TEAM WORK IN THE VOICE CLINIC: TWO CASE STUDIES

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I have been the singing rehabilitation coach at Cheltenham General Hospital's Voice Clinic for fifteen years and in that time I have worked with many singers who have been referred to me by the ENT Consultant Surgeons: Michael Hardingham, Charlie Hall and Mike Thomas.

Over the last three years, I have worked with two voice clinic patients (Clients 1 and 2) who both presented with a vocal fold paralysis. This condition occurs as a result of abnormal nerve input to the laryngeal muscles and can be caused by damage to the recurrent laryngeal nerve (RLN). As a result one, or rarely both, vocal fold can no longer move. The RLN carries impulses to different laryngeal muscles responsible for opening the vocal folds for inhalation and closing them for phonation. Because this nerve is relatively long and takes a 'detour' to the larynx, it is at greater risk of injury from different causes: viral infections and potential damage caused by complications during surgery in the head, neck or chest. These can directly injure, stretch or compress the nerve.

Paralysis of the vocal folds can present in two ways. The more common type, as in the case of Client 1, is an adductor muscle paralysis (see Fig.1), where the folds are easily abducted or moved away from the midline. This produces an open airway, but a weak and breathy voice due to insufficient closure of the folds (adduction). It most often occurs with just one vocal fold being paralysed or having limited movement, resulting in the breath escaping too quickly. The fold is unable to vibrate in synchrony with the healthy fold or, if there is vibration, it is

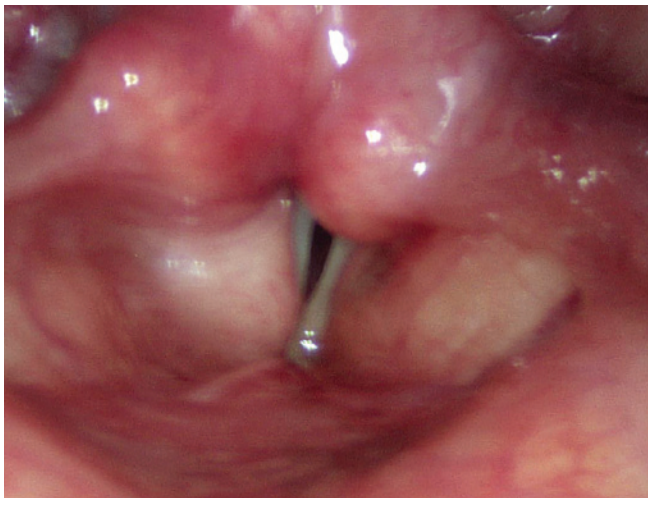

Fig. 1: Left vocal fold adductor paralysis in voicing with poor closure. Nore the recruitment of surrounding muscles.
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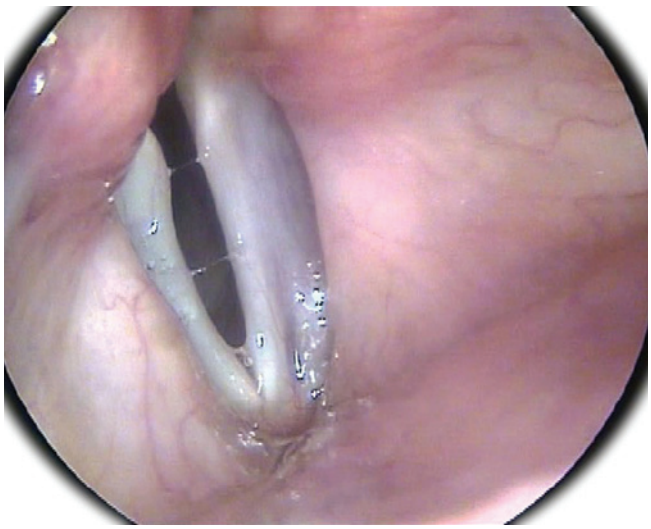

Fig. 2: Bilateral abductor vocal fold paralysis in breathing, with poor airway

abnormal. In some cases, there is no vibration at all. The other type, as in the case of Client 2, is an abductor muscle paralysis (see Fig.2), where voicing will usually be good, with efficient vocal fold adduction, but serious airway obstruction occurs because the paralysis restricts the opening movement of the folds necessary for inhalation (abduction).

Since each type of paralysis significantly affects breathing, my initial aim with both clients was to refine their breath management in order to maximise efficiency of subglottic pressure beneath the vocal folds and establish the best possible phonation. With Client 1, I hoped that this approach would strengthen both her speaking and singing voice by stimulating the paralysed fold to move towards the midline to create a better adduction. With Client 2, I hoped that by establishing balanced voicing, it might encourage increased abduction/opening of the vocal folds and an easing of her breathing problems.

