THE DISSOCIATION OF VOLUNTARY AND EMOTIONAL MOVEMENTS OF THE FACE WITH SPECIAL REFERENCE TO EMOTIONAL PARESIS AS A PHYSICAL SIGN.

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I. INTRODUCTION.

OCCASIONALLY reports have appeared in the literature of cases in which there was paresis of the lower part of one side of the face for emotional movements without any corresponding disturbance of facial movements when carrying out definite tests at command such as showing the teeth or whistling. This type of facial paresis has been referred to briefly as emotional paralysis of the face or mimic facial paralysis. In addition it has been a common observation that a smile which is free and equal on the two sides of the face is possible with the facial paralysis associated with hemiplegia. It was thought that the persistence of emotional movements on the two sides of the face was due to bilateral innervation of the face for emotional movements, but the persistence and even the exaggeration of emotional movements of the face in cases of double hemiplegia made it evident that only the presence of a separate path for emotional movements would explain this dissociation of facial movements. Subsequently, a certain amount of evidence, both clinical and experimental, accumulated in support of a separate path for emotional movements of the face and rather less in support of the actual extent and position of that path.

In view of the possible value of emotional paresis of one side of the face in the localisation of lesions of the central nervous system it is necessary to examine the practical difficulties connected with the identification of emotional paresis of the face as a physical sign and to consider, in the light of the information so obtained and the work already done on the presence and position of a separate path for emotional movements of the face, the conditions responsible for the dissociation of voluntary and emotional movements of the face.

Approximately 5,000 cases have been examined and the condition of the voluntary and emotional movements of the face noted in each. The findings so obtained have been correlated with the rest of the physical examination in those in which dissociation of the voluntary and emotional movements of the face was found, and with operation and post-mortem findings when they

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were available. The voluntary movements of all parts of the face were examined but special attention was paid to the lower part of the face, while in addition the play of the features in conversation and the movements of the face when smiling were noted.

In the following pages the types of dissociation of voluntary and emotional movements of the face under different conditions are mentioned and illustrative cases briefly described. The literature is referred to and the conclusions in reference to the clinical application of the physical sign then discussed.

II. CLINICAL OBSERVATIONS.

In this chapter illustrative cases in which definite dissociation of voluntary and emotional movements of the face has been observed are summarised and discussed, but no distinction is made between cases in which voluntary movements alone were affected and those in which emotional movements alone were affected. In addition a series of cases with lesions of the facial nerve is considered.

1.—Cases in which no adequate cause can be found.

Occasionally a case is seen in which, in the absence of local conditions or of lesions of the peripheral or central mechanism of the face, the lower part of the face is found to move asymmetrically for either voluntary or emotional movements. The absence of any condition which might cause the disturbance of facial movements and the observation of many individuals who use one side of the face more than the other in speaking and in smiling suggest that in these the dissociation of voluntary and emotional movements is the result of habit. In some the former alone is affected and in others only the latter. Dissociation of the two types of facial movement has been observed personally particularly in patients suffering from neuroses. The following cases illustrate this group.

- CASE 1. The patient, female, aged 35 years, had suffered from an anxiety neurosis for five years. The face was symmetrical at rest. On voluntary movement the two sides of the face moved equally, but in speaking and smiling the lower part of the left side of the face moved before and much more freely than the right side. There were no other physical signs.
- CASE 2. A woman, aged 34 years, complained of nothing abnormal. Apart from the following observations physical examination was negative. For voluntary movements the two sides of the face moved equally. When talking and smiling the lower part of the right side of the face moved first and much more freely than the corresponding part of the left side of the face. The play of the features associated with speaking was confined to the right side of the face.
- CASE 3. A patient, aged 18 years, complained of sudden jerks and jumps of the arms and legs for about half an hour after rising in the morning. She had had one major epileptic fit two years before, and had a sister who suffered from epilepsy. Apart from the following physical examination was negative. The face was symmetrical at rest, and the two sides moved equally and simultaneously for voluntary movements. When talking and smiling, however, the lower part of the right side of the face took up before and moved much more freely than the left side.

CASE 4. A patient, aged 30 years, was said to have had attacks at night for eight years. During the attacks, which occurred every two months, she struggled, bit her tongue and passed urine. In smiling the lower part of the right side of the face moved before and much more freely than the left side. With voluntary movements there may have been some delay of the lower part of the left side of the face but it was much less obvious than the definite delay which occurred with emotional movements.

These cases will serve to illustrate the observation that impairment of the movement of the lower part of one side of the face is not an uncommon finding in patients who present themselves for examination, and may be confined to emotional movements, be much more obvious with emotional movements than with voluntary movements, or be apparent chiefly with voluntary movements. Slight asymmetry of the two sides of the face on voluntary movement is very common and need not be illustrated here.

2.—Peripheral conditions of the face and jaw.

In the presence of local conditions affecting the face, jaw or accessory nasal sinuses, and especially the maxillary antra, dissociation of the voluntary and emotional movements of the face may be observed. The following cases may be regarded as examples of this finding under such conditions.

