

## **THE ROLE OF THE OSTEOPATHIC LESION IN THE DISEASE PROCESS**

The early osteopathic research consisted mainly of experiments conducted on animals. However, from the 1940s, research was carried out on human subjects at the Kirksville College of Osteopathy and Surgery by Denslow, Korr and Krems. Their first paper confirmed the hypothesis that there exists in man chronic facilitation or hyper-excitability in groups of nerve cells found in the anterior horns of the grey matter of the spinal cord, which activate, among other voluntary (skeletal) muscles, the erector spinae. These groups of facilitated or hyper-excitability nerve cells were identified by experiments conducted to determine the smallest amount of pressure applied to the spinous process of a vertebra which would elicit a reflex response in erector spinae muscle at the same segmental level; the point of such response being called the reflex threshold. Low reflex thresholds, indicating a condition of facilitation or hyperexcitability of the nerve cells, were demonstrable in subjects over periods of months.

Reflex thresholds were measured by the following method. When the minimum pressure required over a spinous process to elicit response from the erector spinae muscle at the same level was between 1-2kgm the reflex threshold was classified as low (L); between 3-5kgm as medium (M); between 6-7kgm as high (H); and when there was no muscle response at the maximum pressure recordable on the meter (7kgm) as none (N).

In apparently healthy young men, low (L) reflex thresholds were demonstrable over periods of months; persistent differences in thresholds were found between one subject and another; and in the same subject, between one segment and another, and between the right and left side of the same segment.

The detailed findings were reported in two parts, (1) the correlation of reflex threshold with other segmental features, and (2) the intersegmental spread of excitation

### *Part 1. The Correlation of Reflex Threshold with other Segmental Features.*

(a) Pain. When quite severe pressure, beyond that which the pressure meter could record, was applied to the spinous process of a vertebra related to a spinal segment of a high reflex threshold (H or N), pain, other than fleeting, was not usually felt there; whereas quite modest pressure applied to a spinous process associated with a segment of low (L) reflex threshold produced a definite pain described as "like a bone bruise", which often persisted for a time after the pressure had been released. This result, to a lesser degree, was usually found in segments of medium (M) threshold

(b) Tenderness. After a series of repeated pressures at the spinous process of a vertebra related to a segment of low (L) reflex threshold, the process remained tender for more than 24 hours; a result which was not observed at segments of high (H) or no (N) threshold.

(c) Differences in physical characteristics of supraspinous tissues.

Members of the research group with osteopathic training and experience were able to identify, by palpation, abnormal features of the skin and other tissue which closely invest the spinous processes and adjacent muscle of vertebrae related to spinal cord segments of low (L) reflex threshold. This phenomenon was not discernible in such tissue related to segments of high (H) reflex threshold, or no muscle response (N) at the maximum pressure recordable (7kgm). The words "doughy" and "boggy" were used to describe this abnormal condition; the involved tissue appearing to be less resilient to pressure deformation, and to have developed "ropiness" and tenderness in some of its fibre bundles.

Paragraph (c) establishes the connection between "Somatic Dysfunction" and pain and tenderness and low reflex thresholds in vertebral tissues.

### *Part 2. The Intersegmental Spread of Excitation.*

The experimental conditions established for these studies were as demanding as those for the recording of reflex thresholds, and the following is an example of the findings. The muscle at the level of the sixth thoracic vertebra was abnormally responsive, i.e. had a low (L) reflex threshold, indicating that the corresponding segment of the spinal cord was hyperexcitable or facilitated. The reflex threshold at the level of the fourth, eighth and tenth thoracic vertebrae, however, was found to be high (H), indicating a more or less normal muscle response, and a normal situation at the corresponding segments of the spinal cord.

In this example quite light pressure over the spinous process of the sixth vertebra of low (L) reflex threshold, elicited a muscle response at that level, whilst quite heavy pressure there did not produce any muscle response at the levels of the fourth, eighth and tenth vertebrae of high (H) reflex threshold. Conversely, heavy pressure applied over the spinous processes of the fourth, eighth and tenth vertebrae, did not produce any muscle response at these levels, whilst quite light pressure there produced a muscle response at the level of the sixth vertebra of low (L) reflex threshold. The clinical significance of this intersegmental spread of excitation is obvious. Modest stimuli received at any segment of the spinal cord, from no matter what source, e.g. from the outside world, the brain, an internal organ, or the skeletal musculature, may not express itself at that segment if its reflex threshold is high, but will pass to another segment of lower reflex threshold (higher excitability) where a spinal muscle response will take place. The segments of low reflex threshold are thus vulnerable to stimuli - often of a degree which would not activate a normal segment - from many sources, and the skeletal muscles and internal organs which receive stimuli from them will be excessively activated.

