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The Therapeutic Value of Systematic Passive Respiratory Movements

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HENRY LING TAYLOR, M.D.

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THE THERAPEUTIC VALUE OF SYSTEMATIC PASSIVE RESPIRATORY MOVEMENTS.[1]

THERE is little doubt that the specialization of occupations and pursuits which is such a marked feature of modern civilized life, notably in our cities, has been in some respects a detriment to our physical development. If the hand worker is now less frequently starved outright, he is perhaps more often deprived of sufficient light and wholesome air, and his physical and mental activities restricted to a narrow range. In the commercial and head-working classes excessive competition stimulates, and often necessitates, a war of wits, which is usually associated with sedentary habits, and frequently results in starvation of the tissues, in a spindling or flabby physical type, diminished fertility, and stunted asymmetrical offspring. When we come to analyze it, we find that modern city life among all classes, in spite of much superficial variety, is characterized by nothing so much as narrowness if not monotony, and this is as true of the leisure classes as of any. What can possibly exceed in inadequacy of neuro-muscular experience the routine activities of a man or woman of fashion? Probably nothing; but many of our professional and business men working in narrow grooves, under continuous strain, and innocent of the rudiments of a common-sense hygiene, many of our over-worked women and high-pressure children certainly run a good second.

Important regions of the body, as the shoulders, back, and loins, and especially the chest, with the thoracic and abdominal viscera, suffer from our restricted and feeble muscular experiences, with the result of diminished neuro-central tone and general vigor, and it seems to me we

[1] Read before the Section on Theory and Practice, of the New York Academy of Medicine, March 19, 1889.

frequently have a combination of restriction and irritation, well calculated to produce one-sided and unwholesome, instead of well-rounded and robust, development of the organism. There are always feeble individuals, and competition is always hard on the feeble; with increased friction we must get increased detritus.

Flat and narrow chests, and diminished respiratory power, with feeble vital energy and small endurance, are the frequent expression in the second generation of imperfect circulation, assimilation, and innervation, the result of deficient, one-sided, or strained activity in the parents. Thus we can conveniently group, for purposes of study and treatment, those conditions resulting from, or dependent on, deficient chest aspiration. The condition of deficient chest power has long attracted the attention of physicians, and many efforts have been made to develop chest capacity and to increase respiratory efficiency, by gymnastic exercises, especially of the upper extremities, by voluntary attempts at deep breathing, by modifications of air-pressure, and by other means.

All things considered, a prolonged out-of-door life, combined with moderately active but varied exercise in the open air, probably furnishes the best remedy for many of the cases we are considering.

Systematic gymnastic exercises, as usually given, are far from satisfactory for this special object. They are not adapted to the weak and feeble, and they are open to the objection that while pulse and respiration are considerably accelerated, the conditions are not favorable for thorough lung-expansion. In order to pull, push, or lift with the arms, the breath is instinctively held in order to immobilize the thorax, which is the fixed point from which the shoulder muscles work under these conditions. This is a fundamental difficulty, and, as a matter of fact, we notice that boxers, oarsmen, athletes, and porters, who are characterized by great muscular development about the chest, are frequently round-shouldered and of poor endurance. Measurements are easily increased by piling up muscle on the thorax without necessarily increasing respiratory capacity. Dr. Stanton Allen tells

me that a well-known gymnast in this city, who has a chest expansion of ten inches, and enormous muscular development, blows less on the spirometer than before he developed his muscles, and that the same has been noticed in some of his pupils. Of course, gymnastic exercises will increase chest measurement by overlaying the thorax with muscles, and probably in most instances, if judiciously used, real chest expansion will follow from the increased demand; but there will always be the objection I have named in using it in sick people, or primarily for chest expansion. I believe that it may produce chest contraction if injudiciously employed.

Voluntary deep and measured breathing can without doubt accomplish something, but its application is much restricted by its irksomeness and the fatigue it produces. Let anyone take forty or fifty successive full inspirations, and he will find it very tedious and very tiring work.

I can conceive that the respiratory efforts which accompany the inhalation of gases, now systematically practised for various purposes, may have some value as a respiratory exercise. Is it not possible that certain much advertised nostrums may be kept alive by the fact that the method of administration involves an imperfect respiratory exercise?

Is there, then, any method by which we can expand the chest freely and regularly, for considerable periods, without undue fatigue to the patient; any way to automatically stimulate this automatic function?