CASE 5. A man, aged 51 years, had suffered from migraine since he was a boy and from occasional epileptic attacks since the age of 44 years. A visual sensation as of a revolving wheel in the right half of the visual field preceded the attacks and sometimes occurred independently of them. At the age of 47 years the patient suffered from a fracture of the right mandible. On examination, the right angle of the mouth appeared to droop a little below the left angle at rest. When speaking and on showing the teeth at command the right side of the lower part of the face moved less freely than the left side, but on smiling no asymmetry could be detected. Otherwise, physical examination was negative.

CASE 6. A woman, aged 30 years, suffered from pain in the left upper jaw following an attack of coryza. Five days before she was seen a tooth was removed from the left upper jaw. The face was symmetrical at rest. On showing the teeth the right lower face sagged and moved later and less freely than the left side, but on emotional movement the right lower face took up first and moved more freely than the left side. There was tenderness over the left upper jaw.

CASE 7. A woman, aged 47 years, had suffered from twitching of the right side of the face for eighteen months. On examination, an occasional spasmodic twitch of the orbicularis oculi and of the right angle of the mouth was observed. Voluntary movements of the lower part of the right side of the face were definitely impaired compared with the left side, but emotional movements were free and equal on the two sides of the face.

In Case 5 there was impaired movement of one side of the face in its lower part only on voluntary movement, whereas in Case 6 impaired voluntary movement of one side of the face was associated with excessive emotional movement of the same side of the face and relative impairment of emotional movements of the other side. In Case 7, one of facial spasm, the asymmetry of movement in the lower part of the face was associated with voluntary effort only.

3.—Lesions of the infranuclear portion of the facial nerve.

It might be expected that with severe lesions of the infranuclear portion of the facial nerve voluntary and emotional movements would be affected equally and completely, but it is doubtful whether dissociation of voluntary and emotional movements of the face might not occur with mild or transient lesions of the facial nerve or during recovery from facial paralysis. The examination of a large series of cases of severe facial paralysis has confirmed the expectation that no dissociation of the two types of facial movement would occur under such conditions. In the following case the lesion of the facial nerve was particularly severe.

CASE 8. The patient, female, aged 26 years, had suffered from paralysis of the right side of the face since birth as the result of an instrumental delivery. There was complete paralysis of the right side of the face affecting both the upper and the lower parts. Voluntary and emotional movements were affected equally and completely.

In the type of facial paralysis which results from pressure of obstetric forceps it is generally accepted that the nerve is injured after its exit from the skull. The lesion is probably in or about the same region in cases of Bell's paralysis of which the following case is an example.

CASE 9. The patient, female, aged 19 years, awoke one morning with the left side of the face completely helpless. For seven days before she had had pain below the left ear. When examined twenty-four hours after the onset of the facial condition there was complete paralysis of the left side of the face affecting both the upper and lower parts and involving both voluntary and emotional movements equally and completely.

A similar complete involvement of the facial nerve occurs when the nerve is injured as it passes through the petrous portion of the temporal bone or in its course over the base of the skull.

CASE 10. The patient, female, aged 71 years, had a mastoid operation six weeks before she attended for examination. The left side of the face was helpless when she recovered from the anæsthetic. There was complete paralysis of the right side of the face involving both voluntary and emotional movements equally.

Nevertheless, in some cases in which the facial paralysis of a peripheral type is not severe, there is some degree of dissociation between the voluntary and emotional movements of the affected side of the face. The following is an example.

CASE 11. The patient, female, aged 54 years, suffered from severe pains in the back of the neck for three days and awoke on the morning of the fourth day with the left side of the face helpless. When examined seven days later there was paralysis of the left side of the face with inability to close the left eye completely. With voluntary movements the left angle of the mouth merely lagged slightly behind the right angle, but on smiling movements were quite free on the right side of the face and absent on the left side.

The disturbance of facial movements associated with contracture of the facial muscles on one side has probably been illustrated satisfactorily by Case 7 quoted above, but the following cases are added to illustrate the effect of an old facial paralysis which had almost recovered.

CASE 12. The patient, female, aged 42 years, had suffered from twitching of the left side of the face for four years. Seven years before she had paralysis of the left side of the face for three months. On showing the teeth at command the lower part of the left side of the face moved less freely than the right side, whereas in smiling the two sides of the face moved simultaneously and equally.

CASE 13. A man, aged 28 years, had suffered from paralysis of the right side of the face in childhood. During the past three years he had had eight epileptic fits. There was delay of the lower part of the right side of the face much more obvious for emotional movements than for voluntary movements.

As a general rule it is found that the voluntary movements are affected more than the emotional movements in old-standing cases of facial paralysis which have apparently recovered, but occasionally the emotional movements are affected to a much greater extent than the voluntary movements. In other cases voluntary movements are impaired at the angle of the mouth on the same side as the old facial paralysis and at the same time the emotional movements on that side appear to be exaggerated.

It would appear therefore that with severe lesions of the infranuclear portion of the facial nerve both voluntary and emotional movements of the affected side of the face are affected equally and completely, whereas with mild lesions in which the facial movements are only moderately affected, during recovery and with post-paralytic facial spasm the voluntary and emotional movements may be involved to different degrees.

