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Published in:
Journal of Plastic Reconstructive and Aesthetic Surgery

DOI:
10.1016/j.bjps.2008.06.052

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Document Version
Publisher's PDF, also known as Version of record

Publication date:
2009

Link to publication in University of Groningen/UMCG research database

Citation for published version (APA):

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Sir Charles Alfred Ballance (1856–1936) and the introduction of facial nerve crossover anastomosis in 1895

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Received 31 January 2008; accepted 16 June 2008

KEYWORDS
Facial nerve; Crossover anastomosis; Facial nerve surgery; Sir Charles Ballance; Facial paralysis; Facial nerve repair; History

Summary  Sir Charles Ballance (1856–1936) was the first surgeon in history to perform a facial nerve crossover anastomosis in 1895. Although, recently, several papers on the history of facial nerve surgery have been published, little is known about this historically important operation, the theoretical reasoning behind the operation or the surgical perspective in which Ballance developed this method. An original document on the operation, dated in 1895, is not known. The earliest report of the operation is a paper by Ballance, published in 1903. Study of this 1903 paper reveals that Ballance stopped performing the operation after his first attempt in 1895 until he resumed in December 1901. What was the reason for this interruption? Why did Ballance start doing it again in 1901? Between 1895 and Ballance’s 1903 paper, several other surgeons had published the results of their facial nerve crossovers. Were they inspired by Ballance’s operation from 1895 to do the same or did they invent the method independently? To enhance our knowledge about the early history of facial nerve surgery, the original manuscripts by Ballance and his contemporaries have been studied.

Ballance’s first facial nerve crossover from 1895 is described in the surgical perspective of the end of the 19th century. The theoretical reasoning for the operation is discussed. It was discovered that Ballance’s operation was first recorded in St. Thomas’s Hospital Report of 1895, which was published in 1897. However, this report was probably hardly known by Ballance’s contemporaries and consequently could not have stimulated them to perform the operation themselves. Jean Louis Faure (1863–1944), from France, appears to have been the first to have performed the operation until Ballance’s 1903 paper was published. In 1903, after Ballance’s paper had been published, many other accounts of this method were reported in the literature. At that moment facial nerve crossover seems to have been widely regarded as a potential successful technique, a technique which, a century later, is still part of our repertoire.

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doi:10.1016/j.bjps.2008.06.052
Sir Charles Alfred Ballance (1856–1936) (Figure 1), from London, is considered one of the most important contributors to the development of facial nerve surgery in the first half of the 20th century. He was the first in history to perform a so-called facial nerve crossover anastomosis in 1895. Recently, several papers on the history of facial nerve surgery and two extensive biographies about Ballance and his career have been published. Despite this historical effort, little is known about Ballance’s first facial nerve crossover anastomosis, the theoretical reasoning for his operation and the surgical perspective in which Ballance developed this surgical method. An original report of this operation, dated in 1895, has unfortunately never been found. The earliest known written evidence of the operation is dated eight years later, in 1903. Why didn’t Ballance publish his account before 1903 or is earlier documentation of the operation still available? Between 1895 and the date of his publication, several other surgeons had published their accounts of the same technique. Were they inspired by Ballance’s operation from 1895 or did they invent the method independently? A critical study of Ballance’s paper from 1903 raises several other questions. Most striking is the fact that Ballance stopped doing the operation after his first attempt in 1895 until December 1901 (Table 1). What was the reason for this interruption? Why did Ballance start doing it again in 1901? To enhance our knowledge about the early history of facial nerve surgery, the original manuscripts by Ballance and his contemporaries have been studied and these questions will be answered. The aim of this manuscript is to provide an historical analysis of how the technique of facial nerve crossover anastomosis emerged and evolved in its early years.

