in their equilibrium.

This truth being incontrovertible, let us see the effect of extension in cases of temporary deviation of the spine?

Whether vertical or horizontal, extension acts on the whole of the spine ; it stretches the muscles, the ligaments, the sinews, and the result is, a general weakness of all the muscles that have to keep the body erect. The spine stretched may appear straighter, but left to itself the spine bends in any position, and the child is unable to stand. Facts of this kind are so numerous that it is trivial to speak of them. It stands to reason that the verte-

bral column, being elongated by the extension, must necessarily lose the strength requisite to support the weight of the head, the lungs, the heart, the liver, the bowels, in fact of all the internal organs.

Decidedly, for temporary deviations, extension does more harm than good ; for a permanent deviation, in consequence of the alteration of the form of the cartilage, or of the vertebræ themselves, I cannot understand how the system that will tend to loosen and unconnect that beautiful chain formed by the spinal column, could have better effects ! All orthopedists have so well known the dangers of extension of the whole column that they have tried to limit the extension to one particular point of the spine.

For incipient deviations, as well as for permanent ones, extension is then a dangerous practice ; it *weakens* all the muscles that ought to keep the vertebræ together ; it *separates the vertebræ, elongates the sinews and ligaments, destroys their force* ; it loosens all the parts of the spine that nature would keep together by numerous links ; in fact, it stretches the spinal marrow and the blood-vessels contained in the tube of the spine ; therefore, without absolutely discarding extension, the use of it, is so restricted, so rare, that it cannot be the basis of a system, and it must only be resorted to with the greatest discretion.

One of the defects of extension, and not the less prejudicial in its results, is the necessity of confining

a young girl to permanent repose on her back, during many months, nay, sometimes during years. It would disgust us, says the learned Dr. Arnott, to see the attempt made to improve the strength and shape of a young race horse, or greyhound, by binding tight splints or stays round its beautiful young body, and then tying it up in a stall; but this is the kind of absurdity and cruelty so commonly practised in England towards what may well be called the most faultless of created things.

Unfortunately that pernicious system is not only followed in England; there are establishments in Paris where extension is the basis of treatment. To know the effect of extension, take a rabbit and pull it in different directions, holding it by the ears and the hind legs, the dangers of extension *will* then be evident.

PRESSURE.

The system that has had most application after extension is pressure. If a child wanted to straighten a stick, he would take it by each end, and bringing the curved middle against his knee, press against the curve, and bring the extremities towards him. Thus the stick would be straightened.

This is quite right for a stick, but how long has the vertebral column been like a stick? Since, when is the vertebral column one single piece? can any body take a child by the head and legs, and press on the middle of the back to straighten it?

By dividing the stick in twenty-four parts, connecting those twenty-four parts by strings, the supposed stick will take any form given to it; but the vertebral column never remains in the state in which it is put. It is a moving body that changes constantly, by the motions of the head, of the ribs, or of the lungs. It has undoubtedly a tendency to take a normal position, and that is what prevents the bad effect of machinery. The vertebral column is a living stick, to which mechanical force cannot be applied without danger. The tendency of the vertebral column is to be straight, and it is this natural tendency that most assists the medical man.

During the last ten years, some orthopedists have made much noise respecting a belt called *ceinture d'inclinaison*. Nobody can speak of it more freely than I can, for I have employed it and advocated it. But my experience has considerably reduced the merit of the belt, and considerably increased the merit of the medical man who cures a spinal deviation. Experience teaches, and it would be unwise to go against experience.

Having had the opportunity of knowing the disadvantages of MM. Tavernier and Hossard's belt, I should not be justified in leaving the readers of my first works under the impression that my opinion is the same after long experience as it was before. There is no man, on a point of science, who can pass through life with the same opinion. Every day throws new light on a subject—every day brings

progress,—and man would subject himself to scorn and contempt, were he to reverence old, obsolete practices, instead of new ones, more correct and more safe. So it would be with my views on spinal deviations.