4.—Lesions affecting the extrapyramidal motor system.

The common conditions in which the extrapyramidal motor system is involved are postencephalitic Parkinsonism and paralysis agitans. Both are characterised by muscular rigidity of a type usually described as the extrapyramidal type, in the former the rigidity usually being the most prominent feature, while in the latter the tremor is as a rule more prominent than the rigidity. In the former particularly the rigidity may affect the face as well as the limbs and trunk, and just as the limbs of one side may be affected alone or predominantly so may one side of the face be affected more than the other. Since Monrad-Krohn¹ has based certain deductions as to the dissociation of voluntary and emotional movements of the face upon these cases it is necessary to refer to them briefly. The following cases illustrate the more important points in connection with the subject under discussion.

CASE 14. The patient, female, aged 24 years, complained of trembling and of slowness of movement of the right arm and leg. She had a definite attack of encephalitis five years before. On examination, a stare, retraction of the upper eyelids, blepharoclonus, a fixed expression, movement *en masse* in a somewhat flexed attitude, and proximal rigidity of the right arm and leg were evident. On showing the teeth at command the face moved slowly, the left side moving much more freely than the right side, whereas in smiling the two sides of the face moved equally.

CASE 15. The patient, female, aged 25 years, had suffered from trembling of the limbs and oculogyric crises for five years. In walking she took a rapid step with the right foot and then dragged the left foot after it. The left side of the face moved much less freely than

the right side for both voluntary and emotional movements, the difference being much more obvious with the former than with the latter. There were, in addition, tremor of the head and tongue, blepharoclonus, oculogyric crises upwards and proximal rigidity of the left arm and leg.

In these two cases rigidity chiefly unilateral in distribution and of the extrapyramidal type was associated in the first case with impairment of voluntary movement of the face on the affected side, and in the second case with impairment of voluntary movement more than of emotional movement on the affected side. In the following case, however, voluntary movement only was impaired on the same side as the rigidity of the limbs, whereas emotional movements were so active on that side that there appeared to be emotional paresis of the lower part of the opposite side of the face.

CASE 16. The patient, male, aged 52 years, had an attack of encephalitis two years before and had suffered from shaking of the left hand and stiffness of the left arm and leg for eighteen months. On examination, a stare, blepharoclonus, fixed expression, tremor of the left hand, proximal rigidity of the left arm and leg, and bradykinesia were evident. For voluntary movements the left side of the face moved much more slowly than the right side, while for emotional movements the lower part of the left side of the face moved much more freely than the corresponding part of the right side of the face.

In Monrad-Krohn's fifth case, delay of emotional movements only of the left side of the face, proximal rigidity of the left arm and leg and a doubtful extensor plantar reflex on the left side were present together. A similar association of an extrapyramidal type of rigidity with evidence of involvement of motor paths and dissociation of voluntary and emotional movements of one side of the face was observed in the following case—one of mesencephalitis syphilitica.

CASE 17. The patient, female, aged 40 years, had gradually lost the use of the left arm and leg during the previous eleven months. She had been married seven years and had never been pregnant. On examination the following positive findings were elicited—stare, ptosis, relative inactivity of the left pupil to light compared with the right, fixed expression, rigidity of the limbs proximally more on the right side than on the left, grotesque movements of the right leg and extensor plantar reflexes on both sides. For voluntary movements the right side of the face moved behind and much less freely than the left, while for emotional expression both sides of the face moved freely and equally.

In this case the pyramidal lesions were apparently factors common to the two sides. In the following case some degree of dissociation of facial movements with paralysis agitans is illustrated.

CASE 18. A woman, aged 67 years, had suffered from trembling of the hands and face for twelve months. She noticed this first in the right thumb. On examination the following findings were noted—congenital nystagmus, a fixed expression, movement *en masse*, tremor of the lips and tongue, a pill-rolling tremor chiefly in the right hand, and rigidity of all the limbs proximally but more so on the right side. The right side of the face moved less freely than the left side for voluntary movements and also for emotional movements, but with the latter the asymmetry of the face was less obvious.

In addition, it is a well-known observation for which no definite illustration is necessary here that in cases affected with extrapyramidal rigidity more or

less equally on the two sides voluntary movements of the face may begin and develop slowly, whereas with emotional expression the face may move rapidly and much more freely.

5.—Conditions associated with disturbance of cerebellar function.

In the group of cases illustrated above the factor common to them all may be regarded as release of a postural reflex arc with the production of rigidity of the limbs, trunk and face of an extrapyramidal type. In the cases to be described below the essential feature may be regarded as diminution of muscle tone as a result of interference with cerebellar function by disease of the cerebellum or of afferent or efferent cerebellar paths. The relationship between cerebellar dysfunction and the disturbance of facial movements was suggested by Weisenburg² in commenting upon the symptoms of cerebellar lesions as shown by cinema studies. He reported that with cerebellar lesions emotional expression was not as a rule affected, though the face appeared to have less expression and it was difficult for the patient to laugh.

