Guest Editorial

Evolution of Phonosurgery with its Inception and Progress in India

The term 'Phonosurgery' was first defined by Hans von Leden,[3] together with Gottfried Arnold as any surgery designed primarily for the improvement or restoration of voice. Phonosurgery is therefore, not restricted to one or more surgical techniques but is defined by its intended functional goal.

Successful phonosurgical treatment commenced with the injection of substances into the paraglottic space in cases of paralytic dysphonia. Burning introduced injection technique for unilateral vocal fold paralysis in 1911 using intracordal paraffin by means of a novel injecting device that he designed. It was not until the 1950s to 1960s, however, when Arnold championed injection medialization that it become the mainstay of phonosurgical treatment for paralytic dysphonia. Medialization of the vocal fold edge by means of neural reinnervation (phrenic or descending hypoglossal to recurrent laryngeal nerve) was introduced by Balance in 1924 and advanced in recent years by Tucker and Crumley. Although this approach has not become mainstream, it has significant promise for the future.

Payr introduced the seminal investigations describing medialization of the laryngeal framework for treating paralytic dysphonia in 1915. In that approach, he designed an anteriorly based rectangular cartilaginous flap that was depressed to medialize the musculomembranous vocal fold. Although this technique was explored further by Meurman,[1] Opheim, Waltner, Miehlke, and Swashima in the middle part of the 20th century, framework medialization did not become mainstream until the recent past. Isshiki's landmark investigations in the 1970s[2] established a systematic design and organization of laryngeal dramatic shift from injection techniques to larygoplastic phonosurgery for the treatment of vocal fold paralysis. This consisted of medialization laryngoplasty (thyroplasty type 1) and arytenoid adduction. A critical aspect of these contributions is that Isshiki taught surgeons to perform these procedures with local anesthesia sedation, thereby facilitating intraoperative conversation between the patient and surgeon. This allowed for dramatically improved vocal result.

In the United States, Koufman led the drive towards adopting Isshiki's procedures to become the dominant treatment modality for paralytic dysphonia. He not only made numerous modifications, but also created the term *laryngoplastic phonosurgery*. Recently, Zeitels et al[4] introduced the adduction arytenopexy procedure, which is the first formal modification of Isshiki's arytenoid adduction operation. They noted that with this static reconstruction patient had unperturbed conversational voice with typically less then 1.5 octaves of dynamic pitch variation. Therefore, a cricothyroid subluxation procedure was designed to increase length and tension of the denervated vocal fold, which has dramatically improved maximal-range vocal tasks. This procedure is unlike all prior static procedures, which were devised primarily to reposition the paralyzed vocal edge in a more optimal position to facilitate entrained oscillation with the innervated vocal fold. As the phonosurgical management of paralytic dysphonia involves multiple procedures, the surgeon must be well versed with all the laryngeal framework surgical techniques for achieving a goal.

The use of stereoscopic microscope and invention of various microsurgical instrument made phonosurgery find its place into reality.

According to G Friedrich, Professor and Chairman, Ear, Nose and Throat, University Hospital, Graz, Austria, a prerequisite for phonosurgery is the adequate diagnosis and documentation of the disordered voice. Phonosurgery should not focus on the appearance of the vocal folds but rather should aim for an improvement in voice, adapted to the individual request and needs of the patient. As the phonosurgical techniques described by Isshiki became more accepted and became common throughout the world, several new surgical modifications and different terms have been introduced. These new developments have lead to a confusion regarding terminology and types which make it difficult to communicate between and to compare the results of different authors. In an effort to create a more precise and descriptive list of definitions and terms, the Phonosurgery Committee of the European Laryngological Society has developed a new terminology for laryngeal framework surgery. In accordance with the concept of Isshiki, four types can be separated according to the intended purpose of the surgery:

- Approximation laryngoplasty: Medialization thyroplasty, arytenoid adduction.
- Expansion laryngoplasty: Lateralization thyroplasty, vocal fold abduction.
- Relaxation laryngoplasty: Shortening thyroplasty.
- Tensioning laryngoplasty: Cricothyroid approximation, elongation thyroplasty.

The proposed terms are functionally oriented and related closely to the intended purpose of the procedure or related to the underlying pathogenesis of the dysphonia. This new classification should provide a general framework suited not only to classify the current techniques but also to easily apply and adapt to include new procedures and future developments as necessary.