Among the exercises based on the Ling system, which my father used on beginning practice in 1856, and which will be found figured and described in his book,[1] is one where the patient is seated, while the operator, standing on the bench behind him, lifts up the shoulders with the hands under the axillæ; one of his knees supports the patient's back, which is arched backward to produce full inspiration. In another movement the operator, standing as before, grasps the patient's hands and pulls the arms upward and backward against his resistance, after which the patient pulls down the hands of the

[1] Theory and Practice of the Movement Cure. 1860.

operator until they lie in front of the chest;[1] this was also given as a purely passive movement, like Sylvester's artificial respiration. These and similar movements were very much used for many years in his practice to increase chest expansion and as a general tonic. Very soon Dr. Taylor began to substitute for the hand of the operator, in many of the active movements, a graduated mechanical

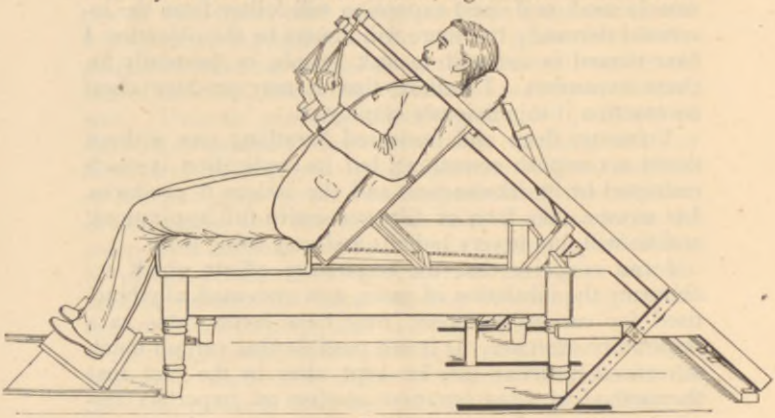

FIG. 1.

resistance, and about 1872 he devised apparatus by which the most important passive movements were given by steam power, among them the passive respiratory movement I have mentioned. This apparatus, called the "respirator" (Fig. 1),[2] has been in constant daily use since then, and has proved itself a most valuable therapeutic aid, far exceeding the old hand-method in efficiency. We use two respirators, one giving thirteen and the other sixteen full respiratory movements a minute, and the strength of the pull can be exactly regulated. The movement is a purely passive one, except that the handles of the apparatus are grasped by the patient. The patient is seated on a reclining couch, the main levers, bearing the handles, pull

[1] Op. cit., pp. 216, 217, ed. 1864.

[2] The illustrations were not finished in time for insertion in THE RECORD.

the arms of the patient strongly upward and backward, while the chest is arched by the simultaneous backward movement of the upper part of the back of the couch (Fig. 2). The main levers are, for most purposes, so adjusted as to slightly raise the patient from his seat at the limit of motion, after which they move downward and forward, allowing the arms to drop by the sides, and the upper part

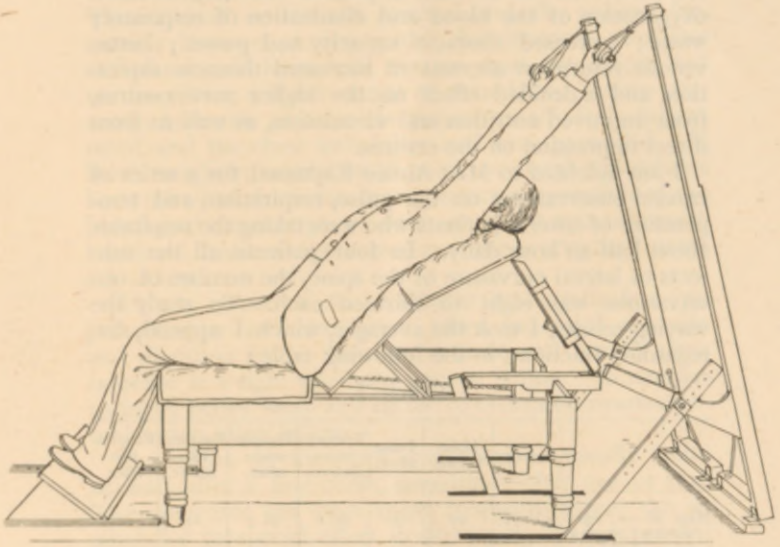

FIG. 2.

of the back of the couch swings forward on its hinges, to favor expiration. The exercise is given for from ten to thirty minutes at a time, or with the more rapid machine, from one hundred and sixty to four hundred and eighty full regular inspirations and expirations at a visit. The respirations of the patient coincide automatically with the movement of the machine.