With tumours of one lateral lobe of the cerebellum it is occasionally recorded that voluntary movements on the same side of the face are impaired, and in others that both voluntary and emotional movements are affected. The latter may be involved more severely than the former.

With the heredo-familial ataxias the changes are often bilateral and consequently attention is not drawn to variations in the facial movements. Rarely a case is seen in which the changes are more obvious on one side.

CASE 19. D. H., female, was admitted under the care of Dr. Walshe with a history of 16 months duration. On examination the patient was dysarthric and showed pallor of the temporal halves of the optic discs and slight nystagmus on lateral deviation of the eyeballs to the left. At rest there was an apparent smoothing of the right lower face and in talking the left side of the face moved more than the right side. On voluntary movements of the face at command and with free emotional movements this difference was, however, partly obliterated. In addition there were found—diminished power, incoordination and dysidiadokokinesia more obvious in the right arm than in the left; weakness and increase of tone in both lower limbs; some impairment of vibration sensibility in the malleoli; and bilateral extensor plantar reflexes. The patient's mother was similarly affected.

The most characteristic changes associated with hypotonia of this type have been observed in cases of Sydenham's chorea. In some cases in which the distribution of the hypotonia was bilateral no definite dissociation was observed, while occasionally in cases in which the hypotonia was confined to the limbs of one side no difference between the voluntary and emotional movements of the two sides of the face could be detected. Nevertheless, in the majority of cases in which the condition was confined to the limbs of one side some variation in the movements of the face on the same side was evident. The following are illustrative cases.

CASE 20. The patient, female, aged 17 years, complained of movements of the right arm of one week's duration. She had had a previous attack for five weeks two and a half years before. There were choreic movements of the right arm and diminution of motor power,

muscle tone and tendon reflexes chiefly in the right arm and leg. On voluntary movement the lower part of the right side of the face moved later and to a less extent than the left side, while on emotional movement this difference was much less obvious.

CASE 21. The patient, female, aged 10 years, had had irregular movements of the limbs for some weeks. There was a slight internal strabismus of the left eye, congenital in origin. The left arm and leg showed choreic movements, decrease in motor power and muscle tone, and diminution of the tendon reflexes. There was some delay of the lower part of the right side of the face for voluntary movements but none for emotional movements.

In all the cases of this type examined the same general features were observed: delay of the lower part of the ipsilateral side of the face for voluntary movements only when the hypotonia was slight, and delay more obvious for voluntary than for emotional movements when the hypotonia was more severe.

In addition, attention must be drawn to the fact that in Weisenburg's³ case of emotional facial paralysis the superior cerebellar artery on the same side was thrombosed. The writer believed the emotional paralysis to be the result of interruption of a cerebellar path. A similar case has been described recently by Russel³¹.

6.—Conditions associated with definite lesions of one or both pyramidal tracts.

It has been long recognised that in cases of facial paresis associated with hemiplegia the smile may be equal on the two sides of the face even though the voluntary movements are lost on one side. This dissociation of voluntary and emotional movements of the affected side of the face appears to occur whenever the pyramidal tract is definitely affected at any level between the motor cortex and the facial nucleus, and to be independent of the nature of the lesion which causes the hemiplegia or diplegia. The same dissociation of voluntary and emotional movements is apparent in both severe and slight cases of hemiplegia and during transient attacks of hemiparesis; while exaggeration of emotional movements may occur when both pyramidal tract are involved.

In the following case, however, emotional movements only were affected.

CASE 22. The patient, female, aged 43 years, found the right arm and leg suddenly become dead and useless. The condition lasted for about three hours and then recovered. Since then there had been twitching of the left shoulder and eyelids, while for twelve months there had been pins and needles from the fingers of the right hand up the arm. When examined two days after the onset of the condition, there was weakness of the lower part of the right side of the face for emotional movements but not for voluntary movements. The only other positive finding was arteriosclerosis of the retinal arteries.

It is evident that in those cases in which voluntary movements are affected while emotional movements are unaffected or excessive the lesion must damage a path controlling voluntary movements and leave that controlling emotional movements intact or even release it from some restraint. In Case 22 paralysis of emotional movements only occurred, but it is possible that the case might be grouped more correctly in the next series.

7.—Conditions affecting the cerebral cortex and the adjacent parts.

With lesions involving one cerebral hemisphere and directly affecting the prerolandic motor cortex it is found that with hemiplegia or hemiparesis the face on the same side is weak for voluntary movements only or for voluntary movements to a much greater extent than for emotional movements. With tumours confined to the motor cortex and the subjacent parts the firstnamed finding is the more common, whereas involvement of adjacent parts of the cerebral cortex is often associated with some degree of emotional paresis as well. With tumours involving other parts of the cerebral cortex the findings may vary considerably from those noted with tumours confined to the parietal region.

In a previous paper on tumours confined to the occipital lobe⁴ it was noted that, while in the majority of cases in which hemiparesis was present the facial paresis associated with it was more apparent on voluntary movement, there were many cases in which either voluntary and emotional movements of the lower part of one side of the face were equally affected, or emotional movements were impaired alone or to a greater extent than voluntary movements.

