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MOUTH-BREATHING - ITS POST-OPERATIVE
TREATMENT BY RESPIRATORY RE-EDUCATION.

THESIS FOR THE DEGREE OF M.D.

by

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INTRODUCTION.

It may be thought that some excuse is required for a description of such a simple method of treatment as respiratory re-education. It is certainly a simple matter, but I am convinced of its efficacy. I have been interested from very early years in mouth breathing, especially of functional origin, having been myself addicted to the habit when a boy. In my case, it was proved by Dr. Bickersteth, of Liverpool, whom I was taken to see, that there was no anatomical basis for the evil habit. So far as I can remember, I commenced to breathe by the mouth during a prolonged attack of coryza, and continued to do so after the coryza had disappeared. I found it absolutely impossible to breathe by the nose.

I have since had many such cases brought under my notice.

Treatment was partly psychical, partly therapeutic, I being led to believe that breathing by the mouth was, in some obscure manner, morally wrong. A similar feeling appears to exist in relation to left-handedness. I suffered a good deal in consequence, and, though recognising the value of suggestion in treating cases of functional mouth-breathing, I have always been careful in my own practice to restrict its use. I certainly tried very earnestly to acquire the habit of nasal respiration/

respiration, and at the end of about two years, after many dreaded visits to my physician (I did not appreciate the nasal douches and digital post-nasal examinations), I succeeded in establishing a physiological nasal respiration.

No wonder, then, that I was much impressed, when working in Dr. Lermoyez's clinique in Paris (1903 - 4), by the results of systematically planned respiratory exercises, which were then being carried out by Dr. Georges Rosenthal. A case of a young lady, 21 years of age, who had been a mouth-breather for at least seven years, cured in four lessons, extending over a period of a fortnight, was so surprising, in comparison with my personal experience, as to command attention and investigation of the subject.

The case is fully reported on page 77.

Subsequent experience has only enforced the lesson of the value of respiratory exercises in functional buccal respiration, and as a complement to surgical methods in cases of organic nasal stenosis.

As I have occasion to point out more than once in this paper, respiratory exercises are only of service when there no longer exists any anatomical obstruction in the continuity of the nasal passages.

They/

They are useless as a substitute for surgical operations in the nose and post-nasal space.

Otherwise, the treatment is a perfectly rational and physiological one, and it is doubtless to this fact that the encouraging results of nasal respiratory re-education are due.

CHAPTER I.NASAL RESPIRATORY INSUFFICIENCY.

The term nasal respiratory insufficiency is used very comprehensively and conveniently to designate all those conditions of unphysiological respiration, whether of organic or functional origin, which depend upon an interference with the free and sufficient entrance of air into the nasal respiratory passages. (1) It was introduced by Vacher, of Orléans, who defines nasal respiratory insufficiency as that particular state, permanent or intermittent in which any individual is placed who cannot draw into his lungs, exclusively by nasal respiration, an amount of air amply sufficient for the oxygenation of the blood.

It will be seen that the term is not synonymous with, but includes, nasal stenosis, for many mouth-breathers have no constant organic obstruction in the nasal passages, sufficient to prevent their breathing through the nose./

- (1). Vacher, Louis. L'insuffisance nasale; ses formes; ses causes; ses conséquences.
La Presse Medicale. 1905. 754.

Nasal respiratory insufficiency is permanent if haematosis cannot be effected solely by air respired through the nose, when the subject is in the upright position, seated or standing, intermittent if this only occurs when the dorsal decubitus is assumed. With regard to the latter condition, nothing is more common than the statement of a patient to the effect that nasal obstruction does not exist so long as the erect attitude is maintained, but that when the head is placed upon the pillow only a very short time elapses before the nose is completely blocked and nasal respiration becomes impossible. The explanation is that the tone of the cavernous tissue of the nose is so lax that the increased venous pressure caused by the horizontal position is sufficient to temporarily dilate the turbinal mucosa and prevent nasal respiration.

Often it happens, when in the lateral decubitus, that it is only on the side which is for the time being undermost that nasal stenosis is present. This swelling of the cavernous tissue is especially common in children, and as children pass a large portion of their time lying down, intermittent nasal insufficiency has a serious signification, leading to the habit of permanent buccal respiration.

One has only to observe those present in any assemblage/

assemblage to be struck by the considerable proportion of people who are guilty of buccal or naso-buccal respiration. Very common indeed in children it is only too often seen in adolescents, and even in adults. Occasional indulgence in mouth-breathing appears to be fairly universal, except in the case of singers and speakers who have learnt to breathe correctly and have too much respect for their health, and knowledge of their art, to permit air to enter their lungs without a preliminary sojourn in the nasal passages. As recently pointed out by Major Austin,⁽¹⁾ many people (medical men not excepted) labour under the delusion that in ordinary circumstances they habitually breathe through the nose, and yet in conversation more often than not, at the end of each sentence the breath is drawn in through the mouth with a quick shallow "gasp." These people are actually the subjects of a functional, intermittent, nasal respiratory insufficiency.

Before entering upon a description of the causes of insufficiency it is well to observe that action and reaction is such that nasal respiratory insufficiency, howsoever established, by lowering the atmospheric pressure in the nasal passages, may induce any of those morbid/

(1) Austin, R.F.E. Respiration and Pulmonary Tuberculosis. Brit. Med. Jour. 1906. II. p 1890.

morbid states, such as congestion of the nose and post-nasal space, leading ultimately to the formation of adenoid "vegetations", or to hypertrophy of the turbinals, to which nasal stenosis is ascribed.

Matters thus work in a vicious cycle, at the expense of the sufferer; a functional causing, or augmenting, an organic insufficiency.

Nasal respiratory insufficiency is of organic or functional origin, or more frequently it is mixed organic and functional.

Organic Nasal Insufficiency.

The causes of nasal respiratory insufficiency are classified as Nasal, Naso-pharyngeal and Bucco-pharyngeal.

Nasal Causes. (1) Vestibular. The most frequent causes of nasal insufficiency at the anterior nares is collapse of the alae nasi, brought about by faulty formation of the lateral cartilages of the nose, or due to the fact that in mouth-breathing the dilatores nasi, from non-use have lost their muscular tone and the nasal orifice has in consequence become narrowed. The weakest point in the lateral walls of the nose is that part below the lateral cartilages, just opposite the junction of the vestibule with the nasal cavity proper/

proper.

In the subjects of buccal respiration there is a marked pit or depression on the alae of the nose at this spot, which is pathognomonic of ^{the} condition.

It sometimes happens that a patient can breathe slowly and quietly through the nostrils, but that on taking a sudden and deep inspiration the alae close, like valves. This vestibular form of nasal insufficiency frequently persists after ablation of an hypertrophied pharyngeal tonsil.

(2.) Nasal fossae proper. The obstacles to free nasal respiration met with in the nasal fossae are numerous, the chief being:-

a. Stenosis of the bony framework, from narrowing of the superior maxilla, causing the hard palate to be highly vaulted and so encroach upon the floor of the nose. At the same time the lateral nasal walls are narrowed. This condition and some of its effects was noticed by Hippocrates, who wrote (6th book of Epidemics): "Some of those with narrow heads have cephalalgia and otorrhoea. The latter have a highly arched palate and teeth which overlap each other."

Bony stenosis may be congenital or acquired.
With/

With regard to the congenital variety, Arbuthnot Lane,⁽¹⁾ in an article in the Clinical Journal, remarks: "One point of great interest about this condition of imperfect development of the nasal cavities is the manner in which it is transmitted to the offspring. I know no other acquired deformity which is handed down so rapidly and so markedly". One must, however, be guarded in too readily accepting this theory of heredity. Almost everyone has seen some instances of children with well-formed faces, correctly arched palates, symmetrical alveolar arches, and perfect nasal respiration, come later in life to present all those appearances typical of buccal respiration. The upper dental arch has become so distorted that the distance which separated the upper molars laterally is diminished, and they only rest by their edges on the molars of the lower jaw. Coincidentally the upper incisors have been carried forwards and are no longer able to meet the lower, but overhang them, constituting the deformity/

(1). Lane, U.A. On the form of the alveolar arch. The Clin. Jour. Lond. 1901 XVII., 343 - 349.

deformity known as "over-bite". Examine the parents, and it is generally found that no such malformation exists with them, that the features are regular and the upper dental arches well-formed.

The exact manner in which a faulty development of the bones of the face is acquired is at present under discussion, and will be considered later on, with the results of nasal insufficiency.

- b. Haematoma, abscess, enchondroma, osteoma, "spurs", "crests", deviations and deflections of the septum are a common cause of nasal insufficiency.

It not infrequently happens that the simple physiological experiment of causing the patient to respire through the suspected nostril proves the absence of respiratory nasal insufficiency, where there is considerable deviation or thickening of the septum. In these cases a slight coryza, or other cause of congestion of the nasal mucous membrane is all that is required to at once produce complete insufficiency.

- c. Erectile swelling, tumours and hypertrophy of the inferior turbinates and hypertrophy of the middle turbinates. Swelling and hypertrophy of/
of/

of the middle turbinal body is perhaps the most common of all causes of nasal obstruction. Mayo Collier⁽¹⁾ writes very clearly on this subject:- "The lower turbinal bone extends from before backwards, right in the path of the inspiratory stream, and encroaches on the posterior and anterior nasal openings. It is covered with a membrane of peculiar constitution in that it is extremely thick, measuring at times from one-eighth to one-half of an inch. It has many vascular cavernous spaces in it resembling erectile tissues and is capable of sudden contraction and dilatation resembling true erectile organs. It so happens that this erectile tissue is more pronounced opposite the anterior and posterior openings of the nose, and when distended, it is capable of completely occluding both anterior and posterior openings, and so capable of stopping nasal inspiration on one or both sides.

"A close study of the behaviour of this tissue/

(1). Collier, Mayo. Mouth-breathing and its relations to diseases of the throat, ear nose and accessory cavities. Lond. 1901.

tissue in its various physiological and pathological conditions is a key to the understanding of the various phases of nasal obstruction and the many consequences arising therefrom. A perfectly healthy individual with a nasal organ normally constituted and enjoying a continuity of normal conditions, would no doubt theoretically pass through the whole span of his existence without even such a temporary obstruction to his nasal respiration, as is experienced in a common cold. When, however, one considers that such a condition of things does not and cannot, exist - that the child in many cases is born with an affection of the mucous membrane inherited from his parents, that his membrane may be affected by the various constitutional and local complaints of its owner, that errors of diet, errors in environment and errors in the constant variations and purity of the inhaled air, may one and all have a disturbing influence on the proper physiological function of the turbinal body - can we be surprised that the normal physiological working of this organ is frequently upset and that the final stage is dilatation and obstruction?

"The/

"The functional activity of the turbinal body is ceaseless, and, for its size, exceeds the functional activity of any other organ of the body. The pathological tendency of any organ is in direct proportion of its functional activity. Therefore, the pathological tendency to temporary and permanent dilatation or to engorgement from relaxation of vaso-motor tone and consequent hypertrophy is apparent.

"Ninety-nine out of every hundred cases of obstruction to the nose are due to this cause. The dilatation may be temporary, intermittent or permanent, but still the tendency is there, the tone is lost, and nasal obstruction is the result. . . . "Loss of tone of the turbinal bodies, with or without hyper-plasia, is the commonest cause of nasal obstruction, and this, like atrophy, may be strictly limited to one side. But in the great majority of cases both sides are affected, and if one side be affected first, the other side follows sooner or later."

- d. Myxomatous or mucoid degeneration. ("Polpi"^y)
- e. Any acute or chronic inflammation of the nasal mucous membrane, coryza, hay-fever, frontal, ethmoidal/

ethmoidal, sphenoidal and maxillary sinusitis, vicious cicatricial adhesions, etc.

Foreign bodies in the nasal fossae, simple and malignant tumours; lupus; tuberculous and syphilitic processes.

Naso-pharyngeal Causes. Here, as in the nasal fossae, the osseous structures may be at fault. The roof of the naso-pharynx may be almost on a level with the hard palate, and the atlas or axis may be prominent, so that the choanae are reduced to a minimum. A very frequent cause of nasal insufficiency in the young is found in this situation and constitutes adenoid "vegetations", or hypertrophy of the pharyngeal tonsil, situated on the posterior wall of the vault of the nasopharynx.

(1)

Czermak, in 1860, and Sir Andrew Clarke, in 1862, found certain groups of tumours in the naso-pharynx which interfered most seriously with the nasal functions, as well as affecting the middle ear and the nasal cavities. Czermak was also the discoverer of the method of posterior rhinoscopic examination, and seems to have made an extensive tour, about the years 1858 and '59, demonstrating his new clinical/

(1) Czermak, J. N. On the laryngoscope and its employment in physiology and medicine.
Lond. 1861. p.30

clinical method in the chief hospitals of Europe.

