The Effectiveness of Hyaluronic Acid in The Recovery of The Voice After Phonosurgery

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ABSTRACT

Objective: The purpose of this study was to compare the effectiveness of hyaluronic acid aerosol in the post-operative treatment of phonosurgical patients with standard therapy. Patients and methods: authors examined two groups of patients undergoing surgery for laryngeal polyps. Group 1 patients received post-operative treatment with aerosol flunisolide and group 2 patients received post-operative treatment with aerosol hyaluronic acid. The results of the treatments were evaluated according to Italian Society of Logopedics and Phoniatrics (SIFEL) protocol. Results: There was a more rapid functional recovery of vocal parameters in patients treated with hyaluronic acid, who obtained good recovery of vocal parameters within 10 days. Conclusion: The study demonstrates the effectiveness of post-operative aerosol hyaluronic acid for recovery of the voice after surgery for laryngeal polyps. Subsequent studies in other diseases are required to validate the post-operative use of hyaluronic acid in laryngeal surgery.

Keywords: hyaluronic acid, phonosurgery, aerosoltherapy, voice therapy, voice

1. INTRODUCTION

Phonosurgical procedures are an important part of every Ear, Nose and Throat (ENT) surgical department. These procedures are usually carried out in day surgery, whereas successive functional evaluations occurred during outpatient visit. In all phonosurgical procedures an objective evaluation of the vocal parameters by GIRBAS Scale and by electroacoustic examination of the voice is useful.

Objective evaluation of vocal parameters is mandatory to estimate preoperative and postoperative improvement of voice quality and to personalize post-surgical phonologopedic rehabilitative treatments [1-7].

Many types of post-surgical pharmacological treatments are used [7]. Our ENT Division has usually adopted a treatment with steroid aerosol (flunisolide 1 mg/ml 1 phials 1 ml/day) for the first 20 days after phonosurgical procedures. From May 2011 we used post-operative treatment with hyaluronic acid (sodium hyaluronate 0.3% phials...
Hyaluronic acid is an essential constituent of connective tissues [15,16,17]. Chemically, it is a glucosaminoglycan with an unbranched polysaccharide chain produced by the condensation of thousands of disaccharide units generated by the union of glucuronic acid and N-acetyl-glucosamine. It is the only non-sulfate glycosaminoglycan. It is a polar molecule; polarity is conferred by carboxyl groups and enables high hydrophilicity and water solubility. It is present in the connective matrix, unlike other glycosaminoglycans, which are linked with proteins to constitute proteoglycans. It acts as binding agent, lubricant, and moisturizer and it can filter the spread of tissue bacteria, viruses and toxic substances; only a few bacterial cells exceed the barrier of hyaluronic acid with the enzyme hyaluronidase, which enables splitting of the macromolecule of hyaluronic acid, but most bacterial cells do not overcome the hyaluronic acid barrier.

The clinical use of hyaluronic acid in dermatology and cosmetic medicine, in ophthalmology as artificial tears, in orthopedics for intra-articular injections, and in otology for the repair of the tympanic membrane, has been known for some time [18]. There are various commercial forms of hyaluronic acid, including the recently introduced aerosol, that promise a number of useful applications both in the treatment of inflammation of the upper airways and in post-operative treatment. Hyaluronic acid is a natural constituent of connective tissues therefore it does not produce obvious side effects and does not have any particular contraindications for use. The possible side effects associated with its clinical, aesthetic and health use should therefore not be sought in the substance itself, but rather in the way it is administered and the fact that the use of hyaluronic acid is a relatively modern practice limits its knowledge on the possible side effects and contraindications that are currently null.

Flunisolide is a derivative of cortisone, it is generally used as therapy and prophylaxis against forms of rhinitis and in nasal polyposis. There is dryness and irritation of the nose and throat, headache. It is clear that using hyaluronic acid rather than flunisolide can be considered more advantageous.

2. METHODS

After institutional review board's approval in 2010, clinical data and voice parameters were collected in clinical routine over the last year during outpatient visit. Surgical procedures were performed with prior patient's informed written consent. All personal information where anonymized prior to publication. The preoperative, operative and post-operative procedures followed were in accordance with the Helsinki Declaration of 1975, as revised in 2008. Vocal fold polypoid disease was chosen for its simplicity in surgical asporation, in order to minimize the possible differences between operators performing
the phonosurgical procedures. Exclusion criteria were precancerous or malignant lesions on postoperative histological examination and non-attendance to postoperative follow-up. Totally 120 patients undergoing to phonosurgery for unilateral vocal fold polyp were evaluated from 01/05/2010 to 30/06/2018, which consisted of 70 women (aged 18 - 74 years) and 50 men aged (18 - 76 years). The recording was distributed in two main groups.

Group 1 included 20 patients (12 women and 8 men) receiving post-surgical treatment with an aerosol steroid (flunisolide 1 mg/ml 1 phials 1 ml/day) for the first 20 days after the surgical procedure.

Group 2 included 100 patients (58 women and 42 men) receiving post-operative treatment with hyaluronic acid (sodium hyaluronate 0.3% phials 3 ml 1 phial/day) aerosolized for the first 20 postoperative days.