Table 1  Ballance’s first facial nerve crossovers as recorded in Ballance’s 1903 paper

<table>
<thead>
<tr>
<th>Case Date of the operation</th>
<th>Substitute nerve</th>
<th>Type of anastomosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st 1895</td>
<td>Facial — spinal accessory</td>
<td>End-to-side</td>
</tr>
<tr>
<td>2nd December, 1901</td>
<td>Facial — spinal accessory</td>
<td>End-to-side</td>
</tr>
<tr>
<td>3rd February, 1902</td>
<td>Facial — spinal accessory</td>
<td>End-to-side</td>
</tr>
<tr>
<td>4th February, 1902</td>
<td>Facial — spinal accessory</td>
<td>End-to-side</td>
</tr>
<tr>
<td>5th April, 1902</td>
<td>Facial — spinal accessory</td>
<td>End-to-side</td>
</tr>
<tr>
<td>6th August, 1902</td>
<td>Facial — spinal accessory</td>
<td>End-to-side</td>
</tr>
<tr>
<td>7th January, 1903</td>
<td>Facial — hypoglossal</td>
<td>End-to-side</td>
</tr>
</tbody>
</table>

Sir Charles Alfred Ballance (1856–1936)

Ballance started his medical career at St. Thomas’s Hospital, London (Figure 2), in 1875. Later in his career he practiced as an aural surgeon at St. Thomas’s, where he rapidly developed the neglected otological service. In 1892 Ballance became surgeon-in-charge of the Ear Department at St. Thomas’s, but he also had a practice at the West London Hospital and one at the National Hospital for the Paralyzed and Insane, Queen Square. By the turn of the century, Ballance had become London’s foremost authority on mastoid surgery. Considering his clinical position and expertise at that time, Ballance must have been regularly confronted with patients suffering facial paralysis.

Before facial nerve surgery was introduced in the late 1890s, people affected by iatrogenic facial paralysis probably had to suffer from their distorted facial features for the rest of their lives. The general treatment of facial paralysis consisted of medicines, ointments and electrotherapy. To prevent the eye from becoming inflamed the eyelids were sometimes closed by adhesive plaster.

![Figure 1](https://example.com/figure1.png)  
**Figure 1** Sir Charles A. Ballance (1856–1936) of London, England, who was the first to perform a facial nerve crossover anastomosis in 1895. (Figure is reproduced with permission of Otology & Neurotology).

![Figure 2](https://example.com/figure2.png)  
**Figure 2** View of St. Thomas’s Hospital in London, England (1895). (Reproduced with permission from St. Thomas’s Hospital).
Adhesive plaster was also used to lift the corner of the mouth to improve facial balance and stop drooling. In the mid-19th century, operation for facial nerve surgery had already been performed by some excellent facial reconstructive surgeons like Johann Friedrich Dieffenbach (1794–1847) and Bernhard Rudolph Conrad Von Langenbeck (1810–1887) from Germany.

It is not known whether Ballance employed these methods, but the following statement by him in 1903 seems to implicate that he initially had no surgical method in his repertoire to treat facial paralysis: ‘the prognosis in facial paralysis of extracerebral origin is a very variable one. Whilst in the majority of so-called ‘rheumatic’ cases (Bell’s palsy) the prospects of recovery are good. Yet in other cases, and especially those due to traumatism or to involvement of the Fallopian aqueduct by a supplicative otitis media recovery may not occur and the patient is doomed to lifelong disfigurement’. But how did Ballance get the idea to perform a facial nerve crossover anastomosis? This invention most probably originated from Ballance’s career-long interest in the healing of nerves in general. In the 1890s, Ballance performed a microscopic study of peripheral nerves and their healing processes. He published the results of this study in 1901 under the title ‘The healing of nerves’. According to Ballance, this study formed the rationale of his first facial nerve operation. Ballance was associated with a staff of many well-known neurologists and neurosurgeons at the National Hospital, which is widely regarded as the birthplace of modern neurosurgery. Considering Ballance’s experimental research and clinical positions he probably had state of the art knowledge on peripheral nerve surgery at the time he performed his first facial nerve crossover.