Nature alone does not vary in the midst of an eternal change ; but the change is successive,—the change is foreseen, prepared, ordered,—the anatomist follows those changes, like the astronomer follows the motions of the celestial bodies, moving according to fixed and immutable laws. Before the anatomist nature stands unveiled, and his merit is, in investigating the admirable mechanism of human structure. In the organization of man there are fixed laws as in the organization of the world.

The law that governs the animal kingdom produces regular beings ; irregularity of shape or of form is not Nature's law, but some infraction of it. From this it results that all spinal deviations are no more nor less than some infraction of the laws of nature.

Medical men have wisely condemned the stays of the present time, those stays compressing the chest and ribs, cause mostly by that compression a deviation of the spine ; the anterior part of the chest, being flexible, yields easily to pressure, and the pressure being more or less transmitted to the vertebral column, causes deviations and torsions of the spine so common in high and fashionable life.

“ The free and easy expansion of the chest,” says

Dr. Combe, "is indispensable to the full play and dilatation of the lungs ; whatever impedes it, either in dress or in position, is prejudicial to health ; and on the other hand, whatever favours the free expansion of the chest equally promotes the healthy fulfilment of the respiratory functions. Stays, corsets, and *tight bands* operate most injuriously, by compressing the thoracic cavity, and impeding the free dilatation of the lungs ; and in many instances they give rise to consumption. I have seen a case," continues Dr. Combe, "in which the liver was actually indented by excessive pressure ; and long continued bad health and ultimate death were the result."

The first defect of MM. Tavernier and Hossard's belt is to compress the lower ribs and to deform the chest. If the compression of M. Tavernier's belt were the only objection to its employment, it would be sufficient to discard its application.

Whatever may be said in its behalf, the double leather bands that pass across the chest from the front to the back, compress strongly all the ribs on one side of the body ; it forces the front of the chest out of its natural position, as well as the vertebral column, if not in all its extent, at least in some of the vertebræ, and produces distortion of these vertebræ.

I recollect, with regret, the grief of an English lady whose child had been attended by M. Tavernier's

system, and who had brought a belt from Paris. After a year's trial, she began to suspect that she was not doing right; when the young lady had the belt on, she looked pretty well, but the moment the belt was taken off, the young lady was quite deformed; the ribs were flattened under the arms, and the chest was deformed. The ribs of the back had a projection. It was evident that the ribs had acted on the vertebræ and produced torsion. The mother could not help crying in acknowledging that in trying to cure a slight deviation she had deformed the ribs and the chest of her daughter; the deformity was not cured, but changed.

The lever-belt of Tavernier's system is one of the strongest that can be applied to the body, although it does not appear so, at first sight. Ladies very seldom understand what is a lever, and consequently they are easily deceived as to the strength of that instrument. In the hands of a medical man that lever may be employed with some advantage, but the cases of spinal deviations in which it may be used are very rare. Let us consider its action.

The belt is placed round the hips, to give it strength, and to diminish the effects of the counter pressure, it is very large. On the belt is an iron stem, not flexible, but inclined; then a leather band, that covers all the ribs transversely and pushes the body out of its equilibrium, is attached to the iron bar or stem; the young lady feels that she is thrown

out of her centre of gravity ; to be able to stand, she must resist the pressure on the ribs, and in that resistance is the prospect of cure.

But to attain the object of M. Tavernier's system, his belt is not necessary to those who understand it ; it is sufficient to give a loaded basket to carry, to obtain the same result as Hossard's apparatus. I have lately seen in London a *self-regulating apparatus* said to be an improvement of M. Tavernier's system, but the author proves by his apparatus that he had never the least notion of it. That self-regulating apparatus is nothing more than a support with crutches under the two arms. Mr. Amesbury himself has taken great care to say that his system differed from that of M. Tavernier. It is to be regretted that he had not a more perfect knowledge of the *ceinture d'inclinaison*.