The actuating mechanism of the respirator consists of two eccentrics symmetrically placed on a counter-shaft; these operate two cranks, to which the long L-levers car-

rying the handles are pivoted in such a manner that the pivots can be shifted on the crank and lever, and the extent of the stroke increased or diminished at will. The eccentrics also operate the levers which give motion to the adjustable back of the couch. The machine is stopped by shifting the belt to a loose pulley.

Theoretically we should expect, as physiological effects from the use of such a passive exercise, increased oxygenation of the blood and elimination of respiratory waste; increased thoracic capacity and power; better venous return on account of increased thoracic aspiration, and a decided effect on the higher nerve-centres, from improved nutrition and circulation, as well as from direct impression on the centres.

I am indebted to Miss Aimée Raymond for a series of careful observations on the pulse, respiration, and temperature of several patients who were taking the respirator about half an hour daily. In four patients, all the subjects of lateral curvature of the spine, the number of observations was eight to thirteen each. To study the varying results, I took the averages, which I append, disregarding fractions, in the following table:

TABLE I.

	Average	Pulse before.	Pulse after.	Temperature before.	Temperature after.	Respiration before.	Respiration after.
Miss M——, aged sixteen; respirator one-half hour.	13 days.	92	90	98.1	98.3	24	24
Miss B——, aged seventeen; respirator one-half hour.	11 days.	94	92	98.7	98.8	27	25
Miss W——, aged eighteen; respirator one-half hour.	13 days.	85	87	98.2	98.8	18	18
Miss L——, aged fourteen; respirator twenty minutes.	8 days..	88	90	97.9	98.0	20	19

From this it is seen that in the two with the slower pulse an increase of about two beats was noted, while in the two with the more rapid pulse a decrease of the same

amount followed the use of the respirator. In two the respirations remained at the same rate after the exercise, and in two they were slightly diminished in frequency. In every one of the four the average temperature under the tongue was found slightly increased after the exercise —the general average being 98.2 before exercising and 98.4 after—due, as I take it, to increased oxidation.

We notice, clinically, that the circulation improves. The cerebral centres are soothed and the patient frequently becomes drowsy under the repeated effortless stimulation of the centres, for we must not forget that we have here a direct means of stimulating certain centres. After the exercise the patient usually feels invigo rated, and the chest feels fuller and more expanded. If there has been mental or physical overwork the patient feels refreshed, from the more perfect oxygenation of the blood, and the exercise of neuro-muscular arcs habitually neglected, while at the same time the overworked areas are at rest.

After a course of the respirator we usually find improved color and circulation, often improved appetite and digestion where these are at fault, and usually some increase in weight when the patient is thin. In nervous patients, better sleep and better co-ordinated neuro-cerebral action often follow.

The effect on the chest expansion is usually quite marked after a few weeks, sometimes after one or two. The respirator has been most frequently given, not so much for its special effect in developing chest expansion as for its effect on the circulation, and as a general and special tonic. But during the last five or six years I have made, from time to time, a considerable number of careful chest measurements. I have taken fourteen cases without selection, except that cases of well-developed lateral curvature of the spine are not included (Table II.), and find that the measurements, after a month or two of the respirator—usually six times a week for from twenty minutes to half an hour a day—has produced an average gain of just about one inch in the chest measurement on full inspiration.

TABLE II.

No.	Sex.	Age.	Date.	Chest, inches.	Date.	Chest, inches.	Number of months.	Gain, inches.
1.	M.	14	Oct. 11, 1883	27¼-30¾	Nov. 13, 1883	27¾-31¾	1	½
2.	M.	16	Oct. 11, 1883	27½-31	Nov. 13, 1883	27½-31¾	1	¼
3.	M.	15	Feb. 18, 1884	30¾-34	March 21, 1884	30¾-34⅛	1	⅛
4.	M.	15	Jan. 23, 1884	30½-32¾	March 21, 1884	31-34	2	1¼
5.	M.	19	May 26, 1884	33¾-36½	July 9, 1884	35-37½	1½	1
6.	F.	35	Dec. 1, 1884	28-29½	Feb. 16, 1885	28½-30½	2½	1
7.	M.	15	Oct. 4, 1886	31¼-32¾	Nov. 2, 1886	31¾-33⅜	1	1⅛
8.	M.	16	Jan. 5, 1887	31¾-33	Jan. 17, 1887	32¾-34	½	1
9.	F.	8	Sept. 9, 1887	20½-22½	Oct. 23, 1887	22-24	1½	1½
10.	F.	11	Sept. 21, 1887	24½-26½	Nov. 12, 1887	25-27	1½	1
11.	F.	9	Oct. 1, 1887	24-25¾	Nov. 12, 1887	23¾-25½	1½	¾
12.	F.	7	Feb. 5, 1887	23½-24	April 7, 1887	24½-26½	2	2½
13.	M.	16	April 19, 1888	30½-32	May 30, 1888	31¼-32¾	1½	¾
14.	M.	18	April 4, 1888	31¾-33	May 3, 1888	32-33¾	1	⅞