In view of Spiller's⁵ suggestion that impairment of the sense of position in the face might be a factor of some importance in the occurrence of emotional paresis of the face, the cases of occipital tumour were analysed to find if there was any definite relationship between impairment or loss of the sense of position in the contralateral limbs and impairment of emotional movements of the corresponding side of the face. It was found that in cases in which emotional movements were impaired either alone or to a lesser extent than voluntary movements the sense of position was unaffected and that when the sense of position was impaired the emotional movements were not necessarily affected. There were, however, cases in which emotional paresis of the contralateral side of the face was associated with loss of the sense of position in the limbs on the same side.

CASE 23. The patient, female, aged 50 years, was admitted under the care of Dr. Adie complaining of headaches, pain in the right side of the face, twitching of the left arm and foot, vomiting, drowsiness, and failing memory of twelve months' duration. On examination, vision was impaired and in addition there were found complete left homonymous hemianopia, slight papilloedema, nystagmoid jerks on lateral deviation of the eyes, and weakness and hypotonia of the left arm and leg. The sense of passive movement was absent or seriously impaired in the fingers of the left hand and the toes of the left foot. There was weakness of the left side of the face in the region of the mouth for emotional movements only. A tumour was removed from the right occipital lobe.

In this case there was no evidence of involvement of the pyramidal tracts and it was probable that the delay of the left side of the face on emotional movements was directly associated with the hypotonia and impairment of the sense of position in the limbs of the same side. In the following case similar findings were recorded,

CASE 24. The patient, male, aged 25 years, complained of dimness of vision and jerking of the right lower limb of three years' duration, and of weakness of the right hand and arm and of difficulty in remembering names of six months' duration. On examination there were found impairment of visual acuity, right homonymous hemianopia, alexia, impairment of superficial sensation over the limbs and trunk on the right side, and some weakness of the right arm and leg. The sense of passive movement was impaired in the right arm and leg, and there was weakness of the right side of the face near the mouth on emotional movements only.

It would appear then that impairment of the sense of position may be related to the diminution or loss of emotional movements of the same side of the face. Nevertheless, the occurrence of unilateral emotional paresis of the face with tumours in the same region and without deep sensory changes suggests that impairment of the sense of position cannot be the only factor.

A review of cases of tumour involving the temporal and the frontal lobes reveals a number of cases in which emotional movements of the lower part of the opposite side of the face are impaired either alone or more than voluntary movements. This observation is not, however, the most usual one with tumours in these regions, as it is more common for voluntary movements to be affected alone or more than emotional movements. The following cases illustrate impairment of emotional movements of the opposite side of the face with tumours of the frontal lobe.

CASE 25. The patient, female, aged 42 years, showed much more obvious expressional movements on the right side of the face than on the left side, while no asymmetry of the face could be detected when showing the teeth at command. At autopsy there was found a glioma involving the centre of the right frontal lobe, extending across the genu of the corpus callosum to involve the opposite hemisphere, and backward to involve the head of the caudate nucleus and the upper and anterior part of the lenticular nucleus.

CASE 26. The patient, male, aged 57 years, had a flaccid hemiparesis involving the right arm and leg. The eyelids on the right side were not approximated so strongly as on the left side, and the right angle of the mouth drooped. In smiling and attempting to talk the left half of the face took up first and moved much more freely than the right side. At autopsy a tumour was found in the right frontal lobe with a hæmorrhagic cyst extending down to the anterior horn of the lateral ventricle.

A similar finding is not uncommon with tumours involving the temporal lobe. The following are illustrative cases.

CASE 27. The patient, male, aged 56 years, had a left hemiplegia. The left palpebral fissure was larger than the right, and the left angle of the mouth drooped more than the right. For emotional movements the right side of the face moved much more freely than the left side, while for voluntary movements very little asymmetry was noted. At autopsy a softened hæmorrhagic tumour was found coming to the surface on the inferior surface of the right temporal lobe. It infiltrated widely the substance of the temporal lobe.

CASE 28. The patient, male, aged 58 years, had slight left facial weakness for voluntary movements. For emotional movements the left side of the face took up later than the right side and moved much less freely. The asymmetry was more obvious with emotional movements than with voluntary movements. At operation a glioma was shelled out of the middle portion of the right temporal lobe.

Reference to case records shows that this particular type of dissociation is much more common with tumours involving the frontal and temporal lobes. In connection with this point it is worth noting that Friedmann and Elsberg⁶ have observed a number of cases of tumour of the temporal lobe with facial paralysis of the supranuclear type which was severe and seemed to be peripheral in type. In these cases there was no question of distal pressure on the facial nerve and the electrical reactions were normal. Friedmann continued: "It is my impression that in these cases we are dealing with a combination of voluntary and mimetic facial palsy, the latter being due to distant pressure on the optic thalamus. We then observe a complete facial paralysis which resembles a peripheral palsy but is not of this type. I have seen this symptom frequently enough to make it an interesting clinical observation."

Emotional paresis of the face has also been observed in a case of disseminated sclerosis, though in this condition the position of the responsible lesion was not known.