Several experimental studies and some clinical cases on peripheral nerve repair had already been published and had shown some promising results. End-to-end and end-to-side suture of nerve stumps and nerve grafts were already performed in the late 19th century. The principle of nerve crossover anastomosis was also known. However, the suture materials at that time frequently led to damage, foreign body reactions, and scarring of the suture line by which axons become disorganised, blocked, or entangled into neuromas. Moreover, transplanting nerve grafts to bridge a defect necessitates two suture lines of potential complication, although grafting was known to be less damaging than forcing an anastomosis under tension. From the quest for a sutureless method of nerve anastomosis, eventually even nerve tubulation with decalcified bone tubes had merged in the last decades of the 19th century.

In 1891, Robert Hermann Tillmanns (1844–1927) from Germany recommended the repair of the facial nerve as soon as possible when the nerve was severed. Direct repair of the intratemporal facial nerve was not reported until 1894, when Ballance did it for the first time. He lifted the facial nerve out of its canal, cut the injured part away, and sutured the ends in the region of the promontory. This operation was not successful and his patient died post-operatively from sepsis. The relative inaccessibility of the facial nerve in the temporal bone is a major disadvantage of intratemporal facial nerve repair, certainly considering the surgical instruments at that time. Moreover, a suppurative environment in case of mastoiditis does not provide optimal conditions for nerve healing (antibiotics were not available to Ballance). Although Ballance did not mention this explicitly, facial nerve crossover anastomosis might have occurred to him in 1895, one year after his direct facial nerve repair, from the search for a technique which avoided these disadvantages. In addition, it has been stated that one of the main factors for facial nerve surgery to have been developed at the end of the 19th century was the increased incidence of iatrogenic facial paralysis as an adverse result of complex operations in the area of the facial nerve. Such operations on the mastoid, the 8th cranial nerve and the parotid gland became possible thanks to better surgical circumstances after the advent of modalities such as anaesthesia, asepsis and antisepsis.

**Ballance’s first facial nerve crossover in 1895**

Ballance’s first patient, treated by facial nerve crossover anastomosis, had an iatrogenic facial paralysis. Ballance wrote: ‘CASE 1. - G.G., a boy 11 years of age, was operated on in 1895 for left-sided otitis media. The left face became paralysed after the operation, and facio-accessory anastomosis was performed six months later’. About the surgical procedure Ballance wrote: ‘The facial nerve was exposed by operation at its point of exit from the stylo-mastoid foramen. The nerve trunk was cut across as high up as possible, and a minute portion of the distal segment was reserved for microscopic examination. The spinal accessory was then exposed, its sheath incised at a level convenient for union with the divided facial, and into it the distal segment of the facial nerve was fixed by means of fine silk sutures’.

According to the current literature, the earliest written evidence of this first facial nerve crossover anastomosis is found in Ballance’s paper entitled: ‘Remarks on the operative treatment of chronic facial palsy of peripheral origin’, published in the British Medical Journal on 2 May 1903. In this article Ballance provides a review of the literature of clinical and experimental facial nerve crossover operations published at that time and included the cases performed by him until that date. Is Ballance’s 1903 paper really the first written evidence available of the first facial nerve crossover in history?

**St. Thomas’s Hospital Report of 1895**

Some believe that numerous oral presentations were held by Ballance preceding his 1903 paper. However, these statements were not validated by explicit and correct references. Still, it would be interesting to find written information about Ballance’s operation dated prior to his 1903 paper, such as an original report of the operation. It might provide some additional information about how Ballance got the idea to perform the operation and how he, his patient and his colleagues experienced the first ever facial nerve crossover anastomosis. Ballance stated: ‘In 1895 the facial nerve was united […] at St. Thomas’s Hospital’. We contacted St. Thomas’s Hospital in London and requested...
a copy of the original report of Ballance’s operation. This report was, unfortunately, not available. However, the operations performed at St. Thomas’s in those days were each year recorded in the Hospital Report.