The following is an extract from the New Sydenham Society's translation of Czermak's original account of "the first pathological observation made in the pharyngo-nasal cavity by means of the rhinoscopic mirror:". . . . "In order to examine the affected part with greater liberty, and on a more extensive scale, I requested the patient himself to depress the base of his tongue with a rectangularly refracted spatula; and with my left hand I elevated the velum palati in front and above, by means of a flat hook with a long stem, assuming the form of a spatula, of which the flat part contained an opening. The application of this hook did not cause the slightest inconvenience in the present instance, and after regulating the inclination and position of the mirror which I had introduced into the pharynx with my right hand, I was enabled to complete, by degrees, a satisfactory and clear examination of the part affected.

. . . . "The right side is perfectly normal, and we can perceive through the posterior orifice of the nasal fossa of the same side a portion of the upper part of the turbinated bones, and a portion of the meatus of the right side, whilst the inferior parts are/

are hidden by the velum palati.

"On the left side, on the contrary, we observe two morbid swellings of the mucous membrane developed, in front and above the pharyngo-palatine arch, which extend up to the opening of the Eustachean tube. These two tumours seem to conceal almost completely the posterior orifice of the nasal fossa of the same side, which are seen only in the form of a small fissure.

"These tumours, of which one part assumed the form of the comb of a cock and of which the base constituted the lateral wall of the pharynx, were enclosed between the posterior wall of the pharynx and velum palati, which they compressed a little to the right by their superior part.

"The superior tumour, which was the larger, corresponded by its swollen extremity to the posterior border of the orifice of the Eustachean tube; and the inferior tumour, which was much smaller, embraced the anterior and inferior limit of the same orifice. The two tumours were of a much darker colour than that of the surrounding mucous membrane and when they were touched with a sound introduced in the course of the rhinoscopic examination, they exhibited a firmness which was well marked."

It/

(1)

It is to Meyer, of Copenhagen, that is generally attributed the distinction of the first complete, scientific description of adenoid hypertrophy, which appeared in the *Hospitalstidende* in 1868, since which nothing of importance has been added to our knowledge of the pathology of this subject.

(2)

To demonstrate its frequency in cities Decker, in 1900, examined 1000 school children, and, as a result, considered that 127 required the operation for adenoid vegetations.

(3)

Cheatle, in 1902, examined 1000 London children of the poorest class, between the ages of 3 and 16, and found hypertrophy of the pharyngeal tonsil in 434. On the other hand, in 1400 school children in the city of Edinburgh, recently examined by medical experts, only 6.77 per cent. had adenoids, though 42.99 per cent. "were victims of some unhealthy conditions of the nose and throat".

(4)

A/

- (1) Meyer, Wilhelm. *Hospitalstidende*, 4th & 11th Nov. 1868; and *Archiv für Ohrenheilkunde*. 1873, I., 241.
- (2) Decker. *Journal of Laryngology*. 1900, XV. 208.
- (3) Cheatle, A.H. *Journal of Laryngology*, 1902, XVII., 282.
- (4) Report on the Physical conditions of fourteen hundred school children in the City of Edinburgh, together with some account of their homes and surroundings. *Brit. Med. Jour.* 1907. I. 819.

A table of age incidences in 4,000 successive cases of operation for adenoids, published by Dr. Wyatt Wingrave,⁽¹⁾ shows that the majority of cases occur between the ages of 3 and 20 years, these accounting for 3,523 of the total number.

The vegetations may be voluminous, completely obstructing the posterior nares, or the same result will be brought about even if they are small, provided the naso-pharynx is itself restricted in its dimensions. But here, as elsewhere in the nasal passages, it is by no means necessary that the obstruction be complete to determine nasal respiratory insufficiency, and induce buccal respiration. Myxoedematous degeneration and hypertrophy of small patches of adenoid tissue may sometimes block the choanae. Simple fibroma, commonly springing from the basilar process of the occipital bone, may encroach upon the naso-pharyngeal space to any extent.

Retropharyngeal abscess, retropharyngeal sarcoma, enchondroma of the Eustachian tubes, and adhesion of the soft palate to the pharyngeal wall are occasional causes/

(1) Wingrave. Adenoids. Med. Monograph series.
Lond. 1904.

causes of nasal stenosis.

Bucco-pharyngeal Causes. Hypertrophy of the faucial tonsils may be a cause of marked interference with nasal respiration. If voluminous, the soft palate is pushed upwards by the hypertrophied tonsils and the orifices of the Eustachean tubes may be interfered with. The circulation in the ring of Waldeyer is impeded, and, lymphatic engorgement taking place, the respiratory accommodation in the naso-pharynx is considerably reduced.

In all cases of nasal insufficiency the condition is much aggravated on assuming the dorsal decubitus, owing to static congestion, thereby produced.

Functional Nasal Insufficiency.

This form of nasal respiratory insufficiency is of special interest in the present connection, as it is only when it is proved by careful anterior and posterior rhinoscopy, and by digital examination if necessary, that there no longer exists any anatomical cause to interfere with the entrance of air through the nasal passages, that respiratory exercises are useful.

It happens not infrequently (ten per cent, according to Marcel Lermoyez) that, after the operation for hypertrophy of the pharyngeal tonsil, the patient disappoints/

disappoints his friends and the surgeon by continuing to breathe by the mouth. This is not to be wondered at, the remarkable thing being that it should ever be otherwise. In truth, these children, who have suffered from obstruction of the nose from very early years, have forgotten the use of that organ. After operation they have a free nasal passage, certainly, ~~but~~ but do not know how to make use of it. Most children brought back to the surgeon with the complaint that "the growth has returned", or that mouth breathing continues, belong to this class - "the residue", as they have been called. If they are old enough to understand, they must be taught by suitable respiratory exercises, to breathe by the nose, and they will very rapidly learn to shut the mouth, much better than under the torture of unphysiological apparatus designed for that purpose.

In this connection Nageotte-Wilbouchevitch⁽¹⁾ writes: "It is a mistake to suppose that it is sufficient to remove adenoid vegetations for the subject to close the mouth, and begin to respire by the nose;/"

(1) Nageotte - Wilbouchevitch. Atlas manuel de gymnastique orthopédique. 1903.

the nose; many patients continue buccal respiration after the operation, or at least open the mouth on the least effort; all have a small respiratory amplitude, which continues a long time after operation if not treated. These children have so completely lost the habit of nasal respiration that it is necessary to teach them anew".

Another gailic author picturesquely remarks: "In order to profit by mountain air it is necessary that it penetrates and not envelopes one like a cloak. The 'adenoidian' operated upon, and the pre-tuberculous in the mountains are like a blind man before a Rembrandt, or a famished sufferer from bulbar paralysis before a meal."

It is especially common to find buccal respiration persistent after operation in people of a nervous temperament.

Dr. Hemington-Pegler⁽¹⁾ has published two cases of complete hysterical abolition of nasal respiration; and Lermoyez,⁽²⁾ in 1899, reported a similar case. I reproduce another nervous case from Lermoyez's clinique/

(1) Hemington-Pegler, L. On functional abeyance of nasal respiration simulating true nasal obstruction. Jour. of Lar. 1902. XVII., 327.

(2) Lermoyez, M. Pseudo-obstruction nasale chez une hysterique. Soc. Méd. des hôp. de Paris. 20th Jan. 1899.

clinique, with the treatment by respiratory re-education, amongst the "Clinical Observations" at the end of this paper. (Case I., page 77)

But many cases of nasal insufficiency leading to mouth-breathing are of mixed organic and functional origin, and may be looked upon as partly the result of a pernicious habit, following, as a rule, some temporary nasal obstruction, such as that caused by attacks of acute coryza. It is these cases particularly which should profit by a system of respiratory education or re-education, by suitably planned respiratory exercises.

Results of Nasal Respiratory Insufficiency.

Bearing in mind the physiological functions of nasal respiration, and that the process is repeated some 20,000 times in the course of the twenty-four hours, it is not surprising that any departure from this normal condition will produce very far-reaching results.

The immediate direct effect of nasal respiratory insufficiency is the establishment of mouth-breathing. The chief indirect effects are faulty development of the bones of the face; deformation of the thorax; the curious group of mental symptoms, characterized by/

by general lassitude, inability to concentrate the attention, disinclination for exercise, or to indulge in games, and by backward intellect, to which Guye,⁽¹⁾ of Amsterdam, has given the name of aproxexia.

Post-nasal catarrh and pharyngitis with cough and dryness of the throat in the morning, deafness and otorrhoea, and a liability to bronchitis and asthmatic attacks are commonly found in association with nasal respiratory insufficiency. As a result of the post-nasal catarrh the digestion often suffers.

It is not easy to explain satisfactorily how nasal insufficiency causes the well-known highly vaulted hard palate, the narrow, V-shaped alveolar arches and consequent encroachment on the bony framework of the nasal fossae. As it appears evident that it must be due either to diminished intra-nasal pressure interfering with the normal lateral expansion of the facial bones, or to increased extra-nasal pressure causing a falling-in, there have arisen two sets of opinions on this much discussed subject.

One is championed by Arbuthnot Lane,⁽²⁾ who considers the /

(1) Guye. On aproxexia, being the inability to fix the attention, and other allied troubles in the cerebral function caused by nasal disorders. Brit. Med. Jour. 1889. II., 709.

(2) Lane, W.A. Discussion on the value of respiratory exercises in the naso-pharyngeal lesions in childhood; introduced by Mr. Lane. Brit. Med. Jour. 1902 II. 687 - 689.

the deformity of the facial bones to be due to diminished intra-nasal atmospheric pressure, brought about by nasal obstruction.

The other view, supported by Lambert Lack,⁽¹⁾ is that the deformity is caused by lateral compression of the jaws from increased tension of the soft tissues of the cheeks, which are put upon the stretch by the open mouth. It seems probable that each theory may contain contributory causative elements. Mayo Collier declares that all these bony changes can be artificially produced in any young animal, chosen indiscriminately, by blocking its nose for a long time with cotton wool, and asks, is it ^{un}reasonable to suggest that turbinal atony and hypertrophy in the young and growing subject will act as the piece of wool does in the nose of the young animal?

With regard to the causation of deafness and otorrhoea in chronic nasal insufficiency, the orifices of the Eustachean tubes are continually bathed in pus, and kept in a state of constant congestion. This hyperaemia soon extends to the calibre of the tubes and often reaches the tympanic cavity during sneezing, or violent effort in blowing the nose.

The/

(1) Lack, L. Diseases of the nose. Lond. 1906

The tubes become insufficient for drainage, pus remains in the tympanic cavity and provokes an acute otitis, with all its gravity, and all its consequences. Nasal insufficiency and deafness too often go hand in hand. The alterations in the shape of the chest were first carefully studied by Dupuytren. He described "a lateral depression of the parietes of the chest, consisting of a retraction more or less great, of the ribs on each side, and a proportionate protrusion of the sternum in front".

There are three types of thoracic deformity:-

- a. The Pigeon Breast, by far the most common form, in which the sternum is prominent, by reason of retraction of the lower lateral thoracic regions in inspiration, and consequent falling in of the costal cartilages. There is a circular depression in the lateral zone, Harrison's groove, corresponding to the attachment of the diaphragm.
- b. The Funnel Chest. In this deformity there is a deep funnel-shaped depression at the lower end of the sternum, which is best seen in cases of adenoid vegetations.

Mouth-breathers often appear dull and stupid, or have a dreamy, apathetic appearance. St. Clair
 (1)
 Thompson/

(1) Thompson, St. Clair. The Practitioner 1896. p.83.

Thompson describes this as "a kind of veiled look about the eyes", chiefly due to an elevation of the under lid, and thus accounts for it. From the circular muscle of the eye to the orbicularis oris there pass bands of small muscles, which when the mouth is kept closed hold the lower lid downwards in a slight degree of tension. When the mouth is habitually kept open, however, the tension is relaxed and the lower lid tends to move a little upwards.

It is this dreamy, poetic expression which artists so often strive to represent in their portraits of beautiful women, (compare the portrait of Madame Le Brun, by herself, No. 1653, National Gallery) whom, otherwise, we might very well suppose, with Dr. G. C. Wilkin,⁽¹⁾ to be chronic sufferers from untreated adenoid vegetations.

Impairment of growth is due to the shallow, hurried respirations, which have not sufficient amplitude to properly aerate the blood.

The following summary of Symptoms resulting from Nasal Respiratory Insufficiency is given by Lambert Lack, Diseases of the Nose. (1906).

II

(1) Direct Results/

(1) Wilkin, Griffith, C. The national importance of the thorough and systematic removal of adenoids in childhood. Brit. Med. Jour. 1905. I., 766.

(1) Direct Results.

- a. Snoring - due to air going through narrowed nostrils, causing altered air pressure, although the mouth be open.
- b. Alteration in the voice.
- c. Anosmia.
- d. Difficulty in breathing through, and in blowing the nose, and its consequences:-
 - a. Loss of the nasal functions and its effects on the nose and neighbouring organs. (see 2)
 - b. The open mouth and its mechanical consequences. (see 3)
- e. Obstructed respiration during sleep and its consequences:-
 - a. Deficient oxygenation of the blood. (see 4)
 - b. Deformity of the chest walls. (see 5)

(2) Effects on the nose and on the neighbouring organs, from loss of nasal functions, from mouth-breathing etc. Liability to repeated colds; chronic nasal catarrh; hypertrophic rhinitis; post-nasal catarrh; adenoids.