CASE 29. The patient, female, aged 41 years, complained of pains and numbness in the thighs of two weeks' duration. The right leg had been weak for eighteen months and the left leg for two and a half years. Six years before the right side of the face had been numb for some months; five years before the right leg had been weak and recovered; three and a half years before there had been diplopia for ten days; and two years before there had been occasional incontinence of urine. On examination there were found temporal pallor of the optic discs, lateral nystagmus, weakness of the left lower limb, bilateral extensor plantar reflexes and absent abdominal reflexes. In speaking the right angle of the mouth drooped below the left, and the right lower face took up later and moved less freely than the left. The same effect was apparent on smiling. With voluntary movements the two sides of the face moved freely and equally.

IV. THE DISSOCIATION OF VOLUNTARY AND EMOTIONAL MOVEMENTS OF THE FACE.

The recognition of the dissociation of voluntary and emotional movements of the face has depended upon two groups of observations, at first distinct from one another but later considered together in the attempt to explain the dissociation and also the emotional paresis occurring independently of paralysis of voluntary movements. As pointed out by Kinnier Wilson, in 1837 Strome⁷ described a case in which there was emotional paresis of one side of the face without impairment of voluntary movements, and in 1844 Bell⁸ drew attention to the dissociation of voluntary and emotional movements of the face, pointing out that paralysis of emotional movements could occur without paralysis of voluntary movements. Cases of this type have been described by Nothnagel⁹, Nonne¹⁰, Monrad-Krohn and many others. On the other hand Gowers¹¹ showed that in the facial paresis associated with hemiplegia the smile might be equal on the two sides though voluntary movements were lost on one side of the face. Apart from reports of individual cases subsequent publications have been concerned with attempts to explain these findings in anatomical and physiological terms. Since these papers have been reviewed within recent years by Kinnier Wilson¹² and by Feiling¹³ there is no need to refer to them further here.

It is necessary, however, to refer to the different views which have been expressed to explain the dissociation of voluntary and emotional movements of the face. These may be summarised briefly as follows.

1. *The peripheral theory.*—It was suggested by Bell that differences in function might result from different degrees of involvement of the facial nerve. It would appear, however, that if the trunk of the facial nerve were involved it would be affected for all types of activity. This is certainly true when the lesion of the facial nerve is a severe one, but there appear to be cases in which voluntary movements are affected chiefly (Monrad-Krohn and Case 12) and others in which emotional movements are affected chiefly or alone (Spiller¹⁴ and Cases 11 and 13). In these cases the dissociation is usually slight, though in Case 11 it was extreme, and the lesion of the facial nerve is either a slight one or apparently recovering.

2. *The hypothesis of physiological couples.*—This hypothesis was propounded by Broadbent¹⁵ to explain the dissociation of voluntary and emotional movements of the face associated with hemiplegia. The muscles of the two sides of the face were regarded as acting as physiological couples for involuntary movements, these movements therefore remaining unaffected in the presence of a hemiplegia. It was impossible, however, to use this hypothesis to explain unilateral impairment of emotional movements of the face.

3. *Separate paths for voluntary and emotional movements.*—While the above hypothesis could not be used to explain paralysis of emotional movements alone, the occurrence of normal and even exaggerated emotional movements of the face in cases of double hemiplegia rendered it equally inapplicable to paralysis of voluntary movements in the presence of normal emotional movements with hemiplegia. Hence there arose the hypothesis of separate paths for voluntary and emotional movements. Subsequent investigations and hypotheses have been concerned chiefly with the identification of the path or paths for emotional movements.

4. *A thalamic psycho-reflex path.*—To explain the cases of hemiplegia Nothnagel suggested a psycho-reflex path distinct from the facial division of the pyramidal tract and concerned with the optic thalamus and its connections. To explain emotional paresis in the absence of voluntary paresis of the face he postulated a lesion in or near the optic thalamus. According to Kinnier Wilson much of the clinico-pathological evidence in support of the latter hypothesis must be accepted with reserve though the role of the optic thalamus cannot be lightly dismissed. Monrad-Krohn also found it necessary to postulate as the emotional path a reflex path with its centres in the corpus striatum.

5. *Cortico-thalamic control.*—It has been suggested (Brissaud¹⁶, Oppenheim¹⁷) that the above mechanism was controlled from the cortex by anatomical connections between the cortex and the corpus striatum, and that the excessive emotional expression in cases of pseudobulbar palsy was the result of irritation of the optic thalamus. As an objection to this hypothesis it has been pointed

out that these anatomical connections have not been confirmed by subsequent observers.

6. *The effect of sensory ataxia.*—Sensory ataxia produced by appropriate cortical lesions has been shown experimentally to be associated with an explosive type of voluntary movement (Bickel¹⁸); and it has been suggested that peripheral sensibility has a much greater influence on emotional expression than on voluntary innervation of the facial muscles. This view has been supported by Hartmann¹⁹, von Monakow, and Lewandowsky²⁰. Lesions producing emotional paresis would then be found in the cortex or subcortical systems. In connection with this hypothesis it is necessary to mention Spiller's suggestion that deep pressure sensation in the face is an important factor, this sensation according to Spiller and others being conveyed by the facial nerve and not by the trigeminal nerve.