St. Thomas’s Hospital Report of the year 1895 was published in 1897 (Figure 4).19 It consists of 19 chapters of which the 12th chapter is entitled ‘Surgical Report’ (pages 271—403). On pages 310 and 311 of this chapter the following information can be found (Figure 5): ‘Facial to spinal accessory nerve anastomosis in a male patient aged under 20, duration of residence after the operation was 2–4 weeks and the result was unrelieved’.19 This table confirms that a boy underwent a facial to spinal accessory anastomosis at St. Thomas’s Hospital in 1895, which seems not to have been successful. The table unfortunately provides only a little more information than his 1903 paper. But, after comparing the information from Ballance’s 1903 paper with the St. Thomas’s Hospital Report of the year 1895 and Ballance’s biographical data, it can at least be concluded that it most probably was indeed Ballance’s operation that was listed.

However, was Ballance’s operation from 1895 known by his contemporaries before Ballance’s 1903 paper was published? In other words, were the other pioneering surgeons inspired by the case to perform a similar operation? Ballance’s 1903 paper contains no reference to the table in St. Thomas’s Hospital Report or to other records dated before 1903.8 At the time that Ballance’s 1903 paper appeared in the literature, Faure20 and Kennedy21 had already published their clinical papers on facial nerve crossover anastomosis. Also two experimental papers on the subject by Manasse22 and Barrago-Ciarella23 were known, also to Ballance, as he listed them in his 1903 paper.8 None of them, however, refer to Ballance’s operation in 1895.20 On July 10th 1901, Faure’s pupil Bréavoine presented his doctoral thesis in which he reviewed the earlier attempts published at that time. His thesis entitled: ‘Traitement chirurgical de la paralysie faciale d’origine traumatique par l’anastomose spinofaciale’ (Paris, 1901) was also published in Chipault’s well-known ‘Travaux de Neurologie Chirurgicale et Orthopédique’.24 ‘L’état actuel de la chirurgie nerveuse’ [present state of nerve surgery], also by Chipault, is a very extensive work on the progress of neurological surgery published in 1902 and 1903, and it lists most accounts of facial nerve crossover anastomosis prior to 1903.2,25 Although Ballance was one of the co-authors of ‘L’état actuel de la chirurgie nerveuse’, his first facial nerve crossover operation (dated 1895) was not mentioned.25 In 1912, Kennedy wrote in his extensive review on the treatment of facial paralysis: ‘Although the case of Faure and Furet was the first published, and at the time supposed to have been the first case in which such a procedure had been carried out, it
was found subsequent to the publication of my case (1899) that Faure had not been the first to perform spino-facial anastomosis, but that a similar procedure had been done previously, but left unpublished, and apparently not followed by very satisfactory results. A case was performed by Ballance in 1895, but was not successful in restoring any dissociated movements of the face at the date on its publication, namely, 1903.26

It should therefore be concluded that Ballance performed the first facial to accessory nerve crossover anastomosis in history in 1895, which is supported by St. Thomas’s Hospital Report of the year 1895, published in 1897, in which the operation was recorded. However, Ballance’s first attempt seems not to have been widely known about until Ballance’s 1903 paper. Several papers on facial nerve crossover anastomosis had been published before 1903,20–24 and at that time not Ballance, but Faure, seems to have been generally considered the first to have performed this surgical procedure (Table 2). Second was Kennedy in 1899. The first experimental studies were published by Manasse in 1900 and Barrago-Ciarella in 1901. Bréavoine provided the first review on the subject in his doctoral thesis in July, 1901.