Catarrh of the Eustachean tube and middle ear, acute and chronic.

Dryness of the mouth (xerostoma), gums and tongue.

Early decay of the teeth.

Septic tonsillitis and pharyngitis.

Pharyngitis/

Pharyngitis sicca and pharyngeal catarrh.

Laryngitis sicca and laryngeal catarrh.

Tendency to Bronchitis and pulmonary affections.

Enlargement of the cervical glands.

General debility and ill-health.

(3) Symptoms due to the constantly open mouth.

The typical facies.

Ill-development of the upper jaw. High, narrow palate; V - shaped alveolar arch; crowded teeth.

Deformity of the nasal septum.

Collapse of the alae nasi.

Ill-development of the lower jaw.

(4) Symptoms due to deficient aeration of the blood during sleep.

Restless and unrefreshing sleep, disturbed by terrifying dreams.

Cyanosis: profuse sweating.

Headache: languor in the morning.

Capricious appetite.

Impaired health and general malnutrition; anaemia and stunted growth.

General stupidity and inaptitude for mental exertion.

General moroseness; nervous depression:

"peevishness" and listlessness.

(5) Mechanical/

(5) Mechanical results of the difficulty of breathing during sleep. Inspiratory retraction, and, ultimately, deformity of the chest walls.

(6) Symptoms of reflex and obscure origin.

Nocturnal enuresis.

Hay fever and asthma.

Laryngeal spasm.

Laryngismus stridulus.

Congenital laryngeal stridor.

Persistent cough.

Stammering, stuttering and other defects of speech.

Epilepsy, epileptiform convulsions.

Choroëa.

A formidable list for all such as breath by
the mouth!

CHAPTER II.PHYSIOLOGICAL RESPIRATION.

It is hardly necessary here to insist at great length on the extreme physiological importance of nasal respiration, importance both to the individual and to the community, nevertheless, it may be well to consider a few points in connection with the anatomy and physiology of the process. Comparative anatomy confirms the dualism of the functions of the nose and the mouth, for whilst the nose is always in communication with the trachea; in certain animals, such as the whale, and the young of the marsupials, the mouth is anatomically distinct from the respiratory organs. Respiration is, therefore, in these animals exclusively nasal. The same may be said of the frog. There are certain aromatic substances which are so obnoxious to this animal that it will by no means inhale their vapour. Should one of these substances be placed in the anterior nares of the frog, it will die from suffocation, being unable to replace a nasal by a buccal respiration.

In the case of the Solipeds (horse, ass, zebra) the upper respiratory and alimentary tracts are not anatomically separated, but the velum palati is greatly developed and extends to the epiglottis, in consequence/

consequence of which the nostrils are the only channel by which air can gain access to the trachea. For this reason, in double facial paralysis in the horse, with collapse of the alae nasi, causing obstruction to the entrance of air through the nose, the nasal respiratory insufficiency cannot be supplemented by buccal respiration.

As we ascend in the animal scale the angle which the axis of the trachea forms with that of the nasal fossae diminishes. In the horse, the trachea and nasal fossae are almost in a straight line, the angle being only one of 14 degrees; in the monkey it is 65 degrees; and in man it is 90 degrees, almost a right angle. This causes the soft palate to become higher in position and to be widely separated from the epiglottis, thus rendering possible respiration by the mouth.

Captain Catlin in his celebrated pamphlet "Shut your mouth and save your life" (1861) says that mouth-breathing was unknown amongst those more remote Native Races in North and South America, "living in their primitive state and practising their native modes", therefore nasal insufficiency could not have existed with these healthy people.

MacDonald/

(1)
 MacDonal^d, so far as I am aware, was the first to place our knowledge of the physiological functions of nasal respiration on a sound scientific basis. He proved by most interesting experiments that air in its passage over the nasal mucous membrane is modified in three important particulars, temperature, moisture and purification from suspended foreign matter.

J.L. Goodale⁽²⁾, in 1896, made a more elaborate experimental study of the respiratory functions of the nose, and arrived at similar conclusions.

Whether the external temperature be above or below that of the body, after having passed through the nasal cavities, the inspired air will be found to be at almost the blood temperature on reaching the larynx. This alteration is brought about not only by the temperature of the passages traversed, but also by the admixture of the air with glandular secretion, and with the moist vapour exhaled by the lungs deposited upon the mucous membrane, and kept at/

(1) MacDonal^d, G. Respiratory functions of the nose. Lond. 1889.

(2) Goodale, J.L. An experimental study of the respiratory functions of the nose. Boston Med. & Surg. Jour. 1896, CXXXV. 457; 487.

at body heat by the underlying vascular supply.

It has been estimated that about half-a-pint of water is taken up by the inspired air in the course of twenty-four hours, and as Watson Williams (1) justly observes, if the air is to reach the lungs in a normal condition of saturation, it is impossible for that amount of moisture to be absorbed from the mucous membrane of the mouth and pharynx without serious risk to its physiological integrity.

Inspired air is filtered from foreign matter in two ways: the larger particles are arrested by the vibrissae situated in the anterior portion of the vestibule, the smaller ones become entangled in the tenacious secretion of the mucous membrane, and with it are gradually propelled toward the anterior nares by the vibrations of the ciliated epithelium.

According to most authors the nasal secretion has a bactericidal influence. It has been calculated that at least 1,500 organisms are inhaled into the nose every hour, whilst it must be a common event, according/

(1) Williams, P. Watson, Why defective nasal respiration impedes growth and development. Bristol Med. Chir. Jour. 1906, XXIV., No. 91.

(1)
 according to St. Clair Thompson and Hewlett, for
 14,000 to pass into the nose in a single hour in an
 average London atmosphere. Nevertheless, the expired
 air is practically germ-free, nearly all the organisms
 in the inspired air being arrested in the nasal
 passages.

(2)
 Klemperer, however, does not admit the bacter-
 icidal power of the nasal secretion, nor that the
 posterior nares are sterile.

Air passing over the nasal mucous membrane
 stimulates the activity of the respiratory centre, and
 causes respiration to be full and complete, contrasting
 strongly with the shallow, hurried movements seen in
 buccal respiration. Clinically, we find many patients
 affirm that nasal respiration causes them to feel
 the need of breathing deeply.

(3)
 According to Mendel, the quantity of air inspired
 in a given time, and with a given effort, is greater
 by the nose than by the mouth. From this it is easy
 to

(1) St. Clair Thompson & Hewlett. Micro-organisms in
 the healthy nose. Med. Chi. Transactions, 1895
 LXXVIII.

(2) Klemperer. On the bacteriology of the nose.
 Jour. of Laryngology, 1896,
 XI., 286.

(3) Mendel, H. Physiologie et pathologie de la
 respiration nasale, Paris, 1897.

to understand the influence of physiological nasal respiration on the development of the lungs, and on the nutrition of the body generally. The same author mentions that in two patients, of sixteen and fourteen years respectively, the number of red blood corpuscles increased after ablation of hypertrophied pharyngeal tonsils, by 200,000 per cubic millimetre in the first case, and by more than a million in the second. I have noted several such cases.

As an instance of the close physiological relationship which exists between the pituitary membrane and the act of respiration, I may mention a case, which came under my observation, in which cauterization of the turbinates was followed by syncope with cyanosis, due to spasm of the bronchi.

Physiological respiration should be exclusively nasal, bilateral, sufficient and complete. When at rest, a single normal patent nostril is sufficient for respiration, as can be easily proved. Examine any healthy, well-constituted subject of whatever age. Obstruct lightly either of his nostrils with the pulp of the finger, without changing the form of the opposite nostril, as taught by Dr. Logan Turner. If there be no nasal stenosis he will continue to breathe/

breathe indefinitely, without inconvenience, without increase in the number of respirations and without variation in the pulse.

But normal nasal respiration must be bilateral to allow for the numerous causes that may at any moment occur to diminish the space destined for the free circulation of the air in the nasal fossae.

If a young subject with one-sided nasal insufficiency be carefully examined, one often notices a diminution in the size of the thorax on the same side as the insufficiency. The patient always sleeps on the side of the obstructed nostril and compresses the thorax, till finally that side becomes flattened. Physiological respiration should be sufficient, that is to say the air should penetrate both lungs sufficiently and equally. The manner in which this penetration is examined will best be considered in a subsequent chapter.

By complete respiration is meant the dilatation of the thoracic cage in its three dimensions, antero-posterior, lateral, and vertical, by the entrance of air into the lungs. Special attention should be paid to the expansion of the apices, as well as to the descent of the diaphragm, as expansion is often insufficient in this direction. In diaphragmatic insufficiency/

insufficiency the last ribs do not move, the intercostal angle does not open. In the dorsal decubitus the abdominal walls are almost immobile.

CHAPTER III.METHODS OF CLINICAL EXAMINATION.

In enquiring into the question of the physiological respiration of a patient two points must be kept in view: (1) is the respiration wholly or partly nasal? (2) is it sufficient and complete?

(1) The existence and degree of nasal respiration is determined by careful inspection of the respiratory act, supplemented by the taking of pneumograms, or "breath-pictures", by the use of Glatzel's mirror, or Courtade's Pneumodograph.

Inspection. The naso-respiratory test is performed as follows.

- a. The patient, being without corsets or any article of dress which might interfere with respiration, stands facing the physician.
- b. He is desired to inspire and expire by the nose, the physician himself making several such respirations to show the facility of the act. The patient is requested to respire thus twenty consecutive times.
- c. The respirations are regulated by beating time with the right hand; inspiration to take place when the hand is raised, expiration when it falls.
- d. The test should be repeated on obstructing each nostril/

nostril separately with the hand or with cotton-wool. If the hand be used care should be taken to apply the palmar surface of the tip of the thumb to the ~~to the~~ anterior nares, and to avoid pressure in a lateral direction which might cause a certain degree of temporary deviation of the septum, and consequently of nasal stenosis of the opposite side. The test should be performed in the dorsal as well as in the erect attitude, in order to distinguish between intermittent and permanent nasal insufficiency, as defined at the beginning of this paper.

Supplementary tests by means of Glatzel's mirror and Courtade's pneumodograph. These are useful adjuncts, which I have found very convenient in practice. Glatzel's mirror is a thin sheet of metal, nickel-plated, and marked with graduations on its surface. It is placed horizontally on the upper lip of the patient, half-an-inch below the anterior nares. If there be free bilateral nasal respiration, the aqueous vapour in the air exhaled from the nostrils condenses on the bright surface of the metal, forming two symmetrical clouds, separated from each other in the centre by a narrow tongue of bright metal, corresponding to the nasal septum. The form of this image has been likened to that of a butterfly./

(1)

butterfly. Dr. Wingrave claims to have improved upon this mirror in substituting for it small sheets of vulcanite, with a moderately rough surface.

The Pneumodograph of Courtade consists essentially of two plates of glass, graduated in centimeter squares, fixed at right angles to each other, **T**, by means of detachable clips. One plate of the pneumodograph is held horizontally against the upper lip, a short distance below the nostrils, so that the other plate hangs vertically downwards a few inches in front of the mouth. The patient is asked to breathe several times, in the manner habitual to him. Condensation of aqueous vapour on the horizontal plate records the degree of nasal patency, and a similar condensation on the vertical plate indicates the presence and degree of buccal respiration. Taken in conjunction with one another, the two pneumograms may be used as a practical test of the degree of nasal respiratory sufficiency. It is in this respect more useful than Glatzel's mirror, which records nasal patency alone.

Clinical pneumographic records can be obtained by passing sheets of paper impregnated with safranin on/

(1) Wingrave, Wyatt. Spirographs or nasal "breath pictures". Lancet 1907, I. 253.

on to the surface of the glass plates of the pneumodograph, the pink colouring matter being liberated by the condensed aqueous vapour. I have recently succeeded, with the kind assistance of Dr. A. W. Titherley, lecturer on organic chemistry in the University of Liverpool, in printing a clear, permanent, and easily-handled pneumogram, by the combined action of iron and gallic acid. Weak, alcoholic solutions of ferric chloride and gallic acid are taken. Sheets of paper are prepared by immersion in the ferric chloride solution, and after drying are ready for use. The solution of gallic acid is spread evenly over the surface of the glass plates of the pneumodograph, with a pledget of cotton-wool, and is allowed to dry, the process taking half-a-minute to one minute.

As soon as the patient has breathed on the glass, a sheet of the prepared paper is pressed upon its moistened surface, ink being at once produced, and a faithful, permanent image is left. Examples are shown in a recent case, described at page 104.

A mercurial Naso-manometer has been imagined by MacDonald, ⁽¹⁾ in which the force of the air expired by/

(1) MacDonald, G. Respiratory functions of the nose. Lond. 1889.

by each nostril is recorded on a dial.

