Vocal fold masses removal techniques were significantly modified back in 1970s by Hirano’s laminar vocal structure and physiology of phonation works, as well as Titze’s vibratory vocal cycle works. New methods were to come. Removing the lesion by maximum preservation of vocal laminar microstructure (lamina propria and epithelium) and minimal damage of surrounding normal vocal tissue, was pointed out.

Microflap technique is based on presenting the superficial layer of lamina propria with the lesion and removing the lesion without damage of the mucosa. Preserving of the mucosal layer provides the shield for vibratory substructures.

There are two elementary approaches for microflap: lateral and medial.

Lateral microflap technique enables better identification of vocal ligament and lowers the risk of its injury, particularly when scars and tightly adherent lesions are present. This technique has been used in case of big or diffuse lesions, such as vocal oedema or vocal ligament identification difficulties (e.g. vocal scarification).

Medial microflap technique seems to be appropriate in removing smaller, localised lesions, such as cysts and vocal polyps.

Our 45 patients experience is presented in this article, in 30 patients lesions were removed by lateral microflap technique (46 vocal cords in total), while 15 patients were treated by medial microflap technique. The outcome was assumed by endovideolaryngoscopic analysis of glottal occlusion and mucosal wave prior and following to the procedure. Reinke oedema management results were analysed separately.

Key words: subepithelial microflap, vocal cord, glottic occlusion, mucosal wave, oedema Reinke

INTRODUCTION

The medicine took a great benefit from scientific and technology development in last few decades, especially in surgery, and phonosurgery, too. Phonosurgery spectrum encompasses:

1. phonomicrosurgery,
2. laryngeal framework surgery,
3. augmentative implant sugery,

Phonomicrosurgery is endoscopic laryngeal surgery using microscope and microinstruments. The aim is to achieve restoration and improvement of the voice.

It is direct suspension laryngoscopy. The main principles are summarized by Zeitels i Vaughan;

1. The patient in supine position, with flexed neck and extended atlanto occipital joint;
2. External pressure to move laryngeal framework backward;
3. Laryngoscop position toward triangle space of glottis;
4. Free hands suspension;
5. Intend to supraglottic structures moving away.

That was Hirano whose explanations about the anatomy of the vocal folds, physiology of the phonation and patophysiology of the voice disorders, as well as Titze explanations about vibratory cycles, who influenced changing of the approach to the vocal fold mass excision and searching for new methods. There was clear conclusion: removing the lesion with maximal preservation of the microstructure of the vocal fold (lamina propria and epithel) and with minimal damage of the surrounding tissue.

The most of the vocal fold disorders are limited to the superficial layer of the lamina propria.

That is well known fact- usually way of ablation of the polyp and decortication especially, leads to postoperative prolonged aphony, and unacceptably final hoarsness and high pitch.

Microflap technique is the way of presenting the superficial layer on the site of the lesion, and the way of removing it without mucosal damage.
The vibratory substructures are protected on that way. This technique gives quick healing according to the primary closure, with minimal scarring.

In preserving good vocal fold functioning, the adequate presentation, careful manipulation, preserving the normal tissue and primary closure are the most important precautions.

**METHODS AND MATERIAL**

There are lateral and medial microflap (Figure 1).

The classical lateral microflap approach includes the incision of the upper surface of the vocal fold near the ventriculus Morgagni. Knife first, than microscissors. Ankled elevator through the superficial layer lifts the mucosal flap. After presenting the lesion and the ligament, the next step is excision of the mass itself. Than the flap repositioning over the ligament (Figure 2). One can do steroid injection, as the way of avoiding the scar formation.

The medial microflap is beginning with an incision over the lesion, near the vibratory margin, the incision is as long as necessary. Next steps are the same- submucosal excision and flap repositioning (Figure 3).

Postoperative absolute vocal rest next three days and relative vocal rest next three weeks. Postoperative vocal therapy in the case of preoperative vocal misuse or if the muscle tension dysphonia was present. Dietetic change or proton pump inhibitors if reflux is present or suspected.

No smoking strong advise.

Preoperative and three months postoperative endovideolaryngostroboscopy.

The patients with parakeratotic or dysplastic lesions were not discussed.

The significance of statistic difference was estimated by Hi square test.

**RESULTS**

There were 45 patients, 30 of them (46 vocal folds) had lateral microflap and 15 with medial microflap technique. There were 15 patients with Reinke edema, 16 with polyps and 14 with cysts. The lesions were bilateral in 16 patients (All of 15 with edema and one with bilateral cysts), so there were 61 microflaps at all.

The results were analysed as Courey et al.\(^1\) suggested: endovideolaryngostroboscopic analysis of the closure patterns and the mucosal wave.

The mucosal wave preoperatively was presented on 12 vocal folds (Table 1), postoperative mucosal wave was absent in all of Reinke edema cases (30 vocal folds).

In 31 vocal folds the mucosal wave was postoperatively absent only in the case of bilateral cysts.

Preoperatively and postoperatively presented the mucosal wave was in 12 vocal folds, and postoperatively restituted in 19 vocal folds.

In statistical analysis edema were excluded because of the nature of the disease.

Among 31 vocal folds, postoperative mucosal wave appearance in 19 of them was not statistically significant.
Restoration of the normal glottic closure was statistically of high significance ($X^2=11,000; \text{df}=1; p<0.01$).

Psychoacoustic analysis shows significant improvement of the voice, and all patients were satisfied in self monitoring.

**DISCUSSION**

Better understanding of the anatomy and the physiology leads to improvement in techniques of vocal fold masses removing from the lamina propria. Endoscopic microflap technique is based on lifting and preserving mucosal cover of the vocal fold and excision of submucosal lesion.

