

IMPROVED TECHNIQUE IN THE SURGICAL TREATMENT OF FACIAL PALSY

The Ballance-Duel Method of Direct Repair of the Injured Nerve by an Autoplastic Graft

by ARTHUR B. DUEL, M.D.

IF I were asked to name one human feature which more than any other seemed to me to reveal the character of an individual, I am sure that I should say "facial expression"! The constant play of the emotions continually is recorded by changing facial expression.

Animals are quite unconscious of these expressions; they are always genuine and accurately portray their emotional state. Young children are also apt to be frank and genuinely reveal the state of mind; while older humans voluntarily control more or less their responses to every emotion, desire, or thought, and thus modify the facial expressions brought out in all their social contacts. At one moment we may exaggerate, at the next we may inhibit our natural expressions in our efforts to amuse or mystify, to convince or deceive those with whom we constantly associate.

Yet, despite this frequently exercised cortical voluntary control, the constant subcortical emotional impulses, with their inevitable responses in the facial muscles, in the long run gradually mold the visages of every one and imprint upon the face the unmistakable evidence of character. The trite saying, "The face is the mirror of the soul," is undoubtedly well founded. Thus, as shown in the illustrations which follow this paper, we find the expression of serenity in the face of the Madonna, produced by perfect contentment of mind; the spiritual expression of resignation in the face of Christ, produced by persecution patiently borne; the careworn, determined expression in the face of Lincoln, produced

by an unending heavy weight of responsibility; the expression of jollity produced by freedom from care in the faces of the friars in the well-known picture by Grutzner; the sly expression in the face of Shylock, produced by intense cupidity; and the expectant expression in the face of Micawber, produced by constant hopefulness. And so on, *ad infinitum*.

It is very interesting in looking up the literature on the subject to learn that the most elaborate and finished work on facial expression was written more than a century ago by Sir Charles Bell.¹

His work, "The Anatomy and Philosophy of Expression" (1872 Edition), is beautifully and perfectly illustrated with drawings which he himself made. Taken from numerous ones, both of men and of animals, sketches illustrating laughter, weeping, fear, pain, jealousy, and remorse are shown in connection with this article as characteristic expressions of Man.

He analyzed and compared the nuances of facial expression in Man and the lower animals. He pointed out the simpler muscular apparatus of the lower animals required for their needs as compared with the more elaborate mechanism required by humans.

Following the publication of this well-known work, facial paralysis was called "Bell's Palsy," and the condition is still usually designated by that name.

It is remarkable that such accurate observations on the mechanism by which facial movements are brought about; such a keen interpretation of the difference between emotional and voluntary control; such a knowledge of the conveyance of motor and sensory impulses, should have been brought out at this early date.

¹Sir Charles Bell was born in Edinburgh in 1774 and died in 1842. He was an artist, scholar, anatomist, and surgeon. He was appointed surgeon to the Middlesex Hospital, London, in 1812. He treated many wounded after the Battle of Waterloo.

The discussion of the whole question of facial expression in connection with the masterpieces of painting by great artists is most illuminating.

A careful reading of the work is well worth while by any who would gain a deeper knowledge of the subject.

The facial nerve, in its long and devious course through the temporal bone, is so deeply situated and is surrounded by a bony tube of such ivory-like density that usually it escapes the feeble efforts of the timid operator, uncertain of his anatomy, or the wilder onslaughts of the boldest bungler.

Yet, in far too many instances, neither timidity on the one hand nor boldness on the other has been successful in preventing the accidental injury of the nerve with its resulting appalling facial palsy. Occasionally, disease of the bone itself may encroach upon the nerve so closely that the inflammatory swelling may cause a paralysis; or so that its operative removal, however skilfully attempted, may result in an injury of the nerve.

Small wonder then that a malady which impairs or destroys this play of expression so manifest in every individual has always engaged the attention and sympathy of the medical profession. The incidence of a facial palsy has always stimulated every possible effort on the part of physician and surgeon to relieve or cure the resulting grotesque appearance.