The Spirometer is an instrument designed to test the "vital capacity" of an individual, a term which John Hutchinson employed to denote the amount of air that can be expired after the fullest possible inspiration. As ordinarily used, the instrument takes no account of nasal respiration and is therefore of no service in estimating the nasal element in respiratory sufficiency. Joal,⁽¹⁾ of Mont Dore, has, however, published some interesting examples of spirometrical examinations conducted before and after operation for adenoid hypertrophy. The vital capacity was very greatly increased.

Results. It can be proved by means of the methods just described that many children cannot breathe by the nose. A large number breathe two or three times correctly enough, but after that the respiration becomes embarrassed, the face is congested and slightly cyanosed, and they tend to press the respiratory rhythm indicated by the hand of the physician.

Most children experience an irresistible necessity to open the mouth, to relieve the dyspnoea.

The pneumodograph shows how common is the mixed naso-buccal type of respiration. Some patients breathe/

(1) Joal. Recherches spirometriques dans les rhinopathies. Revue de Laryngologie, Paris, 1890, X, 257: 310.

breathe with one side of the nose only, a unilateral nasal respiration, so that the least catarrh or congestion of the Schneiderian membrane is sufficient to provoke buccal respiration.

(2) Is the respiration sufficient and complete?

This is investigated in several ways.

- a. Inspection. The chest being disencumbered of all clothing we carefully inspect the general thoracic conformation. Is there any tendency to the formation of pigeon-breast, Harrison's groove, barrel-chest, or funnel-breast? Light falling from the side will often bring out or intensify slight degrees of these deformities. Is the expansion equal on both sides? To which of the classic types of respiration does that of the patient correspond: clavicular, pure lower costal, lower costo-abdominal, pure abdominal, abdomino-costal? This factor is of great importance in the choice of appropriate respiratory exercises.
- b. Percussion is of its usual valuable service, as in all examinations of the lungs.
- c. Auscultation. This is picturesquely described by Rosenthal as the rudder of all respiratory gymnastics. By auscultation especially do we determine the sufficiency and completeness of respiration, and are guided in the progress of the respiratory/

respiratory re-education of the patient. We search carefully for any areas of deficient air entry, paying special attention to the apices, and to the bases, which help us to detect insufficient contraction of the diaphragm. On auscultating a mouth-breather, at the moment at which one asks him to respire with the mouth closed, the vesicular murmur is much more feeble than that which one should normally hear.⁽¹⁾

d. Mensuration. This is not of much comparative value in determining respiratory sufficiency, for although tables of the normal chest measurements for people of a certain age, height, weight, etc. have been drawn up, they can only represent the mean of a large number of people, and are of little use in individual cases.

Individual measurements vary considerably, on either side of this mean, within the limits of perfect, physiological respiration. But mensuration is of the greatest service in estimating the progress made under the use of appropriate respiratory exercises. The thoracic perimeter is noted at the first examination, and it will soon be seen to increase under treatment, both permanently and in power of expansion.

The method of chest mensuration introduced/

(1) M.H. Cuvillier, in Grancher's Diseases of Childhood. Paris. Vol. III. p. 80.

introduced by Rosenthal is performed with the aid of a "symmetrical centimeter tape", which he thus describes. A centimeter measuring tape, 150 centimeters long, is graduated in two halves from 1 to 75, and the halves separated at the figure I. On placing this point over the spinous processes of the vertebrae, and bringing the tapes round to the front of the chest, one is enabled to measure the thoracic cage of both sides in a single operation, both anatomically and physiologically. The level at which the tape is passed round the thorax is the 7th dorsal spine behind, or just below the angles of the scapulae, the arms hanging loosely at the sides and just above the mammae in front. During easy respiration one notes the maximum perimeter, corresponding to the end of inspiration, and the minimum perimeter, corresponding to expiration. The difference between the two figures gives the thoracic expansion or amplitude.

A practical objection to this method is that whilst one is engaged with the measurements in front, the point of separation of the two sets of figures is apt to slip off the spinous process to one side or the other, and thus constitute a possible source of fallacy. At first I tried to obviate this difficulty by/

by attaching a ring at the figure I, to be retained over the spinous process by an assistant, but soon gave up the "symmetrical tape" for an ordinary tape measure, graduated in centimeters on one side, and inches and parts of an inch on the other. With this I take two perimeters, one horizontal, at the level of the axillae, the arms to the sides, passing round the scapulae behind and reaching the level of the second costal cartilages in front; the other passing horizontally round the chest at the level of the xiphisternum. By means of the first measurement the axillary respiratory amplitude (A. R. A.) is obtained, the latter gives the xiphoid respiratory amplitude (X. R. A.).

With children who are not aware of what one is examining for, and who have received no training in lung exercises, the respiratory amplitude is so small, varying from one-quarter centimeter to one centimeter, that it is almost impossible to record it.

Children who know what is expected of them find it impossible to let themselves breathe naturally. It is best then to ask the child to take a deep inspiration and follow it by a complete expiration. Although this is not so instructive as the normal respiratory amplitude, yet it is often the only means/

means possible with children of obtaining a reliable result.

The X = rays constitute an excellent method of determining respiratory amplitude, when it is convenient to employ it. I have found it quite satisfactory in practice to base an estimation of progress in respiratory re-education upon inspection, auscultation and mensuration, supplemented by the valuable aid of the pneumodograph.

CHAPTER IV.RESPIRATORY RE-EDUCATION.

The value of respiratory exercises in the treatment of disease has long been known. In 1872, Bicking, of Berlin, wrote a monograph on "Respiratory gymnastics in the treatment of different affections". In 1875 appeared Burg's "De la gymnastique pulmonaire." In more recent years, in Sweden, the work of Ling brought the matter into prominence. In this country the literature of the subject of respiratory exercises is chiefly connected with the names of Sir Morell Mackenzie, "Hygiene of the vocal organs" 1890; Lane; and Campbell, "Respiratory exercises in the treatment of disease", 1898. In the Spring of 1906 Dr. Watson Williams wrote an interesting article, which has attracted a good deal of attention on the Continent, "Why defective nasal respiration impedes growth and development," Bristol Medico-Chirurgical Journal. He tersely describes the clinical and physiological, or rather, unphysiological aspects of nasal respiratory insufficiency, and advocates the use of appropriate respiratory exercises "after the removal of any abnormal conditions in the nose and thorax." It is only after surgical measures have completed/

completed the anatomical cure that respiratory re-education steps in to provide, if necessary, the physiological cure. The latter is thus the natural complement of the former.

Respiratory exercises as a method of treatment have suffered considerably in the eyes of many medical men by proposals to treat adenoid vegetations, etc., by respiratory exercises alone, without previous surgical interference.

This presumably had its origin in the perhaps too great readiness with which the operation for hypertrophy of the pharyngeal tonsil was undertaken, and the lack of completeness in the manner in which it was sometimes carried out. Of course nothing could be more opposed to any rational system of medical treatment than to attempt to act upon an evident tissue hypertrophy by respiratory exercises alone.

In America, S. A. Knopf has, since 1900, given great attention to the matter, and has devised a simple and more or less complete system of respiratory exercises. It is however in France, and chiefly owing to the efforts of Georges Rosenthal, Louis Vacher, and Marcel Natier, that the subject of post-operative respiratory re-education has received most careful attention.

Although/

Although, as already stated, in the majority of cases (given as 90%) the subjects of buccal respiration are able spontaneously to close the mouth and commence nasal respiration once the anatomical cause of nasal insufficiency is removed, there can be little doubt that there is hardly a single case but would be immensely benefited by a little subsequent instruction in the art of correct, physiological breathing.

It appears extraordinary with what rapidity dull, anaemic, dyspeptic, often ill-developed young people become bright, active, and healthy, when complete and sufficient nasal respiration shall be established.

This is explained when we consider the great function of respiratory movements, namely, the aeration of the blood, and its hardly less important secondary effects on the circulation of the blood and lymph, and on the functions of the abdominal and pelvic viscera.

We will briefly consider the manner in which these secondary effects of respiration may be influenced by Respiratory exercises, before passing on to the subject of their clinical application.

Hyperhaematosia and the elimination of respiratory excreta. By means of deep inspirations a state of/
of/

of hyperoxygenation of the blood is produced, and the elimination of carbonic acid and organic products furthered, and this without notably increasing the work of the organism. The giddiness which is sometimes produced at first by the taking of deep breaths is an instance of the profound effects of respiratory exercises on the economy, and an indication that although so simple a therapeutic measure it must be applied with great caution on account of its powerful action.

(1)
W. Marcet has studied some of the effects of hyperhaematosiis on the activities of the brain. The greater the quantity of oxygen available for absorption by the centres engaged in volition, the longer can voluntary effort be continued without exhaustion of these centres, and the longer therefore the possible duration of muscle contraction.

Thus, Marcet gives an instance of a man "who, after ordinary breathing, lifted a weight of four pounds 203 times in succession, after a rest and forced breathing for two minutes lifted the same weight the same/

(1) Marcet, W. Croonian Lectures, Brit. Med. Jour. 1895, II, 6.

same height no fewer than 700 times".

As pointed out by Dr. Harry Campbell, this effect may be due not only to the augmented supply of oxygen to the brain, but also to the increased elimination of its waste products, brought about by an acceleration in the flow of blood and lymph, coupled with an augmented output of poisonous substances from the respiratory tract, without that exhaustive increase in the production of waste-products which happens when the deep breaths are produced by muscle exercise. Whatever be the explanation, the fact remains that deep inspirations increase the power of sustained nervous effort.

Effects of respiratory exercises on the circulation of the blood and lymph.

Intravenous pressure being normally low in comparison with intra-arterial pressure, the veins are much more susceptible to variations in extravascular pressure than the arteries.

In deep abdominal inspiration the bases of the lungs are expanded more than the apices, the intra-abdominal tension is increased by the descent of the diaphragm, and a large quantity of blood is expressed from the splanchnic veins, filling the right heart, while the increased/

increased extra-arterial pressure has very little retarding effect on the abdominal arteries. At the same time lymph is pumped from the peritoneum into the pleurae.

On the other hand, during a full costal inspiration, the upper portion of the lungs are more fully expanded, intra-abdominal tension is diminished, and the flow of lymph from the digestive viscera into the splanchnic veins, and from the kidneys, pelvic viscera and lower extremities into the inferior vena cava is accelerated. This may raise the blood-pressure in the superior cava, and so be at least a contributory factor in the causation of the initial giddiness which sometimes attends unaccustomed respiratory exercises.

In the thorax, slight changes in extravascular pressure are sufficient to materially affect the circulation in the venae cavae and pulmonary veins, considerable modifications being required to affect the calibre of the aorta.

It is doubtful if the ordinary respiratory movements of the lungs have any decided effect on the circulation, the accelerating influence caused by diminished intra-pulmonary air pressure during inspiration being counteracted by the retardation produced by increased pressure during expiration.

Under/

Under ordinary circumstances, inspiration and expiration are of equal duration, but if inspiration be prolonged and expiration shortened there should be a balance in favour of acceleration in the blood stream. This is what instinctively takes place in dyspnoea from exertion. In running, inspiration is of nearly three times the duration of expiration. Inspiration may then be voluntarily prolonged, but not expiration, which is always cut short by the imperative demand to inspire. Thus it is that expiration is not complete, and the mean size of the chest being thereby increased, the transit of blood from the venae cavae to the aorta, and the flow of lymph into the thoracic ducts is facilitated.

Effects on the Abdominal and Pelvic Viscera.

During diaphragmatic descent, all the abdominal and pelvic viscera are compressed and pushed downwards, their dislocation during deep abdominal respiration being considerable. This rhythmic compression and descent stimulates the abdomino-pelvic viscera. By deep inspirations the liver is considerably squeezed, between the diaphragm and the anterior abdominal wall, and its functional activity favoured by hurrying on the flow of blood, lymph and bile.

CHAPTER V.THE TECHNIQUE OF NASAL RESPIRATORY RE-EDUCATION.General Considerations.

It is essential that any system of respiratory re-education be conducted and controlled solely by the physician himself. He alone can accurately judge of nasal sufficiency, of the complete entrance of air into every portion of the lung area, of the full action of the diaphragm, etc., and he alone can estimate the progress made by the treatment, and the need of special respiratory exercises to correct particular faults in the respiration of the individual.

It is of the highest importance that the air which enters the lungs during breathing exercises be as pure as possible. The room in which the exercises are performed should be well ventilated, scrupulously clean and free from dust, and contain a minimum of furniture. It is often advantageous that the exercises be done before the open window. The natural man breaths physiologically, but civilization with the many blessings it has conferred upon us has also brought to us on the one hand certain tendencies/

tendencies in the direction of nasal obstruction, and on the other hand customs in the shape of dress, habitation and occupation, which interfere with free respiratory movements.

The necessity of the complete surgical removal of all anatomical cause of nasal obstruction before any good can be expected from respiratory exercises has already been sufficiently insisted upon.