According to Mr. Amesbury, Tavernier's belt operates only on two curves. It cannot be used when the muscles are weak. It acts only on one deviation. It compresses the chest. It carries the body in an opposite direction.

Mr. Amesbury's observations are perfectly correct, but more may be said. The *ceinture d'inclinaison* compresses the hips so much that blisters arise. Very often the leg on which the under strap is applied is benumbed.

In weak and delicate girls, it carries the body in a contrary direction, and it changes the deviation without curing it.

With some weak and indolent girls, the stay that goes across the ribs, becomes a support, girls lean against it, and the deviation, instead of being cured, increases.

But my aim is not to show the defects of the existing systems ; it would take too much time to follow that criticism. I have employed all these means. I know what is done in France and in England perfectly well. Comparison has enabled me to judge and to choose ; and it is after comparison and experience that I tried to improve, and I think to do better, in employing more rational means than those employed in the existing orthopedic establishment. According to all orthopedists, the most powerful machines are employed to straighten the human body. It seems as if that body was entirely of iron ; iron levers, iron springs, bars of all sorts, are employed with young delicate girls, and present the most horrid contrast.

To know the power of strings, it is sufficient to look on the effects of stays. Stays without bars, and not of iron, may compress the chest to a degree that suffices to deform it. If a man has one of his straps tighter than the other, that is sufficient to make him walk crooked. And yet what is a strap ? Generally a double piece of tape or ribbon. If that be enough to make a healthy and robust man feel and walk on one side, why then employ iron bars and iron rods with young and delicate females ?

The prejudice had at last grown up, said Dr.

Arnott, that strong stays should be put upon children very early, to prevent the first beginning of the mischief, and that a child should always be made to sit on the straight-backed chair, or to lie on the hard plane ; and it is probable that if these cures and precautions had been adopted as universally and strictly as many deemed them necessary, we should not have in England a young lady whose back would be straight or strong enough to bear the weight of her shoulders and head.

Nothing is easier, says the same author, than to prevent spinal deviations. The best cures are those conducted on the general principles of improving the health of the patient, and using exercises which directly strengthen the affected part. But how could children tied on a board, or on an inclined plane, or on some iron bar, take proper exercise ?

For exercise to restore a distorted form, exercise must be taken not at random, but according to the laws of statics, and those laws are only known to the philosopher. Training children is an art more difficult than training horses, and yet how rare are proper and skilful trainers for animals ?

To say that exercise must be employed to cure spinal deviations is very easy ; but to say what exercise is applicable to each case is, on the contrary, very difficult. There is an exercise that does not invigorate, but fatigue, and it is that which is not adapted to the state of the body. The most proper exercise for the treatment and cure of spinal devia-

tion is that which will give to the body its normal state. If the body is exercised while two antagonist muscles act unequally, the resulting will be inclined on the side in which the traction will be greater, by the effect of the muscles, or by that of gravitation. In order to give a proper resulting force, the two antagonist muscles must be of equal power. If the muscles of the right side are weaker than those of the left side, it will evidently be necessary to apply on the right side a supplementary force to counteract the effect of the left.

Let us again have recourse to the mast. To stand on a moving basis, it must be equally drawn by ropes of equal power.

When one of the ropes is not strong enough to counterbalance the power of its antagonist, the mast loses its equilibrium, and being inclined on one side one of the ropes becomes useless, while the other is unduly stretched and elongated.

While the column is in equilibrium on its basis, each string uses in turn a very slight effort ; but if *C* is lengthened, *D* is then at liberty, and *C* bears all the weight of two strings. The column being out of its equilibrium is continually attracted by the power of gravitation. To bring in equilibrium the column inclined, a double force is undoubtedly necessary.

Such is the simple proposition on which *rational orthopedy* is based.

In deviations, the muscles of one side of each articulation alone bear the weight of the bones and of the

body. The more it is lengthened by the effort of the bone and the weight of the body, the more it is weakened and unable to fulfil its normal functions. While the antagonist muscle is contracted, the other is extended, the resistance is diminished, and every day the deviation increases.