*Studies of hyperexcitable sympathetic nerve cells.*

Having established the presence, in some segments of the spinal cord, of hyperexcitability (facilitation) of nerve cells in the anterior horns of the

cord, which innervate the skeletal (voluntary) muscles, further research was carried out at Kirksville to try to determine whether similar hyperexcitability could be found in the sympathetic nerve cells in the lateral columns of the grey matter of the spinal cord (from the first thoracic to the second lumbar segments) which innervate internal organs and muscle found in the walls of the arterioles (branches of smaller arteries). Since it is well known that free interchange of nerve impulses takes place between the skeletal structures of the body and the internal organs and structures, this was felt to be a reasonable assumption. These researches were carried out by Korr, Thomas and Wright Electrical Skin Resistance Studies

For these studies the sweat glands were chosen because in the lateral columns of the grey matter of all the thoracic and the first two or three lumbar segments of the spinal cord are groups of sympathetic nerve cells which, with their fibres, innervate fairly well-defined areas of the skin, called dermatomes, which are accessible for investigation.

The activity of the sweat glands was studied by what is known as the electrical skin resistance (ESR) method. In this method the resistance of the skin to the momentary passage of an electrical current through it is measured. An increase in activity of the sympathetic nerves serving the sweat glands in an area of skin results in an increase of activity of the sweat glands, and an increase in the flow of blood to the area, i.e. a lowering of the electrical skin resistance (ESR). The validity of the electrical skin resistance method for studying segmental and regional variations in sympathetic activity was first established by Thomas and Korr, and Kawahata and Thomas, who showed that the resistance of the skin is determined mainly by the number of active sweat glands per unit of the skin area, and that this, in turn, is controlled by sympathetic activity.

In explorations of several hundred subjects and patients there were found patterns of electrical skin resistance (ESR) showing variations of current

flow through the skin, and thus of sweat gland activity, in different areas of the trunk. The general pattern for each individual was reproducible, from time to time, over a period of years, although it was not found to be invariable for all detail. However, there was always, in every subject, and often for long periods of time, a group of virtually ever-present areas exhibiting various degrees of ESR; and this group was regarded as the characteristic standard pattern of the individual.

As a result of these extensive investigations, carried out over a long period of time, the following valuable information emerged:

- (a) That there is firm evidence that electrical skin resistance (ESR) is related to activity of the sympathetic nerves expressed through the sweat glands.
- (b) That stimulation of sympathetic nerves reduce the ESR (increases the current flow), whilst inhibition of the activity of these nerves has the opposite effect.
- (c) That the segmental origin of at least some of the low resistance areas was indicated by the frequent presence of them in strips of skin (dermatomes) which are known to be innervated by sympathetic cells in the lateral columns of the grey matter of the spinal cord.
- (d) That the sympathetic nerve pathways related to low ESR areas (areas of high current flow) show exaggerated and easily elicited responses to a variety of stimuli, which suggests that the involved nerve cells have become hyperexcitable (facilitated) and thus vulnerable to stimuli from all parts of the body. The types of experimental stimuli used to elicit these responses were as follows

- 1 Postural stresses induced by lateral tilting of the hips by means of a tilt-chair, or by inserting or removing heel lifts; and emotional stresses (e.g. a

sudden startling noise, or a pin-prick in the calf of the leg) either exaggerated or otherwise disturbed the existing patterns of ESR, or both.

- 2 In a study of clinical patients with musculoskeletal disturbances, a correlation between the areas of most acute stress, pain or tenderness, and the disposition of the areas of low ESR (high current flow) was observed in many individuals.

The conclusion drawn from this research was that it is reasonable to assume that a variety of causes, including the osteopathic lesion, may result in a hyperexcitability (facilitation) of the sympathetic nerve cells innervating the sweat glands, which may become chronic; and that this results in an exaggerated or excessive response by them to stimuli from all sources.

Once this effect was established, the question naturally arose as to whether other autonomic functions were affected by the "osteopathic lesion". Thus were initiated the next series of studies.