It will often require a good deal of tact and patience on the part of the physician to rectify errors in dress, and in domestic internal arrangements which are inimical to physiological respiration. In the matter of the abolition of tight corsets, waist-belts, etc., Campbell recommends that we do not expect too much at first, but proceed slowly and attain our end little by little. The same perseverance will generally be required to obtain a purer atmosphere in the house, by well-opened windows whenever possible, although, fortunately, much good work has been done in this direction of late years by the campaign against Tuberculosis in awakening the public to a sense of the manifold advantages of open-air.

The patient being now supposed to be in every/

every way free to breath correctly, and being supplied with pure air, the general nutrition must be seen to, giving, if need be, cod-liver oil, malt, iron, arsenic, etc. Ordinary gymnastic exercises with dumb-bells, "developers" and the like, are sometimes employed to improve the muscular system in general, and the muscles of inspiration in particular, but have the not unimportant drawback that by provoking the closure of the glottis they impede the circulation in the lungs and venae cavae, and interfere with the flow of lymph into the thoracic ducts. They not infrequently cause emphysema by the violence of the continued muscular effort required, with a closed glottis.

Although the number of respiratory exercises has been considerably multiplied, one clinician obtaining excellent results with one system, one with another, it is to be remembered that the object of respiratory re-education is to abolish the vicious habit of mouth-breathing, and establish in its stead a complete and sufficient nasal respiration under all the varying conditions of life. Every manoeuvre should be accompanied by a gentle but deep respiration.

The complete confidence of the patient must/

must be gained from the outset, the dangers of mouth-breathing, and the advantages of physiological nasal respiration clearly pointed out to him, so that an ascendancy is obtained over his mind and he shows enthusiasm in learning to breathe correctly. The re-education will thus be psychical as well as physiological.

RESPIRATORY EXERCISES.

The first respiratory exercises consist in simple nasal breathing in the erect attitude, then in the dorsal and lateral decubitus, sitting, etc. When this can be easily performed the same exercises are repeated accompanied with passive movements, later with active movements. Finally nasal respiration is practised in all the ordinary acts of life, walking, reading, speaking, singing, etc. Special exercises may occasionally be necessary to overcome local insufficient pulmonary expansion. The cure may be considered complete when silent, sufficient, controlled, nasal respiration under varying conditions is established, and when the patient sleeps quietly at night with the mouth shut.

1. Physiological respiration in the usual attitudes:-

- a. Before beginning any course of respiratory exercises the patient's "naso-respiratory index" is noted, in the manner already described, by inspection, auscultation, mensuration and the taking of pneumograms.

The patient is then asked to stand in front of the physician, in an erect, easy attitude, and the manner of performing nasal respiration carefully explained to him. Several such respirations are taken by the doctor himself, to show how easily it can be done. The patient's method of respiration is carefully examined, and the movements of the chest are regulated by the action of the hand - inspiration when the hand is raised, expiration when it falls. When the patient has thoroughly grasped that which we wish him to do, he is directed to take five, then ten, fifteen, and twenty slow and deep respirations, the respiratory rhythm being regulated by the physician beating strict time with the hand. Usually the patient will at first find it impossible to take several consecutive nasal respirations without the production/

production of so much dyspnoea that he is obliged to open the mouth. Let him do so, taking a few moments repose, then recommence the exercise. Sometimes the dyspnoea may be prevented by permitting the patient to expire by the mouth, but this should be avoided if possible, seeing that it very easily induces buccal inspiration too, and moreover that it is the physiological habitus of an exclusively nasal respiration that we seek to establish.

- b. Dorsal decubitus. Let the patient lie on his back upon a hard couch, with the head slightly raised and repeat the slow deep inspirations as many as twenty times. This is performed in the right and left lateral decubitus also.
- c. Sitting attitude. The same respirations, the patient being seated. The arms may drop to the sides, or be held horizontally, either laterally, or in front of the chest, holding for example a light stick, which may be maintained at varying heights, at the direction of the physician.
- d. The erect attitude is assumed, with the same variations in the position of the arms.

e./

- e. Particular attitudes corresponding to special indications:- If, for instance, it be observed that respiration on one side is deficient, place the patient in the lateral decubitus on the side of good expansion, with a firm cushion under the chest, so that with this as a point of support he may the better bring the muscles of respiration into action and so expand the defective lung. In the standing or sitting attitudes the same effect may be produced by the patient placing the hand in the axilla of the same side, and pressing firmly on the chest wall. The expansion of the opposite side may be helped by, at the same time, placing the hand of that side on the top of the head, and inclining the head and body a little toward the side of the good respiration.

The exercise always corresponding to a special clinical indication, the attitude and movements will be modified by the physician according to the object in view.

These exercises it will be observed are in simple $\frac{2}{4}$ time. Knopf has added others in $\frac{3}{4}$ and $\frac{4}{4}$ time (common time). Thus in $\frac{3}{4}$ time, the hand beats three movements instead of two, and the patient either/

either doubles an inspiration or an expiration. In the former case, we ask the patient after he has taken a normal inspiration to try to take a further inspiration, accompanying the second beat of the hand, then to expire with the third beat.

Inspiration (1), complimentary inspiration (2), expiration (3).

In the second case, after ordinary expiration a forced expiration is taken. Inspiration (1), expiration (2), complimentary expiration (3). The exercise in common time includes the two combined: Inspiration (1), complimentary inspiration (2), expiration (3), complimentary expiration (4).

These exercises of Knopf's in $\frac{3}{4}$ and in common time should not be attempted till near the end of a complete course of respiratory exercises; they being then exceedingly useful.

2. Respiration accompanied by passive movements of the trunk, arms and if need be of the legs.

The essential factor is again a purely respiratory exercise, inspiration and expiration, the accompanying passive movements being accessory, and only to be attempted when the patient breathes satisfactorily at rest in the usual attitudes. This stage/

stage of progress is however soon reached. In these exercises, the movements being passive have the advantage of not producing the slightest fatigue to the patient, and of preparing him easily for the performance of respiratory exercises accompanied by active movements.

- a. The patient being seated, with arms extended horizontally in front of him, place yourself behind him, and taking hold of his fore-arms, separate them whilst raising them slightly during inspiration, and bring them back to the first position during expiration. The amount of separation of the arms, as also of the height to which they are raised is gradually increased as the patient makes progress in his respiratory re-education, till finally they may be drawn as far back as possible, and into an almost vertical position at the back of the head.
- b. The subject standing erect, the fore-arms completely flexed, and the elbows to the sides, raise the elbows to nearly the level of the shoulder during inspiration, and bring them back again to the sides during expiration.

The elbows being flexed at a right angle,
bring/

bring them in a backward direction during inspiration, and in a forward during expiration. It is useful in this exercise to have some support for the patient's back - such as a narrow, vertical pillar, behind which the physician takes his stand. The elbows may very soon be brought into contact behind the back, especially in young children.

- c. The patient standing up, with the arms falling to the sides, carry them to the horizontal plane, either anteriorly or laterally, during inspiration, and let them come back to the sides during expiration. Eventually the arms may be raised till the vertical plane is attained. These exercises may be repeated in the dorsal decubitus. The movements of the arms are not unlike those employed in artificial respiration.

Each exercise is to be repeated twenty times, as in the simple respirations of the previous paragraph.

- d. The subject being seated on the couch, legs extended, bring him into the dorsal position during inspiration and return him into the sitting position during expiration. Or, if one wishes/

wishes to act upon the diaphragm, begin in the dorsal position and bring him into the sitting attitude during inspiration.

- e. Leg movements. Place the patient upon his back and flex the thighs upon the abdomen during inspiration, either alternately or simultaneously. This exercise acts well upon the diaphragm.

3. Respirations with Active Movements.

After the patient has arrived at a satisfactory nasal respiration accompanied by passive movements, he may then, and only then, profitably begin respiratory exercises with active movements. They are very numerous, and all are good provided they only necessitate a minimum effort, and that the accompanying respiration be exclusively nasal, sufficient and complete. They are the most beneficial of all respiratory exercises, for the reason that they train the accessory muscles of respiration as well as the respiratory function. By these means the circulation is doubly stimulated, the heart being excited to increased activity, and, at the same time, the transfer of blood from the systemic veins through the lungs into the systemic arteries/

arteries is facilitated, the blood meanwhile being kept in a high state of oxygenation, and with a low percentage of carbonic acid. The flow of lymph is likewise doubly stimulated, being affected by both the muscular and respiratory exercises.

It is generally only after a little practice in these active movements that the patient acquires a natural nasal respiration. It is for the physician to judge of the opportune moment to begin active exercises. Often enough that moment will arrive early in the treatment, for nasal respiration is often rapidly acquired under intelligent direction. When, for example, the patient can correctly and without any fatigue perform twenty nasal inspirations and expirations, with an occasional passive movement, then active movements may be advantageously begun.

I am in the habit of insisting on the exclusion from a system of respiratory re-education of all exercises performed with dumb-bells, or against resistance by means of elastic recoil, or of weights, as under these conditions the glottis has a great tendency to be closed, which can only interfere with the free play of the respiration.

Manner of procedure./

Manner of procedure.

- a. Let the subject repeat, unaided, exercise (c) in the last section, that is to say, standing erect, with the arms to the sides, let him bring them by his own action into the horizontal plane, either anteriorly or laterally, during inspiration, and back to the sides during expiration.
- b. The patient standing, arms stretched out horizontally in front of him, direct him to bring them backwards as far as possible, in the same plane, during inspiration and return them during expiration.
- c. The patient standing as before let him bring his arms over his head as far backwards as possible during inspiration, and directly forwards to the position they started from during expiration.
- d. The arms hanging down by the side of the body, the hands are moved upwards into the axillae as high as possible, the elbows moving outwards in a lateral plane; they are then returned to the original position. Inspiration accompanies the former movement, expiration the latter.
- e./

- e. Movements of rotation or circumduction of the arms. The arms are slowly swung round over the head as far as possible, in the sagittal plane, and returned to the original starting point. A long inspiration is taken during the upward movement, the patient aiding the act by rising a little on his toes. Expiration is performed quickly, accompanying the downward movement of the arms.

This movement of circumduction is at first performed with the help of the physician, who stands behind the patient and, holding his arms below the elbows, directs their action. It is an easy, pleasant and most useful exercise.

- f. Swimming movements. This has been described by S.A.Knopf,⁽¹⁾ of Baltimore, as a "dry swim," and is a useful exercise. The patient stands erect, heels together, body leaning forwards. The arms are extended horizontally in front, dorsal aspects of the hands together. During inspiration the hands are separated, as if to divide the water, till the lateral plane is reached/

(1) Knopf, S.A. Respiratory exercises in the prevention and treatment of pulmonary diseases. Bulletin of the Johns Hopkins Hospital. 1901.

reached, they are then lowered to join behind the back. The pupil remains some little time in this position, the chest full of air, then expires quickly whilst returning the arms to the point they started from.

- g. Movements of the trunk. The patient places his hands on his hips, the thumbs in front and the fingers behind to steady the pelvis and bends the body forwards, backwards, and to each side alternately. The backward movement is very useful to overcome the habit of stooping.

The legs may be made to perform similar forward, backward and lateral movements. Every movement is accompanied by its appropriate inspiration or expiration.

4. Respirations in the different acts of life.

When, after some training, a sufficient nasal respiration is established, under certain regulated active muscular movements, such as those just described, it is good to educate the respiration under different ordinary acts of life to which it must eventually be adapted. In the act of walking the respiration is apt to become buccal, or naso-buccal/

buccal, unless nasal respiration be firmly established.

It is useful to regulate respiration by taking an inspiration whilst two to four steps are made, and an expiration during one or two steps.

A few simple indications as to the proper places at which to take an inspiration during ordinary speech, or in reading aloud are of the greatest service - the patient being shown the error of continuing rapid speech till he is almost out of breath, as is so common, and then taking a shallow, hurried, and too often buccal, inspiration. Similarly, the proper place for inspiration in singing is of the greatest importance.

REGIONAL RESPIRATORY RE-EDUCATION.

Upper Chest. A lack of expansion of the pulmonary apices during inspiration is the rule with mouth-breathers, from whatever cause the habit arises, so that it is generally necessary to complete a course of respiratory exercises by developing the action of the apices with the greatest care.

Taking the idea probably from the effect of corsets worn by women, which tend to develop the movements of the upper portions of the lungs by compressing the abdominal and lower costal regions.

Rosenthal/

Rosenthal, and others, immobilize the lower thoracic regions by means of a flannel belt, worn at first only during a séance, then for two hours a day, and at last permanently. For my part, I do not approve of this measure, considering it unphysiological. It seems proved beyond doubt that the costal type of respiration of the woman is due to the wearing of corsets, (1) but does air enter the apices more completely in woman than in man? I am by no means convinced that it does, for in that case, the "seat of election" of the tubercle bacillus in the lungs being that at which pulmonary expansion is least, we should hear of apical pulmonary tuberculosis being less common in women than in men.

The following method appears preferable. The subject standing, elbows well into the sides and hands joined across the xiphisternum, by pressure of the arms and forearms the lower costal respiration can be restrained and a point of support given to the muscles of upper forced inspiration.