Let us take a deviation in which the arc is very marked. I had to attend a young lady of fifteen, whose back presented this unusual form ; she was tall and thin, for she had grown very rapidly. This diagram is a true representation of her state.

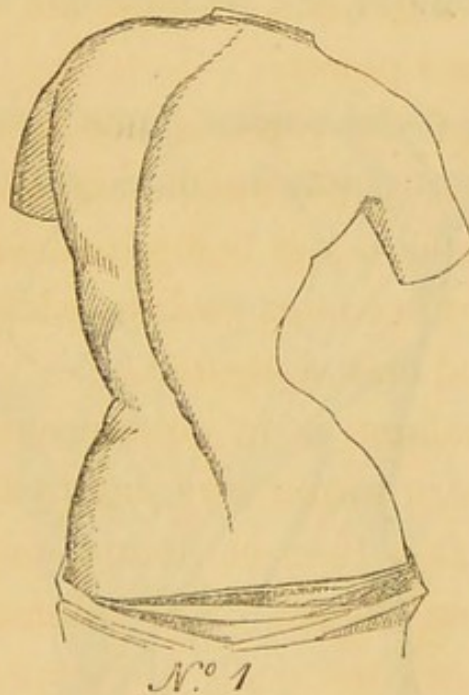


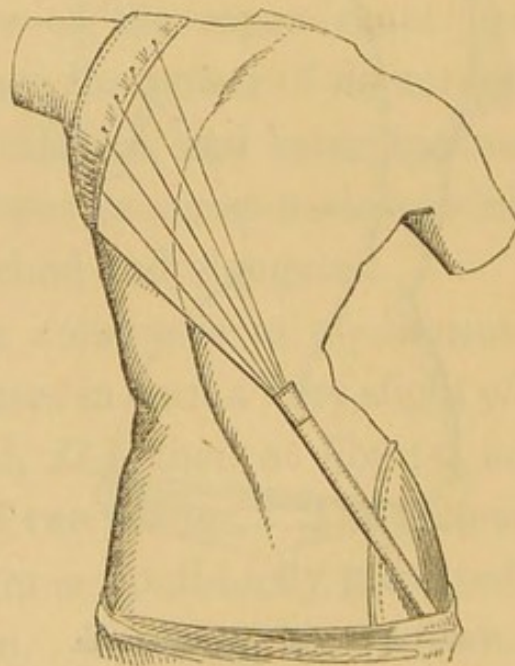
Figure of Lady A. before treatment.

A body that is drawn by two unequal powers, that are situated in a state of antagonism, must follow the course of the stronger, as if it was drawn by that force only. Such is the present case. The muscles of the right side are contracted, while those

of the left are lengthened and weakened. It is easy to understand that the weak muscles are unable to bring the body to its equilibrium.

While the body bends on the right side, the muscles of the left passively follow the curve of the spine.

There was in this young patient a rotation of the spine; all the left side was forward, all the right side backwards. The rotation of the whole body was so marked, that she always walked on one side. I applied an apparatus in order to remind the young patient of her distortion. This apparatus is represented by No. 2.



No. 2.

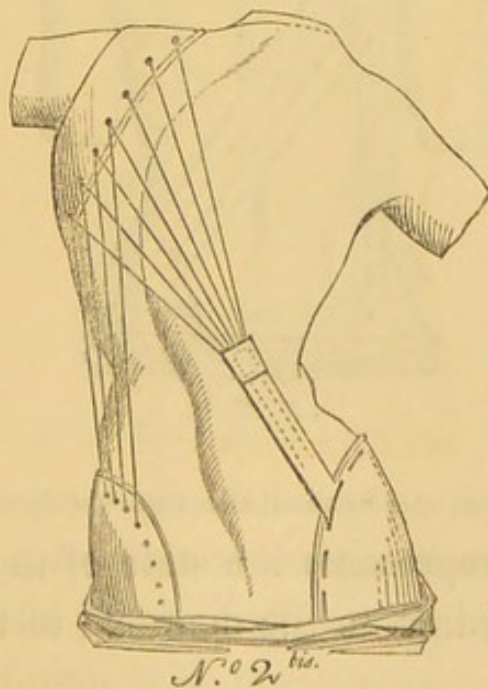
First apparatus used by Lady A. for Distortion of the Spine.