**Ballance and facial nerve crossover anastomosis between 1895 and 1901**

It is striking that Ballance performed his second facial nerve crossover anastomosis six years after his first, in December 1901. The reason for this interruption is not known. Was it related to the unsatisfactory results of his first operation? Had it something to do with the fact that his patient disappeared for seven years until he reappeared again in 1902?8

At the time that Ballance performed his second facial nerve crossover anastomosis, others had already published their attempts20–23 and Faure’s pupil Bréavoine had written his thesis in 1901.24 Ballance seemed to have been privy to these papers,8 which might have given him a new impulse to start performing the operation again in December 1901. In his 1903 paper, Ballance stated: ‘Manasse’s operation is practically the one which we now recommend’.8

**Long-term results of the first facial nerve crossover**

Seven years after Ballance’s first facial nerve crossover anastomosis his first patient had reappeared. Ballance observed that: ‘There is apparent left facial palsy, flaccid in type, with drooping of the angle of the mouth and widening of the palpebral aperture’.6 The ‘old interna-strabismus of the left eye’ was, he said, ‘dating from infancy’, and he considered it ‘quite unconnected with his facial palsy’.6 (Was Ballance already aware of Möbius’s paper on bilateral facial and abducens paralysis from 1888?) By using a spinal accessory to facial nerve crossover anastomosis, shoulder movement and (partial) recovery of facial movements were connected, of which Ballance noted: ‘All the muscles of the face react briskly and normally, both to faradism and to galvanism. Taste in the anterior part of the tongue is still absent on the affected side. No voluntary dissociated movement can be carried out in the left side of the face, but on raising the left shoulder against resistance, marked contraction occurs on the left side of the face, and is maintained as long as the trapezius is innervated. Occasional fibrillary tremors occur in all the muscles of the left face’.8 Ballance included some photographs of his patient illustrating the long-term (seven years) postoperative results (Figure 6).

**Spinal accessory or hypoglossal?**

In his 1903 paper, Ballance discussed six other cases of facial nerve crossover anastomosis performed by his

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**Table 2** Changes during the past century of the early chronology of clinical facial nerve crossover operations

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>Faure (1898)</td>
<td>Ballance (1895)</td>
<td>Drobnik (1879)</td>
<td>Ballance (1895)</td>
</tr>
<tr>
<td>2nd</td>
<td>Kennedy (1899)</td>
<td>Ballance (1895)</td>
<td>Kennedy (1899)</td>
<td>Faure (1898)</td>
</tr>
<tr>
<td>3rd</td>
<td>Kennedy (1899)</td>
<td>Faure (1898)</td>
<td>Kennedy (1899)</td>
<td>Drobnik (1899)</td>
</tr>
<tr>
<td>4th</td>
<td>Kennedy (1899)</td>
<td>Faure (1898)</td>
<td>Kennedy (1899)</td>
<td>Drobnik (1899)</td>
</tr>
</tbody>
</table>

*For about a century Tomasz Drobnik (1858–1901) was wrongly credited with the priority in history of performing a facial nerve crossover in 1879. This claim, however, was based on a typographical error in the date of his operation, which should have been correctly dated 1899 instead of 1879. It was, therefore, recently concluded by Van de Graaf and Nicolai (2001) that Sir Charles Ballance should be considered the first to perform this technique in 1895.*2
brother Sir Hamilton Ashley Ballance (1867–1936) and himself during the period between December 1901 and January 1903 (Table 1).8 His seventh case was a hypoglossal to facial nerve crossover anastomosis. In his first and subsequent five cases Ballance, however, chose the spinal accessory nerve. Why did Ballance choose this substitute nerve for his first facial nerve crossover anastomosis and not other cranial nerves? Was it the anatomical location, the diameter of the donor nerve, or the fact that the spinal accessory nerve innervates less vital structures compared to the rest of the cranial nerves? All of these reasons? Ballance did consider whether the glossopharyngeal nerve would be suitable. He wrote: 'In a letter to one of us (Sir Charles Ballance) in 1895, Professor Schafer (Sharpey-Schafer (1850–1935), then professor of physiology at University College, London) suggested the glossopharyngeal as a suitable nerve to attach to the divided facial nerve, on the ground that its motor nucleus is near to, and apparently serially homologous with the facial nucleus'.8 However, Ballance continued: 'The advice was not taken; the spinal accessory and later the hypoglossal were used, because these nerves were larger and, it was thought, more accessible'.