Another exercise is to place the patient in the upright position in front of the physician, hands on the hips, and to direct him to raise both shoulders simultaneously/

(1) Ellis, Havelock. Man and Woman, Lond. 1904, p.231. et seq..

simultaneously as high as possible during inspiration, and to let them fall gently during expiration. Excellent results are obtained in removing supra- and infra-clavicular flattening by both these manoeuvres.

Later on the greatest benefit may be obtained by forced inspiration in the act of walking. The subject takes a full nasal inspiration and retains the air in his lungs as long as possible: dyspnoea supervening he is compelled to expire, and this is immediately followed by a very complete forced inspiration, during which air rushes into the lungs and expands the little-used apices.

This exercise may be repeated in another way, with even greater effect. The patient empties his lungs as completely as possible by a forced expiration, contracting his abdominal muscles, and takes a few paces, restraining all respiratory movements, till he experiences an urgent air-hunger. During the full inspiration which follows, air rushes into every portion of the lungs, and can be distinctly felt by the patient, and observed by the physician, to expand the apices. After a little practice so much control is obtained over the facial muscles, etc., that these powerful exercises can be performed walking along the street without any/

any evidence of what is going on being apparent to passers-by. It is hardly necessary to remark that they are only to be attempted by robust patients, whose respirations has become comparatively good, and are to be repeated very occasionally.

Lower Chest. Certain young subjects often expire incompletely at the bases of the lungs. In these cases expiration is aided, especially in the dorsal decubitus, by pressure at the end of expiration with the hands over the parts concerned.

Unilateral. If it be determined that incomplete expiration exists only at one base, pressure should be made on that side alone.

In cases in which respiration is unsatisfactory on one side, and at the same time to aid in obtaining command over each lung individually, the body should be well bent over to one side (the healthy side), firm pressure being made over the lateral aspect of the chest on the same side with the back of the hand doubled up.

A deep inspiration is then taken every effort being made to inspire with the insufficient side and to keep the other at rest. Both lungs can be exercised in turn in this way and a wonderful control/

control is soon obtained over them. The value of this exercise in cases of faulty expansion of one lung can hardly be over-estimated.

In the case of children too young to understand what one wishes of them, a certain degree of respiratory re-education may yet be effected. It will really consist in passively performing the movements of artificial respiration, the physician holding the child's arms at the (flexed) elbows, pressing them to the sides during expiration, and with traction during inspiration, he aids in giving a sufficient amplitude to the thoracic cage.

DURATION OF TREATMENT.

Treatment should be continued as long as there is any tendency towards buccal respiration, respiratory re-education only being completed when quiet, deep, complete, nasal respiration is established, even when lying down.

Rosenthal considers three months an average time for this re-establishment, but often a much shorter period is sufficient. Some patients may require a period of three months before attaining a satisfactory nasal respiration, but it is common to find patients breathing correctly at the end of a/

a month or six weeks. A very great improvement is general at the end of a few séances.

As a rule, during the first three weeks, three or four séances per week are held.

During the next three weeks, two séances will suffice, and if necessary during the next two or three weeks, one séance per week.

Each lesson comprises a maximum of ten exercises, repeated five, ten, then twenty times, always stopping short of fatigue. Passive movements are commenced as soon as the patient can correctly perform twenty physiological nasal respirations in different natural attitudes - generally after four or five meetings.

Active movements should be slowly and cautiously introduced, only about the fifth or sixth week. After that, progress is rapid.

CHAPTER VI.CLINICAL OBSERVATIONS ILLUSTRATIVE OF TREATMENT BY
RESPIRATORY RE-EDUCATION.Case I:-

published by M. Lermoyez- Annales des maladies
de l'oreille.
September 1904.

Mlle. B., 21 years of age, came to consult me on the 28th November, 1903, because she was unable to breathe by the nose. The mouth was always open, even when she was not under observation. Her speech has a nasal character, and she cannot blow her nose. The pharynx is dry, the teeth carious from mouth-breathing of long standing. At night she snores noisily, the saliva drivels on to her pillow: even when asleep, she never breathes by the nose.

She remembers that, when about 14 years of age, after an attack of coryza, she began to use the mouth in respiration, and little by little the nose completely lost its respiratory function.

She has been told recently that the nasal fossae must be full of mucous polypi, and she consults me now to have them removed.

On first examining her, nasal insufficiency is striking. If one obliges her to close the mouth, the/

the thorax is seen at once to become immobile, and the face cyanosed. Nasal insufficiency is not, however, absolute, for from time to time, overcome by the need for air, the patient attempts a few nasal inspirations: inspirations jerky, irregular, superficial, scarcely sufficient to prevent asphyxia. But, on examining the nasal fossae, I was surprised to find that they are absolutely free, more capacious even than normal, for the turbinates are slightly atrophied. The naso-pharynx is similarly free from obstruction, and the soft palate presents no affection either of sensation or of mobility.

Perhaps tactile sensibility is a little less acute on the right side of the body than on the left, and the ovarian region a trifle sensitive to pressure. But there is no sensory hemianaesthesia, and no narrowing of the field of vision.

The question of treatment? I submitted this patient to Dr. Rosenthal, chief clinician of the Faculté, who treated her exclusively by respiratory gymnastics. After four séances the nasal insufficiency, of at least seven year's standing, had disappeared. And two months afterwards, in January 1904, the cure was perfectly maintained. The patient closes her mouth, breathes by her nose without effort, and no longer snores at night. Her voice/

voice has become quite natural.

As such a rapid recovery has a certain element of the marvellous, which invites scepticism, I have asked M. Rosenthal to give me a detailed account of the technique which he employed.

The following is a résumé:-

"At the first séance , I explained to Mlle. B., who is very intelligent, the dangers of mouth-breathing and the simplicity of nasal respiration. I invited her to try to breathe by the nose, standing in front of me, and made her understand that a momentary arrest of respiration, supposing it were produced, could not be dangerous. Then I made her proceed in the following respiratory progression.

1. A deep inspiration by the mouth, then an attempt at a consecutive inspiration by the nose; then a new buccal inspiration and so on;
2. the same exercises, but with two consecutive nasal inspirations,
3. third exercise, with three nasal inspirations together, and so on, up to ten nasal respirations, intercalated between two buccal respirations. During the time that Mlle. B., respired by the nose, I encouraged her, telling her that her colour was good and that she ran no risk.

I acted/

I acted, in short, at once, by suggestion and respiratory re-education.

"At the second séance, I commenced the same progression, but from the first exercise Mlle. B., took seven consecutive nasal respirations and at the end she attained to forty.

I continued to encourage her to breathe by the nose, by showing her she ran no danger.

"At the third séance it was again necessary to cause Mlle. B., to take a deep buccal respiration before the series of nasal inspirations.

"But, at the fourth séance (or at the end of the 14 days, two séances per week being held), as soon as this young lady came into my consulting room, I said to her sharply "Breathe properly, with the nose-" and I indicated the respiratory cadence, by raising and lowering the hand, as is my custom. She then took forty consecutive nasal respirations without difficulty.

"In short, four séances, of five minutes each sufficed to cure a nasal pseudo-obstruction.

Several ulterior séances were held to consolidate the cure and prevent relapses."

(Rosenthal).

Case II:-

from Dr. Lermoyez's clinique, Hôpital
St. Antoine, Paris. Reported by Dr. Jacob.

Mlle.L., 7 years old, was brought to Dr. Lermoyez in 1894, suffering from left-sided acute catarrhal otitis with serous discharge.

She was a well-developed little girl of healthy appearance. In infancy she has had attacks of discharge from the ear, of short duration; measles at the age of 12 months.

Last year she commenced to have pain in the ears when she used her handkerchief.

On examination, 10th March, 1894, the child's mouth is wide open, she never closes it, and has been continually scolded on that account.

Right ear. Tympanum opaque. No redness.

Left ear. Malleus reddened. Membrane very transparent at certain points, opaque in the postero-inferior segment. Almost complete immobility with Siegle's pneumatic speculum.

Nose. Anterior nares free. No muco-pus. Turbinals red, no tumefaction.

Pharynx. No trace of muco-pus coming from the post-nasal space. Tonsils not enlarged./

enlarged.

Digital examination Adenoid vegetations, softish,
of naso-pharynx.

median in position, forming a large mass of the size of a hazel nut.

The ablation of the "vegetations" is absolutely indispensable.

27th November 1894. The discharge has dried up.

Occasional attacks of otalgia still persist in the left ear.

5th December 1894. The adenoid vegetations were removed.

The larger vegetations were first removed with Jurac's forceps, then the post-nasal space was thoroughly curetted with Gottstein's curette.

6th December 1894. The child snored during the night,

more than usual. She has no pain in the left ear.

13th December 1894. The patient now scarcely snores at all

at night, but always sleeps with the mouth open. She has a moderately large amount of muco-pus in the left nostril. No pus in the naso-pharynx.

22nd December 1894. The child closes her mouth well during

the day, when she is not being watched: she looks very well.

4th October 1895./

4th October
1895.

The child has grown greatly, is very healthy, and has benefited extremely by the operation. She shuts the mouth day and night. The mucous membrane of the nose and pharynx is pink and without a trace of muco-pus.

30th January
1896.

Nasal respiration is quite free, but paradoxical. The child is in splendid health; she now has the mouth open during the day, but not at night. She inspires very well by the nose, but when she keeps her mouth closed, she cannot expire freely by the nose. Left to herself, she does not know how, voluntarily at least, to breathe by the nose, but at night she does so by instinct.

When she is asked to blow through the nostrils, she aspires.

Spontaneous nasal expiration is impossible and paradoxically it becomes an inspiration.

She must be taught to breathe.

2nd February
1897.

Buccal respiration has become re-established, but the child has coryza and acute pharyngitis.

6th February
1897./

- 6th February 1897. The mouth is always half open.
- 3rd January 1899. The girl is in good health, she has grown. She still has little nasal respiration, which is due to the presence of very much enlarged middle turbinals. The post-nasal space and choanae are free.
- 20th February 1902. The parents find that the child speaks through the nose. She sleeps with closed mouth. The nose is obstructed anteriorly by hypertrophy of the inferior turbinals. Their polypoid mucosa does not retract under cocaine. The vault shows new vegetations, a quarter of the choanae, at least, is hidden.
- 26th February 1902. The extremity of the right inferior turbinal was removed. The child cannot yet blow through the nose.
- 10th March 1902. Two-thirds of the right inferior turbinal was removed. If she cannot yet respire, the post-nasal space must be curetted to remove the tonsillar hypertrophy.
- 31st October 1903. The child cannot breathe at all by the nose. There is still at the left some turbinal/

turbinal hypertrophy and remains of adencoid vegetations.

The child was sent to Dr. Rosenthal for respiratory re-education.

24th November
1903.

At the beginning of treatment Dr. Rosenthal proved that the patient did not know how to breathe by the nose. He undertook respiratory exercises, and continued then for seven séances

Results:-

The child breathes well with the right nostril, and insufficiently with the left. On this side the inferior turbinal still shows hypertrophy.

12th December
1903.

Ablation of the turbinal hypertrophy. She was advised to see Dr. Rosenthal again to complete her respiratory re-education.

9th February
1904.

The girl respirees very well. She closes her mouth during the day, but not at night. Nasal intonation has greatly diminished. She still sleeps with open mouth, but her nose is quite free.

Case III:-

Marcelle F., 13 years, saw me in Dr. Lermoyez's clinique, at the St. Antoine Hospital, Paris, on January 8th, 1904.

Complaint. Breathes by the open mouth, speaks badly, and always feels tired.

History. The patient has had intermittent attacks of catarrh of the left ear, with increasing deafness on that side for the last two years. During this time she has been unable to breathe by the nose, and has found increasing difficulty in phonation, being especially troubled in the pronunciation of Ms and Ns.

Ears. Right tympanum retracted somewhat. On inflation through the Eustachian catheter the right tympanum is found to be unduly lax.

On the left side the tympanum is perforated in the posterio-inferior quadrant, but no discharge is present. Hearing on the right $\frac{30}{36}$, on the left $\frac{5}{36}$

Nose. On anterior rhinoscopy the inferior turbinals/

turbinals on both sides are found to be red and tumefied. On the application of adrenalin solution, adenoid hypertrophy can be detected on the left side, from the anterior nares. By posterior rhinoscopy, sessile, adenoid vegetations of the size of a bean are seen, central in position, but with a tongue-like prolongation on the left side.

The Eustachian tube on the same side is occluded.

Examination with Glätzel's mirror proves the nasal respiratory act to be in total abeyance.

Pharynx.

Chronic pharyngitis. On pressing the root of the tongue with the end of a spatula, the soft palate is reflexly drawn up, and pressing against the adenoid hypertrophy causes mucopus to descend along the posterior wall of the pharynx.

Thorax.