In many lateral curvatures of the spine there is more than a deviation, there is sometimes a distortion. The spine is turned on the axis of the lumbar

vertebræ. That kind of distortion is common in young delicate females playing on the harp, as was the case in this instance. The first thing to be done was to apply the forces so as gently to bring the left side on its proper axis; but this apparatus could only act against the torsion.

In less than three months the desired effect was obtained, the body was very little distorted, but the inclination of the right shoulder persisted. My first efforts had only been directed to the state of the torsion; this being in a better state, I directed the course of the forces to obtain a resulting force whose diagonal represented the parallelogram of the back.

The left side being subjected to the actions of two moving forces, each of which would separately

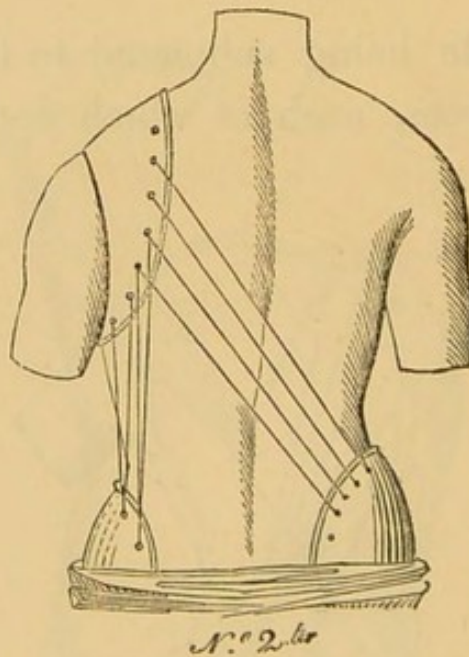


Second apparatus used by Lady A. for Lateral Curvature of the Spine with Distortion.

cause it to describe a parallelogram, the side was drawn in the course of the diagonal ; in the preceding figure, the diagonal passed from the hole of the fourth string to the basis of the vertebral column.

Parents may be deceived by the apparent simplicity of these diagrams, but they contain in reality the highest problems of dynamics.

Varignone, one of the greatest mathematicians of the last century, passed his life in the elucidation of the second law of motion, which is, that every change of motion is proportional to the force impressed, and is made in the direction of that force.

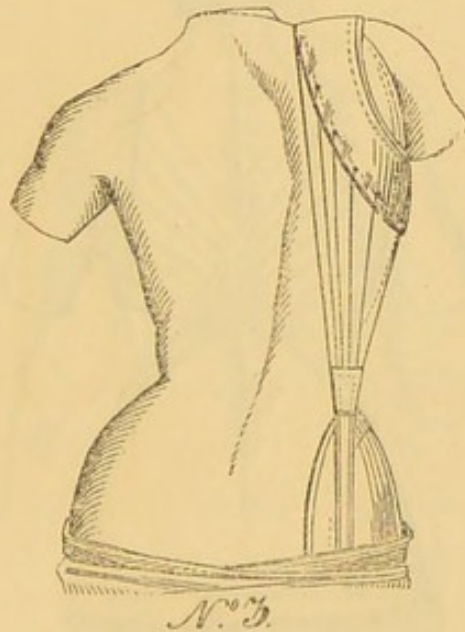


Apparatus, when regulated, after a year's attendance.

This figure represents the state of the young lady attended, according to the diagonal of the parallelogram of forces.

The principles of the composition of forces is of

the most extensive application and utility in mechanics. Before completing his great work, Varignone passed days and months in dissection to study the admirable laws of nature in the various motions of the human body. The principle of composition of forces, says that great mathematician, is sufficient to determine the equilibrium in every case, for by composing successively all the forces two by two, and taking the resulting force as a new force, we arrive at a force which must be equivalent to all the rest.