#### *Vasomotor Studies.*

As has long been known, the sympathetic vasomotor nerves, whose fibres emerge from cells in the lateral columns of the grey matter of the spinal cord, from the first thoracic to the second or third lumbar segments, end in the circular muscle in the walls of the blood vessels (particularly the arterioles). The vasomotor nerves are of two types (a) those called vasoconstrictors which, when stimulated, constrict the arterioles, and (b) those called vasodilators which, when stimulated, dilate the arterioles. Most of these sympathetic vasomotor nerves contain both constrictor and dilator fibres, but the constrictors predominate, and are responsible for the general tone of the arterial walls. By causing alterations in the internal diameter of the arterioles, the vasomotor nerves play an important role in regulating the supply of blood to the various tissues and organs of the

body. Another experimental project was therefore undertaken, by Korr, Thomas and Wright.<sup>3</sup>

The following are the conclusions drawn from their research. In all subjects there was a persistent pattern of variation of red response, at different segmental levels, and between the right and left sides, which was characteristic and highly constant for each subject.

The findings generally revealed that those segmental levels which were asymmetrical in red response were also asymmetrical in their response to the stress of changing from the prone to the erect position; and that, at each level, the side which exhibited a relatively weak response (thin line) also made a relatively weak contribution to the adjustments which are necessary in peripheral vasomotor tone when these positional changes are made. It was thus felt that these skin areas exhibiting a thin red response were in a chronic state of high blood vessel wall tone, making them less able to take part in important physiological adaptations.

Finally, as the tone of blood vessel walls is very considerably under the influence of sympathetic nerve cells in the lateral columns of the grey matter of the spinal cord, and the patterns frequently appear to be of a segmental nature, these studies were felt to be strong evidence in support of the contention that at least some of these nerve cells are often hyperexcitable, and are in a state of hyperexcitability by the ordinary stresses and stimulations of daily life. The effect of this sustained segmental hyperexcitability or facilitation on the blood circulation of the tissues and organs can be widespread and severe, and capable of causing and maintaining a chronic disturbance of the homeostatic constancy of the extracellular fluid which is so vital to their well-being.

These areas of vasoconstriction could frequently be correlated with the areas of low skin resistance and of other segmental features, as mentioned above, thus supporting the hypothesis that the central facilitatory

mechanism extends from the osteopathically lesioned segment to the vasomotor sympathetic pathways.

### *Conclusion*

The following conclusions may be drawn from these researches. The "osteopathic lesion" may be regarded as the regional somatic component of a reflexly organised and sustained response to the stresses placed upon specific tissues or organs by the environment and by the total activities, responses and adaptations of the individuals. Furthermore, the lesioned segment acts as a "neurologic lens", as it focuses and exaggerates the effects of impulses from many sources on the tissues innervated from that segment.

Thus, the "osteopathic lesion" becomes an important diagnostic tool, able to reveal any early impairment of physiological reserve and predisposition to disease. Whereas, in non-osteopathic practice, the treatment of local autonomic imbalance so often requires a generalised alteration of autonomic activity throughout the body, treatment of the osteopathic lesion offers a specific approach to the local autonomic disturbance associated with many chronic diseases. Furthermore, early diagnosis and treatment of the osteopathic lesion offers a direct and systematic approach to the prevention of chronic disease.

### REFERENCES

- 1 *S Denslow, DO, IM Korr, PhD, A D Krems, PhD, Quantitative Studies of Chronic Facilitation in Human Motoneuron Pools, American Journal of Physiology. Vol. 105 No.2 August 1947.*
- 2 *IM Korr, PhD, P F Thomas, ES, DO, H M Wright, DO, Patterns of Electrical Skin Resistance in Man, Acta Neurovegetativa, Vienna*

1958, *Journal of the American Osteopathic Association*, January  
1955, 212 East Ohio Street, Chicago, Illinois 6/611. USA.

3 I MKorr, PhD, P F Thomas, ES, DO, HM Wight, DO, *Regional or  
Segmental Variations in Vasomotor Activity, Federation  
Proceedings March 1953, Journal of the American, Osteopathic  
Association, January 1955.*

4 W Haycock, DO, MSO, *What Is Osteopathy? An Explanation.  
Maidstone Osteopathic Clinic, 28/30 Tonbridge Road, Maidstone,  
Kent, 1976.*