When surgery of the temporal bone had so advanced that operators no longer feared to invade this particular region, the results were twofold. On the one hand, there were those who were possessed of an extreme fear lest they should even touch the facial nerve. Facial paralysis must be avoided at all costs! On the other hand, there were those who, fired by overenthusiasm or overconfidence, were less cautious. Consequently, unskilled surgery of the temporal bone brought

with it an ever-increasing number of cases of accidental facial paralysis.

Confronted by these lamentable facts in the next decade, constructive efforts to repair the palsies resulting from these accidents were made by several men.

In 1895, Sir Charles Ballance, of London, united the spinal accessory nerve to the facial. A few years later, he employed the hypoglossal, the descendens noni, the glosso-pharyngeal. This method of anastomosis, with improving technique, was employed in Germany, France, England, America, and, in fact, throughout the world.

Brilliant as were the successes in many of the reported cases, there remained always something to be desired. In nearly all, the restoration was incomplete; the use of the muscles was always voluntary (an educated movement) and usually accompanied by associated movements. The so-called emotional response—the reaction in the facial muscles to impulses from the centers in the brain—was always lacking.

In 1930, Sir Charles Ballance invited me to collaborate with him in some animal experimentation to discover if possible some method by which the operative treatment of facial palsy might be improved. It is not difficult to imagine with what alacrity I grasped the opportunity to sit at the feet of Gamaliel! For thirty years, I had on every possible occasion made what I called my pilgrimage to the shrine of St. Thomas!²

During all these years, in addition to a most active hospital and private practice, he had found time for surgical research. He was past master at everything he undertook and the

²Mr. Charles Ballance was for many years surgeon-in-chief to St. Thomas' Hospital in London. During the Great War, he was in supreme charge of the surgical work in the Mediterranean. At Malta alone, he had 29,000 beds under his supervision. He was knighted for his distinguished service and is now known as Sir Charles Ballance, K.C.M.G., C.B., M.V.O., L.L.D., F.R.C.S.

most indefatigable worker I have ever known. I hastened to make the possibility of working with such a man an actuality.

Aided by funds from four foundations and a few personal friends, we constructed an animal laboratory at my country place at Holmes, Dutchess County, New York, where we might work in undisturbed quiet, and where the equipment and surroundings were such that the animals could be kept in perfect health for indefinite periods.

We finally demonstrated that a direct repair of the injured facial nerve might be made by the use of autoplasmic nerve grafts. We employed many different nerves—both motor and sensory; any length we desired—either reversed or unreversed. They all were successful. The facial movements were restored without any associated movements; moreover, emotional response, as well as voluntary control, of the facial muscles, was restored.

The principles which we evolved from the animal experiments have been applied to the restoration of the facial nerve in human patients. I have, in the past year and a half, operated on sixteen cases at the Manhattan Eye, Ear, and Throat Hospital. Some of the earlier cases at present have almost perfect restoration. They have both voluntary control and emotional response. Many others are rapidly improving. It is too early to predict how complete the recovery will be. Cases of long standing recover less fully owing to the atrophy of the muscles. The pictures are those of four of the earlier cases. (Figs. 13-24 inclusive.)

Now, in all these cases, both animal and human, the long wait for results after the grafts had been transplanted was very irksome. During the past six months, I have endeavored to improve the technique by using, for graft material, transplants from nerves which have been severed and allowed to remain *in situ* until they had undergone certain degenerative

changes which must take place in all injured nerves before regeneration can occur.

It has been well known over a long period of years that the distal segment of a divided nerve goes through a process of degeneration in which the active nerve cells are broken down and the detritus removed by the circulation; the remaining empty tubules are then ready to conduct new neurons which grow in from the proximal segment. This degeneration must take place in the transplanted graft as well as in the distal segment. As a matter of fact, the graft becomes a part of the distal segment, behaving in the same manner; whereas the proximal segment does not undergo the process of wallerian degeneration.