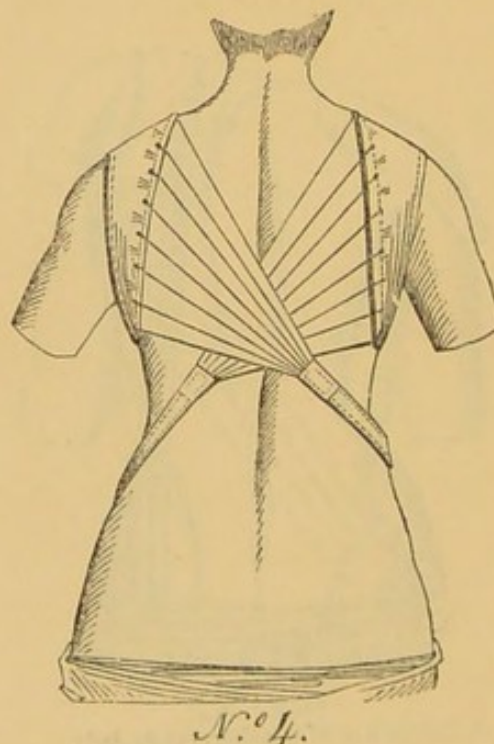


A Curvature of another young lady.

Such is the principle followed in the present diagram, the supplementary strings that are resorted to are antagonist of the left merely, and the result of all those forces is a new force that determines the equilibrium of the body.

But what nicety this system requires ; as soon as one of the forces is stronger than the antagonist the equilibrium is lost, the treatment erroneous. Equilibrium therefore requires equal power of the forces, and notwithstanding this equality of power the basis on which the column stands must resist the combined effect of traction.

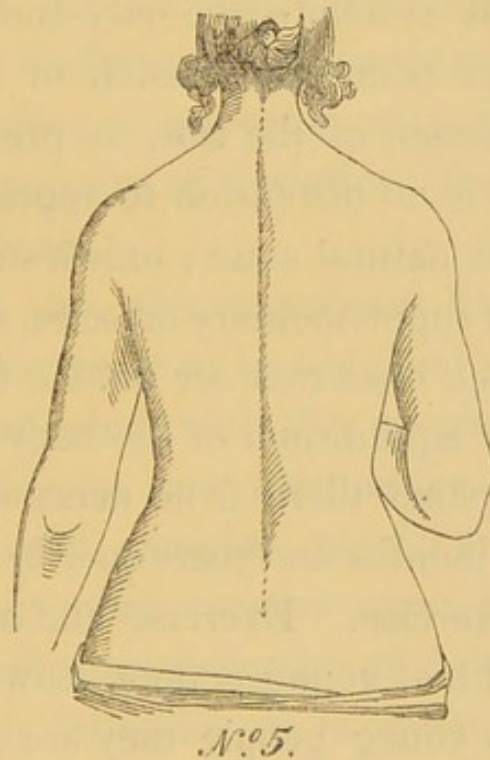
There are cases in which it is necessary to apply not only supplementary force on one side, but on both sides, in consequence of the weakness of the muscles of the body. In those cases the young lady has the following apparatus ; but the equiva-



lent force of each side is not always directed as in this figure ; this apparatus is of the greatest service when the shoulders are out. This kind of debility of the back is found frequently in young

ladies after treatment of spinal deviations by extension or inclined plane; they feel weak, unable to support themselves, and the spinal column is waving, without being able to keep its proper equilibrium. In all cases which are common in young people growing rapidly, or having been treated by the stretching system, or after an illness, this apparatus is principally applicable.

The following drawing has been taken from the back of the young lady whose figure has been presented in No. 1.



State of Lady A. after her treatment.

After two years and a half attendance, without any interruption in her studies, she had nothing to wear but the laces and ribands that formed her apparatus,—nothing preventing her going out in town, or in the country.