Scientific discovery, technological advances, and improved outcomes assessment have resulted in advances and refinements in phonosurgery. Three areas of substantial evolution are phonomicrosurgery, laryngeal framework surgery, and the use of implantable materials in vocal folds. Discovery of the importance of the superficial layers of the lamina propria has led to increased use of more limited medial microflap approaches and less frequent use of the classic lateral cordotomy flap approach. Alternative approaches to managing vocal fold scarring defects have addressed the separation of body and cover, and provided suitable lamina propria replacement. Approaches to sulcus vocalis have been refined to address type II (linear vergeture) and type III (focal invasive pit) sulcus where there is loss of lamina propria, while still recognizing the common nonpathological type I (physiological) sulcus. Technological advancements, such as photodynamic therapy, tuned dye lasers, and laryngeal microdébridement have augmented the armamentarium for mechanical removal of laryngeal papillomata. Careful infusion-assisted microexcision and adjunctive medical management have been refined and made more effective. Laryngeal framework surgery has embraced the development of Silastic, hydroxylapatite, expanded polytetrafluoroethylene, and titanium shims. Anatomical studies have helped to improve operative precision and safety, and have led to inventive variations in arytenoid repositioning that improve closure of the posterior subunit. Vocal fold augmentation by injection has been facilitated by innovative use of the rigid telescope and intraoperative videostroboscopy. Anatomical studies have focused on the infrafold region and rheological studies have attempted to match viscoelastic properties of injectable substances to those of vocal fold tissues. Alloplastic materials, such as teflon have been largely supplanted by newer bioimplantables such as fat.

Approximately 20 years after description of arytenoid adduction by Isshiki, in 1978 Zeitels et al presented a new technique called Adduction Arytenopexy, a procedure designed to model agonist-antagonist function of intrinsic laryngeal muscles (lateralcricoarytenoid, interarytenoid and posterior cricoarytenoid) simulating normal function of arytenoid during phonation.

The stimulus for inception of phonosurgery as subspecialty of otolaryngology started in India in 1995 when Professor Issihiki delivered a keynote address on thyroplasty type-I during National Conference of the Association of Otolaryngologists of India at Cuttack, Orissa. In 1997 there was special focus on laryngology and phonosurgery in Indian Journal of Otolaryngology and Head and Neck Surgery with first publication of Indian experience on medialization laryngoplasty and arytenoid adduction by Professor Phaniendrakumar et al from Sri Satya Sai Institute of ORL and Research Center for voice disorders, Guntur, AP, India. So, I had the credit of doing first successful case of type-I thyroplasty with arytenoid adduction in India in 1996. Professor Murthy PSN from Manipal, South India was very well known in the country for his excellent work on postlaryngectomy voice prosthesis and voice rehabilitation.

I joined as member of Voice Foundation of North America in 1999 at New Orleans, USA and started first voice clinic in India at Hyderabad. Contemporary work on laryngeal framework surgery intiated by Professor Handa AIIMS at New Delhi and Dr Jayakumar from KIMS, Thiruvananthapuram and Professor WVS Ramalingam from Pune. Dr Jayakumar after his basic training in Phonosurgery under the guidance of Dr John D Russell at Dublin, Ireland, he started 1st Spasmodic Dysphonia clinic at KIMS, Kerala in 1999.

He also had credit of organizing the first ever cadaver thyroplasty workshop in the country in Thiruvananthapuram in 1999 and also first successful type III thyroplasty in India Dr. Jayakumar also started KIMS Voice Foundation involving many voice professionals at Thiruvananthapuram, Kerala in 2004.

Dr Sachin Gandhi from Pune started Oswal's Voice Clinic at Deenanathmangeshker Hospital, focusing on lasers in laryngology. Professor Handa had his fellowship on lasers in laryngology in the year 2004 under the guidance of Professor Mackenzie, Glasgow, UK. Dr Nupur Neruker on her return from USA, having trained at Harvard and Mt. Sinai Medical center, started the first voice clinic at the Sion Hospital, Mumbai, in 2003. Her study on vocal outcomes with subepithelial infiltration in benign glottic lesions was published in the 2007 issue of JLO. In 2006 she visited UCSF for a short refresher training program and also made a presentation at the voice conference being held at San Francisco.

Dr Jayakumar presented his work on "flaring of ala nasi—a new diagnostic sign for abductor spasmodic dysphonia" and I presented on "sandwich thyroplsty technique" during 3rd World Voice Congress at Istanbul, Turkey, in June 2006.

Sandwich thyroplosty considered as innovative technique and an alternative to Issihiki's technique of thryoplasty, was modified for the first time 30 years after the invention of Issihiki's thyroplasty. I had an occasion to have direct

interaction with Professor Issihiki during my presentation of sandwich thyroplasty in Voice Foundation meeting (Annual Symposium—care of Professional Voice) at Philadelphia USA in 2007. Professor Issihiki passed his comment "Its a Good Idea". During the same time I was accepted as member of International Association of Phonosurgeons at Philadelphia. I had privilege of initiating for the first time in the country "Office Based Laryngeal Surgery" at Sri Sathya Sai Institute of ORl, Guntur, AP in 2003, which started attracting the attention of many otolaryngologists in the country. Professor WVS Ramalingam and Dr Rakesh Datta released 'Hand Book on Phonosurgery' at New Delhi in 2009. Phonosurgeons from India started getting global recognition and I have been selected as Member of Advisory Scientific Committee for World Voice Congress 2010 to be held in September 2010 at Seoul, Korea. Phonosurgeons of India wish to continue their sincere efforts to win the race in the field of phonosurgery.

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