The process necessarily goes on much more laboriously where the new circulatory apparatus in the transplanted graft is being reproduced slowly. It therefore seems reasonable that the degenerative process and cleaning of the tubes should take place much more rapidly when the nerve, which is subsequently to be used for the graft, is allowed to remain *in situ* for a time after being severed. This process takes from two to four weeks. The graft material seems to be at its best in from two to three weeks.

The tubules at this time have a strong attraction for the neurons which are pushing in from the proximal segment. They pass through with almost incredible speed and on into the distal segment. Their eventual termination in the end plates in the muscle fibres is heralded by a returning response to faradic stimulation. This response returned, in the last animal which I operated, thirteen days after a transplant of ten millimeters of degenerated anterior femoral cutaneous nerve had been placed in the divided facial nerve.

The experiment was first tried in a series of Rhesus monkeys. The results were amazing. In from two to four weeks,

when degenerated grafts were used, responses were obtained which it had taken as many months to accomplish when fresh grafts had been employed.

I have now used the same method on three humans. In two of them, I have already noted responses after thirty days which have never, after the employment of immediate grafts, been noted in less than from ninety to two hundred and forty days. It seems probable that the use of "prepared" grafts (degenerated *in situ*) will shorten the time and improve the quality of the restored function.

In every case, it seems probable that direct repair by grafts will be the operation of choice over anastomosis with other nerves, except in the rare instances in which the palsy has been caused by an intracranial lesion.

The research, which led up to the gratifying improvement in results in the surgical treatment of this appalling malady in humans, has been made possible by generous contributions from the Milbank Memorial Fund, the Carnegie Corporation, the Lillia Babbitt Hyde Foundation, the New York Foundation, and a number of personal friends.

The writer and Sir Charles Ballance collaborating have performed well over 200 operations on baboons, monkeys, and cats. More than six hundred anesthetics have been administered in operations and subsequent tests. It can truly be said that in all these animal experiments, attention to feeding, care, and avoidance of pain or suffering have been carried out as punctiliously as if the subjects had been human.

Perhaps no better argument could be presented for the cause of animal experimentation, employed for the relief of human suffering, than these results bring out. Without the experiments, the technique could hardly have been perfected in two or three generations to the point it has now reached in two or three years.

I am happy to report that the Royal College of Surgeons of England, in recognition of the merits of the work, has awarded the Lister Prize to Sir Charles Ballance. He will deliver the Lister Prize Lecture before the Royal College in April, 1933.

The list of our published works is appended. I have borrowed from all of them in this casual résumé. I wish to express my thanks to the publishers for permitting the use of the illustrations.