None of the 120 patients underwent logopedic treatment before the 30th postoperative day in order to avoid patient intervariability [14]. All patients had a pre-operative normal value of maximum phonation time (MPT) (> 10 seconds) which was not considered significant.

All patients were submitted to clinical evaluation according to the Italian Society of Logopedics and Phoniatrics (protocol SIFEL) protocol preoperatively then at 10, 20 and 30 days after the phonosurgical procedure. The evaluation consisted of assessment of the maximum phonation time of the vowel / a /, recording the patient’s voice and perceptual evaluation of voice with the GIRBAS scale, calculation of vocal parameters by MDVP of the vowel / a / previously sampled to 50000 Hz, spectrogram of the same vowel / a /, and spectrogram of the word / aiuole /. The maximum phonation time (MPT) expresses the greatest duration of emission of the vowel / a / with constant tonality and intensity. The normal value is > 10 seconds.

Electroacoustic analysis of the voice was performed with a microphone placed 20 cm in front of mouth. Patients were invited to pronounce the vowel / a / with normal intensity of conversation, without changes of intensity or frequency. The vocal material obtained was analyzed by MDVP software. MDVP captures, analyzes, and graphically and numerically represents 33 different parameters from a single voice element. Its normative references are based on an extensive database of normal and disordered voices and results are compared to normal values, providing an index of voice quality.

According to Ricci Maccarini [12] and De Colle [13] recommendations only the eleven main voice parameters were taken into account: jitter % (relative evaluation of the period-to-period variability of the pitch within the analyzed voice sample), vFo (coefficient of Fundamental Frequency Variation), shimmer % (relative evaluation of the period-to-period variability of the peak-to-peak amplitude within the analyzed voice sample), vAM (coefficient of Amplitude Variation), NHR (Noise-to-Harmonic Ratio), VTI (Voice Turbulence Index), SPI (Soft Phonation Index), FTRI (Frequency Tremor Intensity Index), ATRI (Amplitude Tremor Intensity Index), DVB (Degree of Voice Breaks), and DSH (Degree of Sub-Harmonic components). The graphical representation of these parameters is represented in a vocalgram.

The GIRBAS is a perceptive evaluation of voice consisting of six parameters (G = global grade of dysphonia, I = instability of voice, R = grade of roughness, B = grade of breathiness, A = grade of asthenia, S = grade of strain) with a score from 0 to 3. Statistical significance was validated by the Student’s t test. Each GIRBAS Scale parameter and four MDVP parameters (jitter %, vFo, shimmer %, vAM) were compared for each patient group before surgery and post-operatively on days 10, 20 and 30. Preoperative and post-operative data were also compared in flunisolide and hyaluronic acid patients.

(In the Student’s t test a p value <0.05 meant the statistical probability that the observed difference of the means was due to coincidence was inferior to 5%. A p value <0.01 meant the statistical probability that the observed difference of the means was due to coincidence was inferior to 1%).

3. RESULTS

Results showed significant differences between the pre-operative and post-operative controls between group 1 and group 2 in mean values for four MDVP parameters (jitter %, vFo, shimmer %, vAM) (Figure 1), and mean values for all parameters of the GIRBAS Scale (Figure 2), particularly at 10 days. Regarding the GIRBAS scale, the most important differences at 10 days is between grade of asthenia and grade of strain which showed a significant improvement. There were no significant differences in any parameters between male and female patients.

In the hyaluronic acid group, MDVP parameters were significantly improved from baseline at post-operative day 10 (jitter % p=0.032; vFo p=0.00001; shimmer % p=0.00001; vAM p=0.045).

In the next post-operative days there was a statistically significant difference improvement of the four MVDP parameters in hyaluronic acid group at 20 and 30 days after phonosurgery(jitter % p=0.002; vFo p=0.0165; shimmer % p=0.0001; vAM p=0.00).

4. DISCUSSION

This study confirms the efficacy of treatment with hyaluronic acid aerosol in phonosurgical patients. Patients treated with hyaluronic acid obtain a more rapid and complete recovery of voice quality evaluated by GIRBAS Scale and electroacoustic examination by MDVP.

Voice parameters are easily restored after phonosurgery in patients affected by polypoid lesions, in both groups these improvements were present and statistically significant into the 30 post-operative days. The main difference found between the two groups of patients is represented by the time necessary to return to normal range of voice parameters; in group 2 there was an almost complete recovery in 10 days, while patients in group 1 did not obtain a significant improvement until 20 or 30 post-operative days. These findings are objectively supported by MDVP numerical data.

Hereafter this study could be extended to other phonosurgical pathologies such us vocal nodules, Reinke’s edema and others in order to confirm the validity of hyaluronic acid postoperative treatment in all phonosurgical procedures.

At the moment treatment with hyaluronic acid costs a little more. However, the treatment is shorter and
therefore the total cost is almost equal to the treatment with flunisolide.

5. CONCLUSIONS

The present study demonstrates the effectiveness of post-operative aerosol hyaluronic acid for recovery of the voice after surgery for laryngeal polyps. Subsequent studies on other diseases, such as Reinke's edema, may provide interesting topics for discussion to validate the post-operative use of hyaluronic acid in laryngeal surgery.

REFERENCES