But, again, I say, let no mother be deceived by the apparent simplicity of this system, unless she understands how to find the *diagonal of a parallelogram of simple forces*, she will never be able to take advantage of the only system of dynamics that can with safety and comfort be applied to young ladies.

The advantage of this system is obvious. To find the antagonist force necessary to counterbalance the excess of traction of the muscles of one side, and the effect of gravitation on a body that has lost its equilibrium, is a very scientific task ; but the application of this system is the only one *that has no danger*. There is no compression of the chest to fear, no deformation of the ribs, no pressure of the breast ;—there is no distension to apprehend. The body is left to its natural state ; only a supplementary muscle, or many supplementary muscles, are employed to help the weak ones that are unable to fulfil their functions in the equilibrium of the body.

With that system there is no necessity to live in doors—to pass months and years on a bed—to perish from want of exercise. Exercise and air are necessary to the health of young people, as well as to that of adults. To young people they are as necessary as bread, for the medical man who knows how to find the compound course that may arise from the joint actions of three or four or more simple forces, gymnastics present innumerable advantages. He will find in playful exercise the means of curing the deviations of the body, and of invigorating it.

I have frequently established in school-rooms *playthings* that had the best results. Ropes, pulleys, swings, wands, dumb-bells, ladders, winches to turn ; such were the instruments I used to obtain success in spinal deviations. I took care to imagine the most pleasant way of taking exercise. Not unfrequently I have advised riding to cure spinal deviations, but the saddles were made expressly for that purpose, and the young lady sits according to my directions.

In all incipient deviations, when there is not an alteration in the cartilages and bones of the vertebræ, these inoffensive and simple means will obtain the best results ; to a greater evil a greater remedy ; but in the majority of deviations there is no alteration in the bones.

Again, I say, the compound force of different tractions is the point to be obtained ; but anatomists alone can succeed with the proper knowledge of organization—the anatomist alone can understand which are the muscles requiring an additional force, and in what manner must be directed the diagonal of the parallelogram of simple forces.

The mode of finding a compound course arising from more impulses than one is not an easy task. Among the greatest philosophers we find the names of Archimedes, Galileo, Torricelli, Huygens, Newton, Descartes, Varignone, D'Alembert, De la Place ; in fact, the most eminent mathematicians in the world.

Let the reader remember that the vertebral column is composed of twenty-four bones, that each of these bones has antagonist muscles, and that, if the straight station keep these muscles in action, the motions of the vertebral column changing constantly double the actions of the muscles, and each step presents a new diagonal.

Rational orthopedy consists, therefore, in applying the laws of motion according to what is revealed by nature itself. Rational orthopedy is the knowledge of the laws of equilibrium; the notion of the diagonal of a parallelogram of simple forces; the research of the resolution or composition of forces, represented by the muscles of the body; the application of the composition of these forces, according to the laws of the organization and of the dynamic of living beings. Then it is the employment of strings, ribands, laces, to act as supplementary muscles, in order to obtain the equilibrium of the body.

Such is the system, the most sensible, the most rational, the most in accordance with the laws and provisions of nature for the treatment of spinal deviations, caused by weakness of the muscles, by bad attitudes, irregularities of growth, delicacy of health; the human frame is organized to stand, and to stand by the combined forces of the muscles, and not to stand by iron supports.

In another memoir I shall explain my views on the treatment of permanent deviations of the spine, and I shall speak of the worst forms. I beg my

readers to remember that I am perfectly conversant with what has been done in England and in France, and with what is doing now, and it is only after an experience of fifteen years, that I venture to bring forward my views, enlightened by a long and successful practice.

In my last work on *Growth, or Health and Diseases of Youth*, I pointed out the various maladies to which young females were liable in consequence of irregular growth, and I advise parents, who desire to have some knowledge on that very important subject, to read my observations: I hope they will find the explanation of many diseases of youth which hitherto have been neglected, or very little known by the majority of authors.

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