PUBLICATIONS

- ANASTOMOSIS OF NERVES. SIR CHARLES BALLANCE. *Archives of Neurology and Psychiatry*, January, 1931, lxxv, pp. 1-28.
- THE OPERATIVE TREATMENT OF FACIAL PALSY BY THE INTRODUCTION OF NERVE GRAFTS INTO THE FALLOPIAN CANAL AND BY OTHER INTRATEMPORAL METHODS. SIR CHARLES BALLANCE AND ARTHUR B. DUEL, M.D. *Archives of Otolaryngology*, January, 1932, xv, pp. 1-70.
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- THE EFFECTS OF STIMULATION OF THE HYPOTHALMIC PUPILLO-DILATOR CENTRE AFTER SUCCESSFUL ANASTOMOSES BETWEEN THE CERVICAL SYMPATHETIC AND CERTAIN MOTOR NERVES. JOHN BEATTIE, M.D., ARTHUR B. DUEL, M.D. AND SIR CHARLES BALLANCE. *Journal of Anatomy*, April, 1932, lxxvi, pp. 283-299.
- A NOTE ON THE RESULT WHICH FOLLOWS THE GRAFTING OF THE RAW PERIPHERAL END OF THE DIVIDED CERVICAL SYMPATHETIC NERVE TO ANOTHER NERVE IN THE VICINITY. ARTHUR B. DUEL, M.D., AND SIR CHARLES BALLANCE. *Brain*, 55, Part 2.
- TREATMENT OF FACIAL PALSY. SOME PROBLEMS WHICH AROSE DURING AN EXPERIMENTAL ENQUIRY. Five short papers. ARTHUR B. DUEL AND CHARLES BALLANCE. London, John Bale, Sons and Danielsson, Ltd., 1932.
- SURGICAL TREATMENT OF FACIAL PALSY—BALLANCE-DUEL METHOD. ARTHUR B. DUEL, M.D. *The Laryngoscope*, August, 1932, xlii, pp. 579-587.
- CLINICAL EXPERIENCES IN THE SURGICAL TREATMENT OF FACIAL PALSY BY AUTOPLASTIC NERVE GRAFTS. THE BALLANCE-DUEL METHOD. ARTHUR B. DUEL, M.D. *Archives of Otolaryngology*. In press.
- HISTORY AND DEVELOPMENT OF THE SURGICAL TREATMENT OF FACIAL PALSY. ARTHUR B. DUEL, M.D. *Surgery, Gynecology and Obstetrics*. In press.

Illustrating Dr. Duel's Article
IMPROVED TECHNIQUE IN THE SURGI-
CAL TREATMENT OF FACIAL PALSY

Showing the importance of facial
expression in reflecting human
character . . . and the application
of the Ballance-Duel method in
the treatment of facial palsy

~ Illustrating Dr. Duel's Article ~

The Face is the Mirror of the Soul. "The constant sub-cortical emotional impulses," says Dr. Duel, "with their inevitable responses in the facial muscles, in the long run gradually mold the visages of every one, and imprint upon the face the unmistakable evidence of character. The trite saying, 'The face is the mirror of the soul,' is undoubtedly well founded." Reproductions of well-known pictures show how facial expressions reflect lasting traits of character as well as fleeting emotional moods.

Figures 1 to 6 illustrate serenity, resignation, determination, cupidity, jollity, and hopefulness. Figures 7 to 12, taken from Sir Charles Bell's "The Anatomy and Philosophy of Expression," published more than a century ago, depict laughter, weeping, fear, pain, jealousy, and remorse.

Restoring Expression to Paralyzed Faces. "The incidence of a facial palsy," Dr. Duel declares, "has always stimulated every possible effort on the part of physician and surgeon to relieve or cure the resulting grotesque appearance." By experiments in a method of surgical treatment, the author, collaborating with Sir Charles Ballance, "finally demonstrated that a direct repair of the injured facial nerve might be made by the use of autoplasmic nerve grafts." Photographs of four patients indicate the degree of success with which surgical treatment was carried out.

Figures 13, 16, 19, and 22 show patients at the time of undergoing operations for facial palsy. Photographs made some months after each operation indicate the success of surgical treatment, Figures 14, 17, 20, and 23 showing facial expression in repose, and Figures 15, 18, 21, and 24 showing the effects of emotional contraction on the patient's expression.