The pigeon-breast deformity is present, the sternum being prominent, a circular depression in the lateral zone, corresponding to the attachment of the/
the/

the diaphragm, and the intercostal angle being very narrow. Supra and infra-clavicular flattening is observed at both apices, especially well-marked on the left side. The intercostal angle opens very little during expiration. On auscultation the vesicular murmur is feeble all over the thorax, especially so at the bases and apices. Blood count shows the red corpuscles to be 4,000,000 per c.m.m. Haemoglobin 78%

I arranged for the girl to return in a week for ablation of the adenoid vegetations.

13th January
1904.

The adencids were removed by Dr. Bourgeois, with a Gottstein curette, under a general anaesthetic. Haemorrhage considerable.

23rd January
1904.

The child feels better, can pronounce the letters M and N more correctly, but has no idea of nasal respiration. I decided to commence her respiratory re-education as soon as possible.

1st February
1904.

Height 53 inches. Weight 75 pounds.
Axillary/

Axillary respiratory amplitude (A.R.A.)
 $23\frac{1}{2}$ - $24\frac{1}{2}$ inches

Xiphoid respiratory amplitude (X.R.A.)
 $20\frac{1}{2}$ - 21 inches.

First séance. The child at first cannot take more than three nasal respirations before being obliged to open the mouth. I showed her how to take deeper and more complete nasal respirations, and at the end of the lesson she could manage ten consecutive nasal inspirations in the erect, sitting and dorsal positions - expiring however by the mouth.

4th February
1904.

At the end of the second meeting the child performed six nasal respirations, inspiring and expiring by the nose.

8th February
1904.

Fifteen nasal respirations are now attained and passive movements were commenced.

18th February
1904.

Sixth lesson. Good progress is being made. The girl has a more healthy appearance. Twenty nasal respirations can now be made, accompanied by passive movements in the different progressions. Special exercises, described in the text, were commenced to aid in the expansion of the apices and bases.

28th February
1904./

28th February
1904.

The girl now breathes the greater part of the day by the nose, but snores at night.

6th March
1904.

Twelfth, and last séance. The girl now breathes well by the nose. Glatzel's mirror proves a sufficient bilateral nasal respiration. The mouth is kept well shut and the appearance and intelligence are vastly improved.

Active exercises accompany the nasal respiration, without disturbing its rhythm.

Breath sounds are clear and equally well-heard at corresponding points on each side of the chest. The vesicular murmur at the bases is much more clearly heard.

The red corpuscles are $4\frac{1}{2}$ millions per c.m.m. Haemoglobin 85%

Height $53\frac{1}{2}$ inches. Weight $77\frac{1}{2}$ lbs.

A.R.A. 24 - $25\frac{1}{2}$ inches.

X.R.A. 21 - 22 inches.

Case IV:-

Carl G., aged 28, postman, was seen by me on 28th November 1902, in B. Frankel's Klinik, in Berlin.

He has breathed entirely by the mouth for some years, and suffers from almost constant headache and frontal pain. The patient has had no previous illnesses.

He is very anaemic in appearance. The blood count shows the red corpuscles to number 3,900,000 per cubic millimeter. The nares are narrow and slit-like.

On rhinoscopic examination, the middle turbinals are swollen, on the right and left, and the posterior end of the right inferior turbinal is much enlarged and of a bright red colour.

The post-nasal space is free from adenoid hypertrophy.

A simple alkaline, warm nasal douche was prescribed, along with iron and arsenic internally.

5th December 1902. The swollen posterior end of the right inferior turbinate was removed with the cold snare, under local application of 10% cocaine, and the right inferior meatus packed with chinosol gauze.

12th December
1902/

12th December
1902.

The middle turbinates are no longer swollen, and the nasal air-way is now free. The patient can project a stream of air through his nose, but does not breathe by it under ordinary circumstances.

I explained to him the importance of nasal respiration, and the risk of a return of the conditions preceding the operation which mouth-breathing incurred.

Height 5 feet $6\frac{1}{2}$ inches. Weight 9 stones 13 lbs. Chest measurement at the level of the axillae 33 inches.

I then told the patient to close his mouth and breathe through his nose—inspiring and expiring myself along with him. He became cyanosed after 8 such respirations, and was obliged to open his mouth.

Before the end of the sitting the patient could take twenty nasal respirations.

26th December
1902.

Fourth séance. The patient appears much better. Weight 10 stone $1\frac{1}{2}$ lbs. Chest/

Chest $32\frac{1}{2}$ inches. He can now breathe well by his nose, but the habit has not yet become natural to him and he often forgets to do so. He snores at night.

2nd January
1903.

Eighth séance. The patient appears very much better in every way. The nose is not so pinched as at first. Red blood-corpuscles $5\frac{1}{2}$ million per c.m.m. He breathes by the nose by day and does not snore so much at night. He says he has not felt so well for years. Weight 10 stone, 5 lbs.
Chest 33 inches.

Case V:-

Samuel H.S., aged 8 years was brought to consult me by his mother, on 9th May, 1905.

Complaint. Sleeps with the mouth open and snores at night. Increasing deafness.

History. For the last eighteen months the little boy's hearing has been getting worse, he has found increasing difficulty in breathing by the nose. His parents, who are in a good position, are fully alive to the evils of mouth-breathing, and continually "correct" him for the bad "habit."

His work at school has suffered.

Mouth and Pharynx.

The palate is highly arched, the alveoli are narrowed, and there is vicious implantation of the teeth. The tongue is furred, the tonsils congested, mucus is seen on the posterior wall of the pharynx.

Nose.

The nasal passages are free, except that there is a small spur on the right side of the septum.

Naso-pharynx.

It is not possible to make a posterior rhinoscopic/

rhinoscopic examination, but on introducing the finger into the naso-pharynx, vegetations about the size of a small bean are to be felt, situated centrally, and coming into contact with the openings of the Eustachian tubes.

Ears.

No discharge. Drum-heads retracted on both sides. Prominence of short process of malleus. A warm, weak, alkaline, antiseptic, naso-pharyngeal douche was prescribed.

15th May 1905. I removed the adenoid hypertrophy, under gas and oxygen, using forceps and curette.

20th May 1905. The patient has recovered from the effects of the operation, but does not breathe by the nose. The tubes were inflated through the Eustachian catheter. Hearing is improved. I decided to commence respiratory exercises in a week's time.

27th May 1905. First séance.

Thorax.

The chest is well formed, but poorly covered with muscles.

The vesicular murmur is feeble throughout, and becomes extremely so on attempting/

attempting to breath by the nose.
 Courtade's pneumodograph proves that
 the nose is little used and that
 respiration is almost entirely buccal.
 Height 4 feet. Weight 3 stone 12 lbs.
 Axillary respiratory amplitude
 23 $\frac{1}{2}$ -24 inches
 Xiphoid respiratory amplitude
 22-22 $\frac{1}{2}$ inches

At the end of three nasal respirations
 the boy felt faint and dizzy. He
 rested in the reclining position for
 five minutes. I then reassured him and
 directed him to renew his attempt at
 nasal respiration, safeguarding him by
 allowing him to expire by the mouth.
 Finally he performed ten respirations
 in this manner, and a satisfactory
 beginning was made.

30th May 1905. The little patient has an attack of
 acute coryza, so that it is necessary
 to discontinue respiratory treatment
 for a time.

1% menthol, in sterilized vaseline was
 prescribed to be painted frequently
 inside the nostrils.

6th June 1905. Second séance. The coryza has
 disappeared/

disappeared. Three complete nasal respirations (inspiration and expiration), can now be performed. At the end of the lesson eight respirations are accomplished.

12th June 1905. Fourth séance. Ten nasal respirations, in the standing, sitting and reclining position can be taken without causing dyspnoea. The mother tells me that her boy's appetite and spirits are much improved.

He appears manifestly better than when first I saw him. The buccal mucosa is much healthier in appearance.

20th June 1905. Eight séance. Great improvement. Twenty complete, sufficient nasal respirations can now be obtained. Gentle passive movements of arms and trunk were commenced.

30th June 1905. Twelfth séance. The boy now breathes by the nose the greater part of the day but still snores at night.

10th July 1905. Last séance. The patient's general health has greatly improved. His hearing is normal, his respiration, as proved by the pneumodograph, is nasal, but he still snores occasionally during sleep /

sleep.

Height 4 feet. Weight 4 stone, 4 lbs.

A.R.A. $24\frac{1}{2}$ - $25\frac{1}{2}$ inches.

X.R.A. $23\frac{1}{2}$ - $24\frac{1}{2}$ inches.

Case VI:-

James S., aged 13 years, was brought to me on 10th June, 1904, on account of a dry, persistent cough, and because he could not breathe by his nose.

History. His family history is good. He has several brothers and sisters, older than himself, none of whom have suffered from the nose or throat. Since the age of 8 years the patient has been a mouth-breather, and in 1901 he was operated upon for adenoid vegetations in the Royal Infirmary, Liverpool. After the operation he breathed imperfectly by the nose for some time (naso-buccal respiration), but soon reverted to the buccal type. When I first saw the boy he was small for his age, thin, pale, of delicate appearance, mouth continually open.

Nose. On anterior rhinoscopy the right nasal passages are free, the mucosa healthy. The septum is slightly deviated to the left. The anterior end of the left inferior turbinate is tumefied, but did not touch the septum/

septum at the time of examination, though a distinct depression in the septal mucus membrane, just opposite the anterior end of the lower turbinate, indicates that they do come into contact when the vascular supply of the turbinal erectile tissue is increased. The tumefaction disappeared after the application of a 5% solution of cocaine.

On posterior rhinoscopy the nasopharynx is quite free from adenoid hypertrophy.

Pharynx.

The pharyngeal mucus membrane is dry and glazed.

Larynx.

Vocal cords a little congested. The voice is weak and has a "covered" quality. On examination with Glatzel's mirror, it is proved that the respiration is mostly buccal. Only a very small stream of air can be forced through the left nostril. An alkaline naso-pharyngeal douche was prescribed, to be used night and morning. Patient to return in a week.

10th June 1904. Several punctures were made into the swollen anterior end of the left inferior/

inferior turbinate with an electro-cautery needle, with the object of causing the mucous membrane to become tacked down by adhesions.

5th July 1904. Both nostrils now appear sufficiently patent, but, as the boy is unable to breathe by the nose, it was decided to at once begin respiratory re-education.

6th July 1904. Height 4 feet 4 inches. Weight 5 stone 8 lbs.

Thorax. Inspection. The chest walls move fairly well in inspiration and expiration, but supra and infra-clavicular flattening is marked at both apices.

Auscultation. Breath sounds are distinct all over the thorax, but it is to be remembered that the chest walls are very thin.

Axillary respiratory amplitude
(A.R.A.) $27 - 27\frac{3}{4}$ inches

Xiphoid respiratory amplitude
(X.R.A.) $25\frac{1}{2} - 26\frac{1}{2}$ inches.

At the first séance the patient can only take three nasal respirations, before being obliged to take a forced buccal respiration. At the end of the/

the lesson he could take six consecutive nasal respirations both in the erect position and in the dorsal decubitus.

9th July 1904. At the second meeting the boy could take ten nasal respirations, and at the end of the lesson twenty.

12th July 1904. Twenty nasal respirations were correctly performed at the beginning of the lesson, and passive movements of the arms and trunk were commenced. The patient could at first only take four or five nasal respirations accompanied by passive movements of the arms and trunk, but he became used to the movements before the end of the séance and could manage twenty nasal respirations.

20th July 1904. Sixth lesson. The boy is now able to go through all the passive exercises (described in the text), and can easily accomplish thirty consecutive nasal respirations. He also begins to breathe through the nose during the day, but not when asleep.

30th July 1904./

30th July 1904. Tenth séance. Nasal respiration is now practically established. At night the patient still breathes by the mouth. His mother is directed to impress upon him to keep his mouth shut last thing before he goes to sleep. Active movements begun, as well as special exercises to aid in the better expansion of the pulmonary apices.

16th August
1904.

Eighteenth séance. The boy's general appearance has greatly improved. He breathes well by the nose both day and night. His muscles have improved in tone under the exercises.

Height, 4 ft. $4\frac{1}{4}$ ins. Weight 5 st. 12 lbs.

A.R.A. 27 - 28 inches.

X.R.A. $25\frac{1}{2}$ - $26\frac{3}{4}$ inches.

August 1905. The boy has developed considerably and breathes well by the nose, day and night. His chest is well formed and there are no signs of apical retraction. He now no longer suffers from attacks of coryza, which were formerly very frequent with him.

Height 4 ft. $7\frac{1}{2}$ ins. Weight 6 st. 5 lbs.

A.R.A. 29 - $30\frac{1}{2}$ inches.

X.R.A. 28 - 29 inches.

Case VII:-

James B., 13 $\frac{1}{2}$ years, came to see me on the 6th November 1906.

Complaint. Inability to breathe by the nose; mouth continually open, and deafness.

History. The boy had scarlet fever at the age of twelve years, that is to say, about 18 months ago. Since then he has been unable to breathe through his nose and has had intermittent attacks of discharge from the left ear.