7. *Separate paths identical with those described by Spencer.*—Kinnier Wilson has suggested that there is a double control over the facio-respiratory movements—voluntary control which inhibits automatic movements, and involuntary control when the facial muscles are forced to give way to the expression of emotion. Voluntary control is secured through the corticopontine, bulbar and spinal motor path. In addition to this path, Spencer²¹ described an arresting path from the under surface of the frontal lobe and an accelerating path from the sensory cortex, both independent of the motor path, coming together on the mesial aspect of the optic thalamus and running down near the middle line of the tegmentum to the medulla. Wilson thinks it feasible to regard these paths as those for the emotional activation of the facio-respiratory apparatus. In support of this suggestion are cited the clinico-pathological findings in Stromeier's case, and Graham Brown's²² stimulation experiments on a path close to the inner aspect of the red nucleus. Emotional paresis of the face might then be produced by a lesion of this path anywhere between the cortex and the pons.

The evidence available strongly supports the presence of separate paths for voluntary and emotional movements of the face, and the identification of the paths for the latter, at least below the level of the optic thalamus, with those described by Spencer and referred to by Kinnier Wilson. While this hypothesis certainly explains the cases of hemiplegia, pseudobulbar palsy and many of the cases of unilateral emotional paresis of the face, it leaves unexplained some of the cases described in this paper. The occurrence of unilateral amimia in individuals without any evidence of an organic condition might, however, be explained by postulating that the emotional movements of one side of the face are released habitually to a greater or lesser degree than those of the other side. It may be possible to classify this emotional asymmetry of the face as a tic-like effect operating through the accelerating and retarding paths mentioned above. The fact that it has been observed particularly in patients suffering from neuroses and less often in epileptics, in both of whom there is an evident or partially concealed maladaptation to life

and environment, is certainly very suggestive of a release mechanism operating from the higher cortical or psychological level. The relative urgency of emotional movements compared with voluntary movements suggested by Monrda-Krohn seems to provide an adequate explanation of the impairment of voluntary movements to a greater extent than emotional movements in some cases with local conditions of the face and jaw, incomplete lesions of the facial nerve, an extrapyramidal type of muscular rigidity and cerebellar dysfunction. If then this factor comes into operation it is necessary to consider how its effects may be varied by the increased muscle tone of extrapyramidal rigidity, the diminished muscle tone associated with cerebellar dysfunction, or the probable decrease or increase of muscle tone in the facial muscles associated with a mild or recovering lesion of the infranuclear portion of the facial nerve. It is necessary also to consider whether the variations in muscle tone are important in those cases with lesions of the cortex associated in some cases with impairment of voluntary movements alone and in others with impairment of voluntary movements more than of emotional movements. With some cases of peripheral facial paralysis there appears to be a stage during recovery when emotional movements are impaired either alone or more than voluntary movements, an example of which is quoted in a previous chapter. That being so, may not a similar stage occur during the development or recovery of facial paresis associated with cortical lesions and so explain the occurrence of some degree of emotional paresis of the face with lesions so widely separated as those of the frontal lobe and those of the occipital lobe? If the condition of muscle tone in the muscles of the face is a factor influencing the relative effect of voluntary and emotional innervation of the face, it is probable that impairment of postural sensibility will be a factor in some cases in so far as it varies the condition of the peripheral structures through which the dual control of the facio-respiratory mechanism produces its visible effects. These questions which naturally arise from a study of the dissociation of voluntary and emotional movements of the face in patients presenting themselves for examination do not in any way invalidate the evidence adduced in support of the hypothesis advanced by Kinnier Wilson, but they do suggest that other factors may come into operation and influence the voluntary and emotional movements of the face in such a way as to produce effects which resemble those due to a lesion of the suggested emotional path.

IV. EMOTIONAL PARESIS OF THE FACE AS A PHYSICAL SIGN.

Since the correlation of clinical, pathological, anatomical and experimental evidence has suggested the identification of the path for emotional expression with that mentioned above, a lesion injuring or destroying this path might be expected to produce emotional paralysis of the face on the opposite side. It is very probable that lesions of the tegmentum between the level of the optic thalamus and that of the upper part of the pons do so, as cases have been described in which this part of the path could have been injured and emotional

paralysis was present on the opposite side of the face. Hence in such cases emotional paralysis of one side of the face may be a physical sign of considerable value. It is necessary, however, before applying a physical sign in clinical work to be sure not only that it can be readily identified but also that other conditions do not produce an effect which may be confused with it.

It has been shown that diminution or paralysis of the emotional movements of one side of the face may occur in individuals in whom there is no known physical lesion, and in others what appears to be emotional paresis with local conditions of the face and jaw. The effect of an apparently recovered facial paralysis of the peripheral type must also be considered, as impairment of emotional movement alone or to a greater extent than of voluntary movement may sometimes occur. The poverty of emotional movement in contrast with free voluntary movement may also introduce a fallacy into the identification of the physical sign in the presence of cerebellar dysfunction. Again, when rigidity of the extrapyramidal type is more obvious on one side of the face, the impression may be produced that emotional movements of one side of the face are impaired. Finally with lesions of or in the neighbourhood of the cerebral cortex emotional movements of the opposite side of the face may be impaired either alone or to a greater extent than voluntary movements with tumours not only of the frontal and temporal lobes but also with those of the occipital lobe.