The patient often continues to gain in chest measure for a considerable time, even when the visits are much less frequent, but the rate of increase is not so rapid after the first two or three months. When the exercise is discontinued frequently some of the gain is lost, but a good deal is retained. In all of the fourteen unselected cases there was some gain at the end of the short period given. Whatever the amount of gain in chest capacity, there is nearly always marked improvement in health.

A lady, aged thirty-five, not included in the table, who was taking the respirator for its tonic action, told me that the waists which had always fitted her had become so much too small after a month of the exercise that she was no longer able to put them on, though she had not gained in weight. It should be remembered in considering these results that they were all obtained in delicate, or even sick people, with particularly deficient chest capacity. Chest measurements are subject to many inaccuracies, but we can, I believe, get useful information from repeated observations.

This exercise is particularly useful in cases of flat, narrow, shallow, weak, and inelastic chests, whether due to faulty development, phthisical predisposition, old pleuritic exudations, round shoulders, or other causes; but, valu-

able as it is in such cases, I believe that still greater benefit is derived from passive respiratory movements systematically employed in the actual physiological and clinical effect of the exercise, irrespective of its expansive power on the thorax.

Lateral curvature of the spine always diminishes respiratory capacity, and for this and other reasons I prescribe this exercise for such cases in connection with other treatment. Lateral curvature is one of the most difficult things to treat in orthopedic practice, and I do not claim to be always able to secure brilliant results; but I have noticed that whatever be the effect I am able to produce on the curvature, my patients almost invariably improve in health and vigor. The exercise is indicated in anæmia and in convalescence from exhausting disease. Another class of cases in which its use is followed by particularly gratifying results is that of the functional neurotics, ranging from anæmic, delicate, and overworked persons—women especially—of flabby fibre and feeble respiratory power, through the victims of backache, headache, the neuralgic, dyspeptic, and semi-uterine type, up to the well-developed neurasthenics and hysterics, even including the bed-ridden neurotics. This is a large and heterogeneous class of invalids, many of them very great sufferers, who should command our best skill and sympathy. In no class of cases is routine treatment of any kind less applicable. Each case must be treated and guided on its own merits after the closest analysis and discrimination of the conditions and indications. In nearly all, however, we need to improve the quality of the blood and the general health, and to regulate nerve-centre action. The respirator is one of the means at our command to fulfil these indications. For we have here (and this is only one of many exercises, but perhaps on the whole the most important) a means of directly affecting the nerve-centres as well as the circulation. We may begin with special exercises in bed, if need be, and after a time are able to add the passive respiratory and other passive movements in the exercise-room. This idea is perhaps the most fruitful of any in connection with the application of

the respirator, but I have not time to develop it here. I refer those interested to a paper on "The Hygiene of Reflex Action," published last March in the *Journal of Nervous and Mental Disease*. I wish to call attention to the circumstance that the action of the respiratory and similar passive movements for the trunk and extremities have this in common with the use of massage, electricity, and hydro-therapeutics—all valuable when used for specific indications—that they act directly on the nerve-centres by peripheral stimulation. But I emphasize a marked difference in the kind of stimulation. The respiratory and similar movements are not a simple shock or stimulus, or shower of stimuli, to the centres, but train and educate them in coherent associated movements by a series of changes in position and muscular tension of the arms, trunk, and thorax, and modify their tone and action by a series of impressions on the centres which react to changes in the respired air and circulating blood. Each has its appropriate indications and inherent limitations ; I simply note a difference. There is an equally radical and important difference in the general effect produced by such exercises, and by gymnastics, which consists in the almost total absence from the former of voluntary or violent effort and consequent fatigue, rendering them applicable to the very weak and delicate. Here, too, each has its appropriate field.

The application of systematic, passive respiratory movements to the treatment of some forms of organic heart disease, and to certain diathetic vices and faults of elimination where it might seem indicated, remains to be studied ; but we have in them a tested means of—

1. Expanding and strengthening the chest, and invigorating the respiratory function.
2. Oxygenating the blood.
3. Equalizing and toning the circulation.
4. Regulating and co-ordinating nerve-centre action.
5. Improving general vigor.

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