I believe that if sensation and feeling can be established to create the optimal conditions for efficient phonation, for both speaking and singing, the voice has more of a chance of finding its own way to wellbeing. This depends upon frequent and regular repetition of suitable exercises, which are carefully monitored. It is best managed by recording all sessions to CD for the client to use in their own time at their own pace at home.

Client 1: Frances 62 years old A singer and music teacher

Diagnosis

Frances was diagnosed with a paralysed left vocal fold at the clinic in March 2010. There was a gap between her vocal folds along their full length, but most significantly at the posterior end. There was considerable leakage of air through the glottis in phonation, and her voice was hoarse and breathy. Speaking was an effort and she was not able to access her singing voice at all. The consultant recommended a referral for rehabilitation before considering surgery, which would involve a substance being injected adjacent to the paralysed fold to move it into a medial position to allow for better adduction. It would also provide a buttress for the normal vibrating fold.

Rehabilitation

BREATHING

Over a six month period, Frances and I worked to achieve precise levels of engagement of the abdomen (Transversus Abdominis/TA), employing a yoga-based relaxation exercise that I use in my singing teaching. As breathing for singing is based on a 'pressure system', we first had to establish the correct use of the vocal folds as a controlling valve, which would encourage full adduction by creating the appropriate level of subglottic pressure i.e. resistance to the upcoming air flow from the lungs. Although it is principally the diaphragm that regulates subglottic pressure, it relies on the action of the TA, to which it is attached, for the appropriate stimulus when voicing. Because the necessary movement of the TA can be quite challenging, Frances initially performed the exercise lying down on her back, when the rise and fall of the abdomen can be felt more readily.

EXERCISE

By maintaining a gentle pursing of the lips on exhalation, a valve is created and consequently the breath pressure rises, causing the abdomen to engage and flatten of its own accord. By letting go of the strong instinct to pull the air in, and instead allowing the body to deal with the inhale as a natural response to the exhale, the abdomen will rise and air will automatically be taken back into the mouth. The breathing can then gradually fall into a natural pattern as the focus is fixed on the rise and fall of the abdomen (rather like the movement of a foot pump). Once this is established, I begin voiced counting to gradually move the client towards doubling the length of exhale to inhale. At all times, the body is allowed to find its own pace so that there is no forcing or tightening of the breath. Finally, short pauses are introduced after both the exhale and inhale. This helps to strengthen the muscles and pattern the movements into the muscle memory. When practised standing up, the abdomen is more prepared to fall into a gentle swinging movement, as it is gently 'zipped and unzipped', with the initial engagement on exhale being no more than 50% muscular effort. As with muscle training for athletic activity, the exercise is practised little and often to produce the best results.

Once established, this exercise is then applied to voicing, initially by continuing to use the lips as a valve as mentioned above, but with the addition of sounds that create a gentle resistance to the air flow e.g. ZZ, VV, TH.

Despite the fact that this is the breathing pattern we use at birth, it is overridden as we start to experience the world. Learning to return to this system and to release the abdomen on inhale is very challenging, as we become deeply conditioned to tighten these muscles and gasp at the air, particularly when anxious – fight or flight breathing. This causes the shoulders to rise and the subglottic pressure generated is achieved through the use of compensatory muscle patterns. When vocal problems occur, it is important to work on creating a precise balance between abdominal exhale and inhale if one is to achieve a safe, efficient and consistent level of subglottic pressure under the vibrating vocal folds. The success depends on learning to feel exactly how much to engage/disengage the TA muscles and to monitor potential substitute patterns. Overdoing as well as underdoing the movements can be equally unhelpful!

SIRENS

I also introduced Frances to sirening (pitch gliding), to help the vocal folds to gently stretch and release. I hoped that this would encourage the paralysed side to start moving towards the midline, especially if the siren was accompanied by a gentle 'zipping' of the abdomen to be sure that subglottic pressure was activated to encourage precise fold adduction.

EXERCISE

After first experimenting with an OO vowel, Frances moved on to making an NG sound, being sure to keep the jaw relaxed and to feel the vibrations high up at the back of the mouth on every repetition. This gave the folds the best chance of efficient movement, but initially there was a considerable 'cracking' in her middle/speech range, which dismayed her. However, by conscientiously maintaining the same movements and sensations, this was ironed out quite quickly and the pitch range extended both higher and lower as the voice gradually found its way. At this point she tried pitch gliding on a rolled RR which, with its reliance on a higher level of subglottic pressure, gave the sound more stability.

ONSETS – VOWELS AND CONSONANTS

Maintaining an awareness of the relevant sensations and feelings as the way forward, Frances also did some work on onsets i.e. making a clean start to each sound. This helped to stabilise it, both by preventing leakage of air prior to voicing and by creating as clean an adduction of the vocal folds as possible – rather like vocal aerobics!