It appears then that there are many fallacies associated with the identification of emotional paresis of the face as a physical sign and that, in the present state of our knowledge, it is of value in the localisation of a lesion of the contralateral portion of the tegmentum between the optic thalamus and the pons only when these fallacies have been excluded and when associated with other physical signs of a lesion at this level.

V. SUMMARY AND CONCLUSIONS.

1. The voluntary and emotional movements of the face have been examined in a series of 5,000 patients presenting themselves for examination and the findings correlated with the rest of the physical examination and in some cases with operation and post-mortem findings in those cases in which dissociation of voluntary and emotional movements of the face has been observed.

2. Cases are described to illustrate the occurrence of various types of dissociation of voluntary and emotional movements of the face under different conditions.

3. Reference is made to the various hypotheses propounded to explain the dissociation of voluntary and emotional movements of the face.

4. The presence of separate paths for voluntary and emotional movements is essential to explain the dissociation of the two types of facial movement, but it is probable that other factors influence the condition of the facial musculature and vary the relative extent of voluntary and emotional movements.

5. There are many fallacies associated with the identification of emotional paresis of the face as a physical sign.

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REFERENCES.

- ¹ MONRAD-KROHN, G., *Brain*, 1924, xlvii, 22.
- ² WEISENBURG, T. H., *Brain*, 1927, l, 357.
- ³ WEISENBURG, T. H., *Brain*, 1927, l, 728.
- ⁴ ALLEN, I. M., *Brain*, 1930, liii, 194.
- ⁵ SPILLER, W. G., *Arch. Neurol. and Psychiat.*, 1928, xix, 699.
- ⁶ FRIEDMANN and ELSBERG, C. A., *Arch. Neurol. and Psychiat.*, 1929, xxii, 1059.
- ⁷ STROMEYER, *Casper's Woch. f. d. ges. Heilk.*, 1837, 33.
- ⁸ BELL, C., *The Nervous System of the Human Body*, 3rd ed., 1844, p. 256.
- ⁹ NOTHNAGEL, *Topische Diagnostik d. Nervenkrankheiten*, 1879.
- ¹⁰ NONNE, M., *Neurol. Centralbl.*, 1895, xiv, 476.
- ¹¹ GOWERS, W., *Manual of Diseases of the Nervous System*, 1888, vol. ii, p. 72.
- ¹² WILSON, S. A. KINNIER, *Jour. Neurol. and Psychopath.*, 1924, iv, 279.
- ¹³ FEILING, A., *Jour. Neurol. and Psychopath.*, 1927, viii, 141.
- ¹⁴ SPILLER, W. G., *Amer. Jour. Med. Sci.*, 1912, cxliii, 370.
- ¹⁵ BROADBENT, W., Quoted by Wilson, ref. 12.
- ¹⁶ BRISSAUD, E., *Leçons sur les Maladies Nerveuses*, 1895, p. 446.
- ¹⁷ OPPENHEIM, H., *Textbook of Nervous Diseases*, Eng. ed., 1911, ii, 1025.
- ¹⁸ BICKEL, Quoted by Wilson, ref. 12.
- ¹⁹ HARTMANN, *Zeitschr. f. Heilk.*, 1902, xxiii, 256.
- ²⁰ LEWANDOWSKY, O., *Handbuch d. Neurologie*, 1911, Part 2, p. 74.
- ²¹ SPENCER, W. G., *Phil. Trans. Roy. Soc. Lond.*, 1894, clxxxv, 609.
- ²² BROWN, GRAHAM, *Jour. Physiol.*, 1915, xlix, 195.
- ²³ POYNTON, F. J., *Proc. Roy. Soc. Med. (Sect. Dis. Child.)*, 1929, xxii, 79.
- ²⁴ ALLEN, I. M., *New Zeal. Med. Jour.*, 1928, xxxvii, 320.
- ²⁵ MONRAD-KROHN, G., *Act. Psychiat. et Neurol.*, 1928, iii, 35.
- ²⁶ MILLS, C. K., *Jour. Nerv. and Ment. Dis.*, 1909, xxxvi, 738.
- ²⁷ MILLS, C. K., *Proc. Amer. Psychol. Assoc.*, 1902, xix, 297.
- ²⁸ MILLS, C. K., *Jour. Nerv. and Ment. Dis.*, 1908, xxxv, 331.
- ²⁹ MILLS, C. K., *Jour. Nerv. and Ment. Dis.*, 1912, xxxix, 73.
- ³⁰ WILLIAMSON, R. T., *Brit. Med. Jour.*, 1900, i, 576.
- ³¹ RUSSEL, C. K., *Arch. Neurol. and Psychiat.*, 1931, xxv, 1003.