As already stated, Ballance’s seventh case was a hypoglossal to facial nerve crossover performed on January 9th 1903.8 Ballance stated that: ‘the accomplishment of dissociated facial movement is, of course, a matter of education of the cortex, or that part of it from which shoulder movements are initiated.’ Keeping that in mind he considered ‘whether it might not be practicable to select for anastomosis with the distal segment of the paralysed facial some other healthy nerve supplying muscles whose cortical centre is nearer to the face centre than in the case of the shoulder. The hypoglossal nerve and the cortical tongue centre fulfil these requirements, as will be seen from the accompanying diagrams’ (Figure 7).8 Based on the hypothesis for optimal conditions of cortical reorganisation he finally suggested in his 1903 paper: ‘Facio-hypoglossal anastomosis is the one which we would recommend in future in preference to that of facio-accessory union,’ Ballance was, however, not the first to actually perform a hypoglossal to facial nerve crossover anastomosis. On December 20th 1901, the German surgeon Werner Körte (1853–1937) had already performed this operation.27 It is striking that after this operation Körte favoured, in contrast to Ballance, the spinal accessory nerve, because he considered the loss of tongue function more impairing than dysfunction of the shoulder muscles.27 The German neurologist Martin Bernhardt (1844–1915), who was

Figure 6 Photographs of the postoperative results of the first patient in history to undergo a facial nerve crossover anastomosis performed by Sir Charles Ballance in 1895. (A) Facial expression at rest. (B) Facial expression during elevation of the left shoulder. (Reproduced with permission of the British Medical Journal).

Figure 7 Ballance’s scheme to illustrate the cortical connections between the movements of the face, tongue and shoulder, respectively. The centres of the movements of the tongue and the face overlap in the cortex, while that for the shoulder is some distance away from the face (1903). (Reproduced with permission of the British Medical Journal).
involved in the postoperative treatment of Körte’s patient, did not agree with Körte’s preference for the spinal accessory nerve. In a private letter to Ballance, in May 1903, he wrote: ‘I believe, however, that there are associated movements of the tongue which escape observation, as the tongue is confined within the mouth, but they in no way trouble the patient nor are they noticed by those around her. From all that I have observed, I entirely agree with you (Ballance) that in grafting the facial for the relief of facial palsy, it is, better, notwithstanding the opinion of Körte, to choose the hypoglossal rather than the spinal accessory’.27 The discussion on which donor nerve to use in facial nerve crossover anastomosis would continue for years.18,26,28

Soon after these landmark papers by Körte and Ballance an avalanche of papers on the subject appeared in the literature and a discussion on many aspects of facial nerve repair was started from that moment.26 In 1903, facial nerve crossover anastomosis seemed to have been established as a potentially successful method, a method which was also called by some ‘the Körte-Ballance operation’.29

In conclusion, Ballance is regarded as one of the most important contributors to the development of facial nerve surgery in the early 20th century. He was the first to perform a direct intratemporal facial nerve repair (1894) and the first to do a facial nerve crossover anastomosis (1895). The latter is supported by St. Thomas’s Hospital Report of the year 1895, which was published in 1897, and in which Ballance’s first facial nerve crossover was listed. However, this report was probably hardly known by Ballance’s contemporaries and consequently could not have stimulated them to perform the operation themselves. Jean Louis Faure (1863—1944) from France appears to have been regarded as the first to have done the operation until Ballance’s 1903 paper was published (Table 2). In 1903, after Ballance’s paper had been published, many other accounts of this method were reported in the literature. At that moment facial nerve crossover seems to have been widely regarded as a potentially successful technique, a technique which is, after a century, still part of our repertoire.

Acknowledgements

The authors thank Mrs Susan E. Henry from St. Thomas’s Hospital Medical Library in London, England, for providing copies of the original St. Thomas’s Hospital Report of the year 1895.

References