He sleeps badly, has terrifying dreams, and wakes up breathless and bathed in profuse perspiration.

The patient is pale and of a strumous diathesis, glands can be felt along the sterno-mastoid on both sides. He is an intelligent boy.

Mouth and Pharynx.

The teeth are carious, the tongue flabby and furred. Chronic pharyngitis is present. Mucc-pus is seen on the walls of the pharynx.

Nose.

On anterior rhinoscopy the nostrils are found to be full of the crusts of dried nasal secretion.

Naso-pharynx/

Naso-pharynx. A very good view of the post-nasal space can be obtained by posterior rhinoscopy, and voluminous adenoid vegetations are seen, almost completely blocking the choanae and hiding the openings of the Eustachian tubes.

Ears. Acuteness of hearing on the right $\frac{2}{3}$
 " " " " " left $\frac{1}{3}$

No discharge. A small perforation is seen in the postero-inferior quadrant of the left tympanic membrane. Both membranes are retracted and the short process of the malleus is prominent.

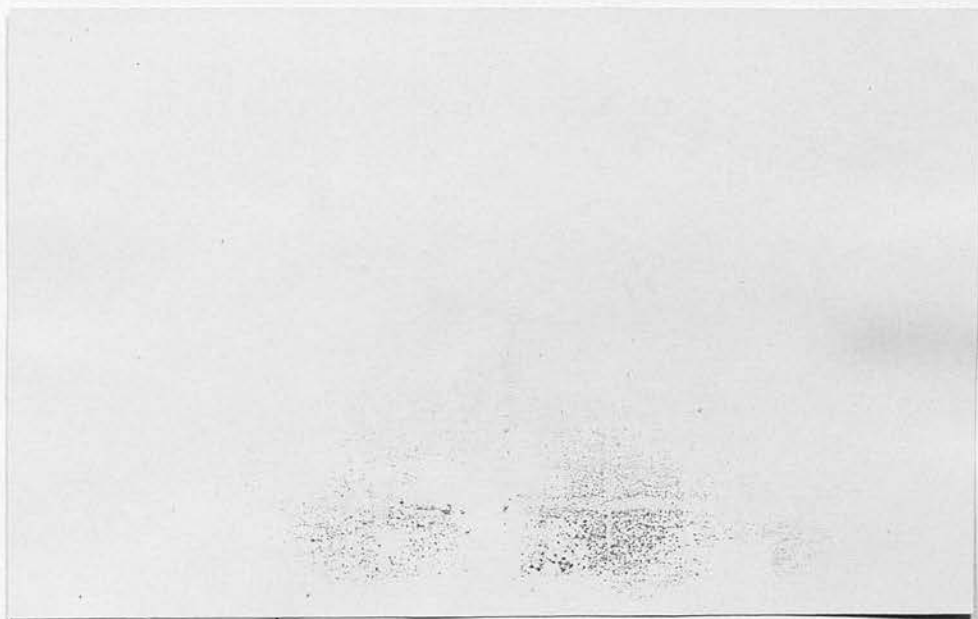
Thorax. A moderate degree of dorso-cervical left-sided scoliosis is present, the left shoulder being one inch higher than the right. Respiratory movement is scarcely perceptible on the right side. The vesicular murmur is weak all over the chest.

On submitting the boy to the naso-respiratory test it is found that he can only take two nasal respirations before dyspnoea forces him to open his mouth.

15th Nov.1906./

- 15th Nov.1906 The adenoid vegetations were removed under chloroform, a good deal of haemorrhage took place.
- 16th Nov.1906 The boy passed a good night, temperature 100^c the evening of the operation. I recommended him to go to a dentist for extraction of carious teeth; and prescribed a warm alkaline, nasal douche to dissolve and remove the dried nasal secretion.
- 26th Nov..1906 The patient is quite better from the operation. There is no larger mucus in the naso-pharynx and pharynx. Respiration is naso-buccal.
- 7th Dec.1906 The respiration continues to be buccal or naso-buccal. Sleep is disturbed and profuse perspiration on waking. The nose is free from dried secretion. The parents were advised to insist that their son keep his mouth shut. The Eustachian catheter was passed; and iron and malt prescribed. He was advised to drink four tumblers of milk per day, in addition to his ordinary diet.
- 8th Jan.1907./

8th Jan.1907. Respiration is shallow and unsatisfactory and completely buccal - no attempt being made to breathe by the nose. Respiratory training to be commenced forthwith.



Nasal Pneumogram. James B. 10/1/07..

10th Jan.1907. First séance. Height 4 ft. 11 inches.

Weight 5 stone. $10\frac{1}{2}$ lbs.

A.R.A. 25 - 26 inches.

X.R.A. $23\frac{1}{2}$ - $24\frac{3}{4}$ inches

Only three nasal respirations could be taken at first, but by the end of the lesson, we had reached ten.

15th Jan.1907./

15th Jan.1907 Third séance. Ten nasal respirations can be taken at the beginning. Then twelve and fifteen, standing and sitting, but not lying down. The anterior nares were then examined, but the turbinates were not found to be tumefied.

The Eustachian tubes were inflated.

22nd Jan.1907. Fifth meeting. Good progress is being made. The boy looks better and can take twenty full complete consecutive nasal respirations, sitting or standing. Five can be taken lying on his back.

29th Jan.1907. Twenty nasal respirations can now be taken, in all positions. Passive exercises were commenced. The hearing has very much improved. The anterior nares are quite free. Suitable movements and exercises were undertaken to re-educate the muscle-sense and overcome the scoliosis.

5th Feb.1907. Ninth séance. Twenty nasal respirations can now be taken, combined with the various passive movements.

Special/

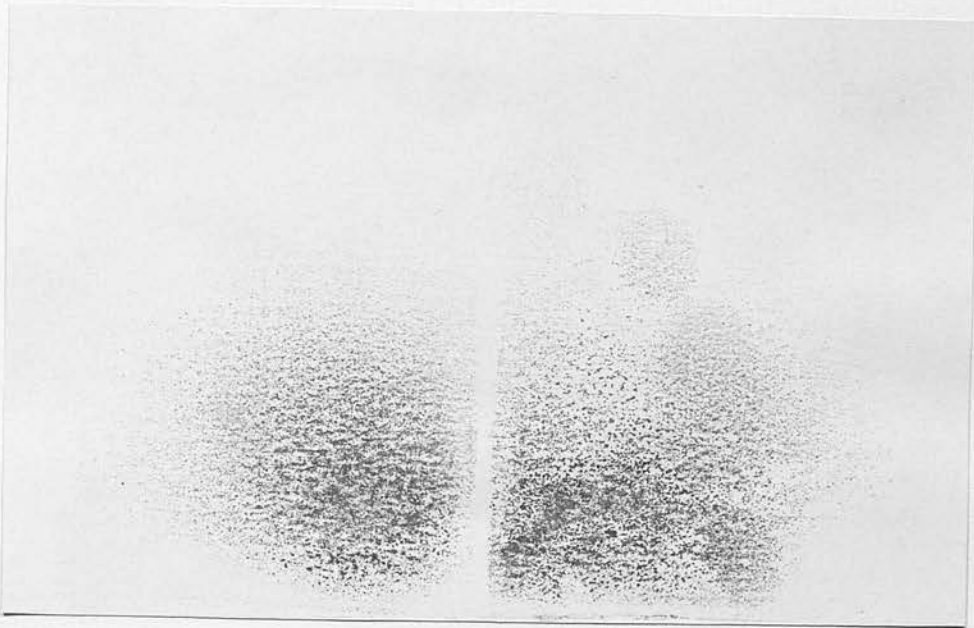
Special exercises to expand the right lung are performed.

Height 5 ft. Weight 5 st. $12\frac{1}{2}$ lbs.

A.R.A. 26 - 27 inches.

X.R.A. $23\frac{1}{2}$ - 25 inches.

The pneumogram shows that a sufficient nasal respiration is now established.



Nasal pneumogram. James B. 5/2/07.

4th March
1907.

Fourteenth séance. The breathing is now entirely nasal during the day, but the boy snores at night, though he has now no terrifying dreams, nor excessive/

excessive perspiration. His colour and appearance have greatly improved. Active exercises, accompanying nasal respiration, are commenced.

29th March
1907.

Last séance. The patient is in splendid health and breathes by the nose, day and night. Appetite and digestion are excellent. No nightmare. The scoliosis has greatly improved, the shoulders are now on the same level.

Hearing R. $\frac{3}{3}$
" L. $\frac{1}{3}$

Height 5 ft. $0\frac{1}{2}$ ins. Weight 6 stone.

A.R.A. $26\frac{1}{2}$ - 28 inches.

X.R.A. 24 - $25\frac{1}{2}$ inches.

Case VIII:-

Miss S.L., 18 years, consulted me in private on the 6th July, 1904.

- Complaint. Great difficulty in normal nasal respiration a feeling of oppression and suffocative attacks.
- History. The young lady has had difficulty in breathing since she was ten or eleven years old and has very frequent attacks of coryza, during the winter months especially. Menstruation has been suppressed for the last 18 months, during which time the respiratory trouble has been notably accentuated. Typical adenoïd facies.
- Nose. The nasal fossae are quite sufficiently patent: the septum a little deviated to the left, and the anterior ends of the inferior turbinates slightly tumefied. With Glatzel's mirror it is shown that nasal respiration is very feeble.
- Mouth and Pharynx. The alveolar arches are narrow and the palate high. Several teeth have been extracted to make room for the rest. Tongue furred and red at the edges. Pharynx dry and glazed.
- Naso-Pharynx. A posterior rhinoscopic examination was not possible, but with the fore-finger

large, soft, adenoid vegetations can be felt, occupying the vault and posterior pharyngeal wall.

Thorax.

A tendency to the pigeon-breast type.

On percussion the resonance is not good at either apex anteriorly.

Auscultation - weak, vesicular breathing, no prolongation of expiration.

11th July 1904. I removed the adenoid vegetations, under chloroform, with forceps and curette. Haemorrhage normal in amount, ceasing immediately on swabbing with resorcin.

15th July 1904 The patient can project a stream of air through each nostril, as tested with pieces of cotton-wool, but has no adequate nasal respiration.

22nd July 1904 Miss L. still has the mouth open, so I decided to commence respiratory exercises.

Height 5 ft. 6 ins. Weight 9 st. 2 lbs.

A.R.A. 31 - $31\frac{3}{4}$ inches.

X.R.A. $29\frac{1}{2}$ - 30 inches.

I carefully explained the absolute necessity of nasal respiration and the ease with which it could be acquired, now/

now that there is no organic nasal obstruction. At first Miss L., could only breathe twice through the nose, and then was obliged to open the mouth to take in air, with a quick, shallow "gasp."

She persevered and before the end of the séance she attained to five moderately good, nasal respirations, I indicating inspiration and expiration with the hand.

25th July 1904 Second séance. Ten consecutive nasal respirations in the three attitudes were accomplished, before dyspnoea forced the patient to open the mouth. As the latter condition seemed to depend largely upon nervousness, and the patient being of adult years, I was at some pains to explain to her that there was no real reason why she should not breathe by the nose, and that nasal respiration would be in every way beneficial to her health. In this way twenty sufficient nasal respirations were obtained at the end of the second lesson.

2nd Aug. 1904./

2nd August 1904 Fourth séance. Twenty nasal respirations, accompanied by passive movements can now be taken.

The patient has commenced to menstruate, the first time since the beginning of 1903.

6th Aug. 1904. Respiration has now become nasal and there is very little snoring at night.

25th Aug. 1904 Twelfth and last séance. The patient has greatly improved, she now breathes quite physiologically. Sleep is undisturbed. No feeling of oppression. Weight 9 stone 3 lbs.

A.R.A. 32 - $33\frac{1}{2}$ inches.

X.R.A. 30 - $31\frac{1}{4}$ inches.

The vesicular breath sounds are stronger and more forcible than before the operation, and respiratory re-education. Apical resonance fairly good. Special exercises undertaken to expand the bases and apices.

10th Aug. 1906. The cure is perfectly maintained. Respiration is exclusively nasal. Weight 9 stone 6 lbs.

CHAPTER VII.CONCLUSIONS.

1. Respiration, in order to be physiological, must be exclusively nasal.
2. Respiratory re-education should be both psychical and physiological.
3. Respiratory re-education is a valuable and physiological system of treatment:
 - a. After operation for adenoid hypertrophy, or other organic changes in the nasal passages causing buccal respiration, whether the latter condition be relieved by the operation or not.
 - b. In all cases of buccal or naso-buccal respiration, depending upon a functional disturbance.
4. Respiratory exercises are of great service in aiding in the expansion of the lungs, local or general: in increasing the respiratory amplitude and "vital capacity:" in protecting against pulmonary tuberculosis.
5. The treatment can only be beneficial under the following conditions:
 - a./

- a. In the absence of all anatomical obstacle to respiration.
- b. When the respiratory exercises are directed by the physician himself, being guided by the clinical indications, (inspection, percussion, auscultation, mensuration, pneumograms, etc.)

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