Pliability of the vocal fold cover (epithelium and superficial layer of the lamina propria) is critically important for normal phonation. Loss of its elasticity leads to vocal fold stiffness, with uprising of the subglottal pressure for oscillating of the glottal valve. Stroboscopic image of stiffness is absent mucosal wave.

Lateral microflap technique gives better identification of the vocal ligament and smaller damage risk, especially in very tight lesions. Vocal ligament damage leads to scarring and permanent dysphonia. Some authors suggested that lateral incision itself brings smaller risk. This is good technique for bigger or diffuse lesions as well as in cases of difficult identification of the ligament in scarring.

The site of incision is different in medial microflap, with minimal tissue damage, especially the basal membrane complex; on that way we preserve intact part of the lamina propria.

Medial microflap is ideal when
1. Lesion is in the medial surface of the vocal fold,
2. the cover is very thin on the place,
3. there is much more cover on the place,
4. there is easy preparing from the vocal ligament.

Preserving the lamina propria integrity is especially important in microsurgery of Reinke edema with suction of pathologic substrate and maximal preserving of the lamina propria in order to avoid basal membrane adhesions to vocal ligament with consequences such as stiffness or scarring. This phenomena could lead to prolonged postoperative dysphonia in Reinke edema cases.

Cold instruments are better than CO$_2$ laser in little superficial lesions. The same conclusion is for Reinke edema.

The superficial lamina propria is the most important factor for optimal viscoelasticity in vocal fold oscillations. The injury leads to replacement of proteins, elastin and hyaluronic acid with collagen fibers and fibronectin. There is no problem in epithelial regeneration, but lost elastic tissue has no regeneration potential. That increases the viscosity of the tissue with losing the amount of the energy in resolving the oscillation frictions.

Consecutive iatrogenic adhesions of basal membrane to vocal ligament in scarring of the vocal folds it is especially important to avoid in the management of Reinke edema. The technique must be the removal of volume with epithelium and lamina propria preserving.

**TABLE 1**

<table>
<thead>
<tr>
<th>Mass (no of vocal folds)</th>
<th>Lateral flap</th>
<th>Medial flap</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>preoperative</td>
<td>postoperative</td>
</tr>
<tr>
<td></td>
<td>present</td>
<td>absent</td>
</tr>
<tr>
<td>Edema (30)</td>
<td>0</td>
<td>30</td>
</tr>
<tr>
<td>Cysts (15)</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Polyps (16)</td>
<td>8</td>
<td>2</td>
</tr>
</tbody>
</table>

**TABLE 2**

<table>
<thead>
<tr>
<th>Mass (no of patients)</th>
<th>Lateral flap</th>
<th>Medial flap</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>preoperative</td>
<td>postoperative</td>
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<tr>
<td></td>
<td>present</td>
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</tr>
<tr>
<td>Edema (15)</td>
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<tr>
<td>Cysts (14)</td>
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<td>0</td>
</tr>
<tr>
<td>Polyps (16)</td>
<td>10</td>
<td>0</td>
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</tbody>
</table>

1. Lesion is in the medial surface of the vocal fold,
tic and collagen fibers difference. This fibers are parallel to the vibratory margin as well as vascularisation is. The multiple protein connections are present in the basal membrane and superficial lamina propria site of the contact. Microflap technique preserve elastic fibers of the intermediate layer of lamina propria as well as basal membrane and its vascularisation.

As many authors suggested, this technique is superior for restoration of normal voice, almost in 100 per cent. Restoration of the mucosal wave is achieved in most cases too.

In Reinke edema, lateral microflap gives good identification of the ligament, with less possibilities of its damage and consecutive adhesions in bilateral operation with shorter postoperative dysphonia. In Reinke edema the superficial layer of the lamina propria is substituted with mixomatus stroma. The superficial tissue is lost, and there is postoperative direct contact of the intermediate layer and the mucosa. That is the reason for not postoperative direct contact of the intermediate layer and the mucosa. That is the reason for not postoperative dysphonia. In Reinke edema, lateral microflap gives good identification of the ligament, with less possibilities of its damage and consecutive adhesions in bilateral operation with shorter postoperative dysphonia.

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There are arguments about the fixation of the lateral microflap. Some authors propose vocal rest that is enough to adhaeasive forces to fix it. Others suggested suture or fibrin glue.

Postoperative vocal rest is argued too. Some authors propose immediate vocal activity in order to avoid atrophy and emotional trauma, but others suggest two weeks of absolute vocal rest because there is 14 days need for establishing of collagen bridges and fixation of the flap.

Mucosal wave restitution and upper and lower vibratory limbs of the vocal folds appears in 3 months.

Vocal practice occasionally with phoniatric examinations next 2 years.

CONCLUSION

We wanted to present the microflap technique in our work and to emphasize the importance of good knowledge of the anatomy, histology and physiology of vocal folds. To achieve the primary aim with good surgical skill and that is preserving and restoration of the voice.

Phonomicrosurgery should secure removal of the pathologic substrate with maximal preservation of normal multilayer microstructure of the vocal fold.

Microflap is the excellent technique in preserving the mucosa, vocal ligament and mucosal wave, in achieving prompt improvement of the voice.

In future there is a need for randomised studies of clinical entities with computer assisted analysis of the voice in objective evaluation of the results.

REZIME

UKLANJANJE IZRAŠTAJA SA GLASNICA SUBEPITEL-NOM MIKRO REŽANJ TEHNIKOM

Značajno poboljšanje u tehniči uklanjanja izraštaja sa glasnica datira od sedamdesetih godina prošlog veka i Hiranovog opisa slojevite strukture glasnice i fiziološke fon-