1. Serenity



2. Resignation



3. Determination



4. Conviction



5. Jollity



7. Laughter



8. Pain



9. Jealousy



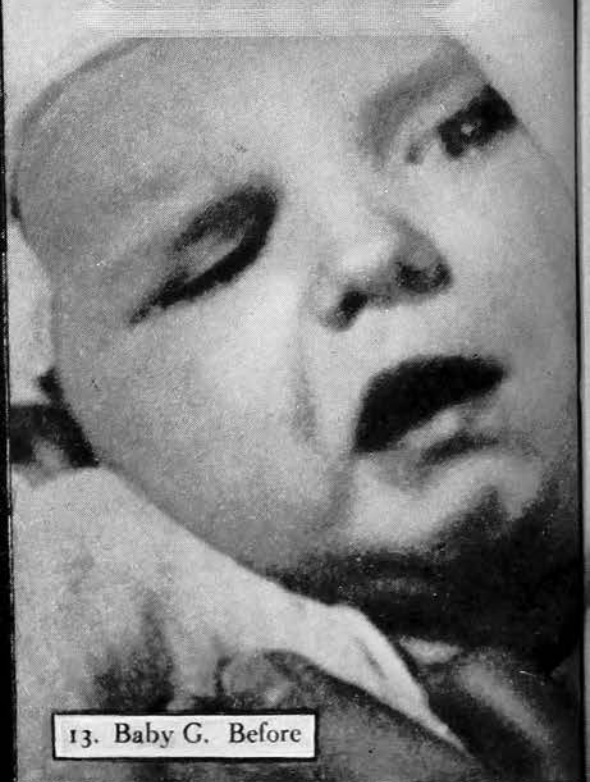
10. Fear



11. Weeping



12. Remorse



13. Baby G. Before





5. Baby G. Fourteen months after



Mrs. B. Before



17. Mrs. B. Eleven months after



18. Mrs. B. Eleven months after



19. Mary A. Before



20. Mary A. Three months





2. Mary Y. Before



23. Mary Y. Seven months after



24. Mary Y. Seven months after

THE COMMITTEE ON THE COSTS OF MEDICAL CARE PRESENTS ITS FINAL REPORT

THE first comprehensive study of the costs and distribution of medical service in the United States, has been concluded by the Committee on the Costs of Medical Care in a final report which is arousing many expressions of conflicting opinions regarding the changes recommended. The Committee, headed by Dr. Ray Lyman Wilbur and consisting of forty-eight members representing points of view of the medical profession, economists, sociologists, business men, and laymen, has been at work for five years. The results represent an investment of one million dollars granted by foundations, one of the first supporters being the Milbank Memorial Fund which gave \$255,000.

The final report of this Committee, published in December, 1932, by the University of Chicago Press under the title, "Medical Care for the American People," summarizes and interprets the findings of fact previously published in twenty-six separate reports, and presents final recommendations by a majority of the Committee and by minority groups.

How to provide satisfactory medical service at costs which can be met without undue hardship by all people except the indigent while providing fair remuneration for the medical profession was the fundamental problem the Committee five years ago set out to investigate. It found that, at present, 38 per cent of the people in this country receive no medical, dental, or eye care, although its final report does not estimate how many of them needed such care. The rest are served very unevenly, with uneven costs, and with some doctors receiving too little money for doing the same work that pays others well. Meanwhile, nearly half a billion dollars a year is expended for patent medicines and "quacks."

As a cure for these and other ills, the Committee in its majority report prescribes organization of medical service in community medical centers and in groups of doctors; more public health service; payment in the form of small but regular fees, the same for everybody, through voluntary insurance in communities or groups of persons,¹ or through taxation or both; raising standards and cutting out overlapping work in counties, towns, cities, and states through the watchful help of councils specially organized, and better professional education for doctors and nurses. The objections to the majority report and the counter-recommendations by different minority groups and dissenting statements of individual members of the Committee will be discussed in connection with the following more detailed summary.

THE FACTUAL FINDINGS

Whatever differences of opinion there may be, the Committee has assembled and analyzed a vast amount of information never before available in one place. A few of the outstanding facts will illustrate the scope of the Committee's work.

More than one million American citizens make their living in the broad field of medical care and protection of health. For their services and for medicines, the American people spend three and a half billion dollars a year. This, if collected as a head tax, would be about thirty dollars each for every man, woman, and child in the country. There are nearly 7,000 hospitals with nearly one million beds. Nearly three-fourths of all patient-days of service are rendered by governmental institutions.

Full credit is given the medical profession for the remarkable advance of medicine both as an art and a science. The

¹Several members signing the majority report favored compulsory insurance for states, especially the industrial states.