EXERCISE - VOWELS

Starting with spoken vowel onsets, we used the Estill-based UH-OH glottal onset with prior deconstriction of the larynx. As many readers will be aware, this entails making sure that the false vocal folds that lie slightly above and to either side of the true ones are kept apart, in order not to impinge on the free vibratory movement of the true vocal folds (note the constriction in Fig.1). There are various ways of achieving this – creating a gentle silent giggle builds up subglottic pressure, the feeling of which is then maintained on abdominal inhale, prior to voicing the UH-OH with an open mouth. To consolidate an awareness of deconstriction, I like to add a visual image of widening the throat on the inhale e.g. the drawing apart of curtains/sliding doors or the widening of an angry cobra's neck! Using the same approach, Frances also practised onsets on the words "Ah hello!"

This was followed up with better management of consonant onsets. By going back to the idea of the lips acting as a valve, I encouraged Frances to place her consonants as far forward as possible, including sounds like K and G, and to feel the build-up of some resistance to the air behind them, which creates an appropriate level of subglottic pressure. The consonants can then act like a spring as enunciation takes place, with the result that both clarity of sound and safe vocal projection are achieved.

EXERCISE - CONSONANTS

Having a goal for them to be aimed at, such as the wall on the opposite side of the room, consonants are gently 'fired' forward with small repetitions e.g. BBBBB, TTTTT, GGGGG etc, with the focus being on the control of the air flow. With fricative consonants like VV, ZZ and TH, the escape of air through the sound needs to be carefully balanced with maintaining some breath pressure behind them. I then introduce double and triple consonants e.g. PL, CH, STR to be tried in the same way.

Outcome

Although slow and painstaking work, Frances learnt how to take control of her voice, including the importance of vocal

hygiene and also how to deal with it on her vocal 'down days'.

By the fourth session, she was beginning to sing and over the next six months her tone became less airy and the weakened middle register began to grow stronger. Although still a little breathy, she started to own her voice again and once we had consolidated other aspects of technique, she was singing repertoire and feeling more comfortable in her natural soprano register. After nine months, she achieved her goal of singing at her son's wedding in Australia!

A review in the Voice Clinic in October 2010 revealed that although there was still some vocal fold irregularity, the posterior gap was significantly smaller and the vocal folds were more flexible. The previously paralysed vocal fold was looking stronger and moving more readily to the midline with better adduction and her breath analysis was normal. Frances was discharged on that day, and she and I were both delighted!

"The three things that helped me most were re-establishing my breathing and at the same time learning about the mechanics. This, and all the exercises for bringing the folds together, made me so much more aware. The siren really was the yardstick to feel how the paralysis was diminishing. Lots of frustrating days, but a fantastic exercise! Everything you gave me to do increased the strength and gradually the range of my voice. But the most important thing was the encouragement! It is a long journey with lots of bad days, but now it is fabulous to know that when I open my mouth a singing voice will come out!" (Frances)

Client 2 – Carol 64 years old A retired teacher

Diagnosis

Carol had a persistent bilateral abductor vocal fold palsy following a total thyroidectomy in October 2010. She had had a significantly enlarged goitre for eight years before her operation, by which time there were difficulties with its size and, as a result, the recurrent laryngeal nerve had been severely stretched. When this happens, there is no knowing whether a vocal fold paralysis will occur post surgery or not. If it does, as in Carol's case, the RLN is only thought to be able to make any significant recovery within twelve months.

Immediately after the operation, Carol had great difficulty with breathing and speech. She spent five days in a high dependency ward, having her breathing, speech and calcium levels monitored. Surgical treatment was considered to help with her breathing, but a conservative approach to management was adopted. In the following weeks, Carol had speech therapy to restore basic enunciation and pronunciation. Over the next eighteen months she began to resume her normal activities, including swimming, yoga and pilates, but she could not breathe comfortably and displayed a considerable stridor (noisy inhale). She had shortness of breath with exertion and her quality of life was greatly impaired. Towards the end of 2011, she was told that there might still be some scope for recovery, as there was some flickering of the right vocal fold, but by New Year 2012 she was warned that it was unlikely that she would recover any further mobility of her vocal folds. In February 2012, she was offered an operation to 'tie back' her vocal folds which would widen her airway, but there was a definite risk that this could impair her vocal quality. She was advised of two other possible surgical options for opening up her airway, but Carol chose to try to address her breath management before going ahead with further surgery. Following discussion with her surgeon, Mr Thomas, we started rehabilitation treatment in April 2012.

Rehabilitation

BREATHING

This was the main focus for Carol. We followed the same exercises as with Frances, my idea being that if she could regulate her subglottic pressure on exhalation, it might enable her vocal folds to 'swing open' a little more on inhalation. It was by no means assured that any progress would be made, but Carol was both determined and prepared to work hard. At this point, her speaking voice was quite strong, as the vocal folds were adducting well, but her inhalation was very effortful and noisy. She still tired quickly when trying to walk uphill.

Having been previously physically active, including doing yoga, Carol's response to the recommended exercises was excellent. The concept of abdominal breathing was straightforward for her and she quickly mastered a well-controlled abdominal exhale, but initially she found herself unable to stop gasping on inhale. However, by practising the exercise on an hourly and daily basis, using the CD recordings of our sessions, the abdominal muscular patterning became easier and her inhale less effortful. Even much later into our work together, Carol still had a tendency to gasp at the breath between sentences, especially when in animated conversation. Relinquishing control of the inhalation and allowing the body to deal with it instead was a key factor in the eradication of her stridor. In Carol's own words – "in February 2012, when offered another operation to improve my breathing, I wanted to be able to breathe more easily, but did not want further surgery, especially when it might impair what hesitant speech I had. When I met Alison two months later, I was quite desperate for help. Because of the specificity and clear delivery of the breathing exercises, I could see after only one session that this was exactly what I needed. The exercises were extremely helpful since they involved both what to do and what not to do." (Carol)

SIRENS

By encouraging Carol to try sirening, I wanted to give her easily adducted folds a chance to have a good stretch! She was willing to try this, and it reinforced her breathing as it had to lengthen as she explored higher and lower pitches. All the time I had in mind that the other side of the coin to a well produced sound was, hopefully, a more active movement of the folds on inhale that may enable them to open a little wider. "After so short a time, it is excellent that I can even do a siren. Each one I do brings a huge smile and warmth to me – it just seems so extraordinary that I, who could not even sing before the operation and could not talk after it, can now almost sing!" (Carol)

ONSETS

Again, both the deconstriction of the larynx prior to speaking and the gentle building up of air pressure behind consonants helped to reinforce Carol's breathing. They also encouraged appropriate energy levels when projecting her voice and had a strengthening effect on her vocal tone. "Reciting melodious and metric poetry was excellent practice for my breath control and also gave me good consonant practice. It was also good fun and gave me lots of laughs which were a great confidence boost. All those things one does such as laughing, coughing,

sneezing etc have become so much easier because I can 'relax' and let my body take over." (Carol)

In parallel with the vocal rehabilitation, Carol underwent some fascial release technique with physiotherapist Nicola Ellis. This helped release the chronic muscular tension which had built up with her prior inability to breathe properly. "Nicola said that my upper body looked as if it was vacuum-packed, but now I have greater freedom in my diaphragm, chest and shoulders. I had become very round-shouldered through trying desperately to breathe. Tips from both ladies on deportment also gave significant and immediate relief." (Carol)

Towards the end of rehabilitation, Carol paid a visit to laryngeal physiotherapist Ed Blake. "My one visit to Ed Blake was terrifying in anticipation of what could go wrong, but very satisfying in that the discomfort I expected with the treatment was in fact pleasurable. Joyful when leaving his room, I took a breath which was something beautiful that I had not felt for a long time. He seemed to give me a clear airway which felt wonderful – a motorway as opposed to a narrow country lane – that feeling has not gone!" (Carol)

Outcome

Carol now swims for an hour several times a week, including underwater, which had been one particularly long-term goal. Some atrophy of her right vocal fold had been observed at her voice clinic review in April 2012, but by July, following the prescribed exercises, it was much plumper and more flexible. This was also due in part to steam inhalations on a daily basis, which Carol had found to be both soothing and effective. At the same time, her stridor was significantly diminished and she could walk uphill without getting breathless. Better abduction was evident and there was a reduction in laryngeal tension. By January 2013, she presented with a normal voice quality and no stridor. Again, better abduction of the vocal folds was seen during inspiration as was a good mucosal wave within the adducting folds during phonation. The best news was that, after eleven years almost to the day since she had been diagnosed with an enlarged thyroid, she was discharged from the voice clinic!

In conclusion, although in these two complementary cases of vocal fold paralysis there was significant benefit gained from having rehabilitation alongside and following the ongoing medical process, the outcome was unknown at the beginning. Perhaps this article may give hope to others with the same diagnosis, but each case is unique, and it is by no means assured that the same course of action would result in the same outcome. However, it has to be true that if appropriate breathing and vocalising exercises are not pursued with persistence and regularity over several months, there will not be any significant recovery.

I would like to express my sincere thanks to Frances and Carol for their co-operation in the writing of this article. Equally to ENT Consultant Mike Thomas, who has given me every support and kindly verified the accuracy of all the medical terminology.

Healthy Vocal Folds

Back of the neck

Right

ABducted or Vocal Folds Apart

Left

ADducted or Vocal Folds Together

Front of throat