

# Optimal Duration for Voice Rest After Vocal Fold Surgery: Randomized Controlled Clinical Study

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**Summary: Objectives.** Voice rest is commonly recommended after phonosurgery to prevent worsening of vocal fold injuries. However, the most effective duration of voice rest is unknown. Recently, early vocal stimulation was recommended as a means to improve wound healing. The purpose of this study is to examine the optimal duration of voice rest after phonosurgery.

**Study Design.** Randomized controlled clinical study.

**Methods.** Patients undergoing phonosurgery for leukoplakia, carcinoma *in situ*, vocal fold polyp, Reinke's edema, and cyst were chosen. Participants were randomly assigned to voice rest for 3 or 7 postoperative days. Voice therapy was administered to both groups after voice rest. Grade, roughness, breathiness, asthenia, and strain (GRBAS) scale, stroboscopic examination, aerodynamic assessment, acoustic analysis, and Voice Handicap Index-10 (VHI-10) were performed pre- and postoperatively at 1, 3, and 6 months. Stroboscopic examination evaluated normalized mucosal wave amplitude (NMWA). Parameters were compared between both groups.

**Results.** Thirty-one patients were analyzed (3-day group,  $n = 16$ ; 7-day group,  $n = 15$ ). Jitter, shimmer, and VHI-10 were significantly better in the 3-day group at 1 month post operation. GRBAS was significantly better in the 3-day group at 1 and 3 months post operation, and NMWA was significantly better in the 3-day group at 1, 3, and 6 months post operation compared to the 7-day group.

**Conclusions.** The data suggest that 3 days of voice rest followed by voice therapy may lead to better wound healing of the vocal fold compared to 7 days of voice rest. Appropriate mechanical stimulation during early stages of vocal fold wound healing may lead to favorable functional recovery.

**Key Words:** Voice rest–Stimulation–Phonosurgery–Fibroblast–Voice therapy.

## INTRODUCTION

Vocal fold scarring can occur following injury, inflammation, or surgical intervention. Vocal fold scarring leads to the disruption of the layered structure of the lamina propria.<sup>1–3</sup> Once the vocal fold is scarred, severe dysphonia can occur. Although many therapeutic strategies for vocal fold scarring have been evaluated, a consistent treatment has yet to be developed. Therefore, prevention of scarring is an important therapeutic target.<sup>4</sup>

Voice rest is commonly recommended after vocal fold surgery to prevent worsening of the injury and scarring of the vocal fold. Whether voice rest actually leads to better wound healing of the vocal fold, however, is unknown.<sup>5</sup> Recent literature reviews have shown the absence of an established standard protocol for voice rest, and the type and duration of voice rest vary among clinicians.<sup>6,7</sup> Cho et al<sup>8</sup> evaluated the effect of voice rest after vocal fold surgery in a canine model. Bilateral excision of the vocal fold mucosa was performed followed by simulated “voice rest” induced by resection of the left recurrent laryngeal nerve.<sup>8</sup> Cho et al concluded that voice rest precipitates the re-epithelialization process and recommended 2 weeks of voice rest

and 8 weeks of vocal hygiene after phonosurgery. An American Academy of Otolaryngology survey indicates that most surgeons recommend 7 days of voice rest, but there is a lack of evidence supporting this duration.<sup>7</sup> Koufman and Blalock<sup>6</sup> performed a retrospective review of the patients who had undergone microlaryngeal surgery. They concluded that there were no standard protocols for the duration or type of voice rest recommended by the surgeons.<sup>6</sup> Typical voice rest periods are not based on mechanisms of the wound healing process. Moreover, there have been very few prospective randomized clinical studies comparing durations of voice rest based on the wound healing process. To date, there are no established protocols or duration for voice therapy as well.<sup>5,6,9–14</sup> Moreover, Rousseau et al<sup>15</sup> have described a relatively low self-reported “complete compliance” of 35% among patients who were prescribed voice rest.

The effect of rest versus exercise has been a controversial topic in orthopedic rehabilitation research for more than a century.<sup>16</sup> However, controlled remobilization during the early stages of healing leads to favorable functional recovery.<sup>17–19</sup> Long-term immobilization is even considered to be detrimental to the recovery; therefore, it is not generally recommended in orthopedic rehabilitation.<sup>17,19–21</sup> Such outcomes rely largely on the degree of connective tissue healing.

The general wound healing process is divided into three phases: inflammation, proliferation, and maturation. The inflammatory phase consists of the 3 days after injury, during which hemostasis and inflammatory responses occur.<sup>5,9</sup> The proliferative phase extends from day 3 to 1 month post injury, during which angiogenesis and epithelialization occur. Fibroblasts migrate into the wound area between 48 and 72 hours after injury,<sup>22</sup> and play an important role by producing large amounts of extracellular matrix

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including collagen, elastin, proteoglycan, and glycosaminoglycan.<sup>23</sup> The maturation phase lasts for 1 year or longer, during which remodeling of the wound occurs.<sup>24</sup> Kishimoto et al<sup>25</sup> investigated the clinical maturation process of human vocal folds scarred by type I–III cordectomy, and they reported that vibratory function appeared to stabilize about 6 months after the procedure.

Reactive oxygen species (ROS) are another important factor that determines the fate of wound healing.<sup>26–28</sup> Several studies demonstrated that ROS have a positive role in the healing process as a defense against invading microorganisms or mediators of intracellular signaling,<sup>29,30</sup> but overexposure to ROS is harmful to wound healing.<sup>30,31</sup> The correct balance between oxidative and antioxidative forces is needed for favorable wound healing. Mizuta et al<sup>32</sup> suggested that a large amount of ROS is produced during the early phase of vocal fold wound healing, until postinjury day 3,<sup>26</sup> and this period may be crucial for regulating ROS levels. Therefore, rest of injury should be required for a certain period particularly during the inflammatory phase to avoid additional tissue damage caused by ROS. But it is not known if we should require the voice rest after postinjury day 4. Also, the effect of early mobilization on vocal fold tissue is unknown.

Empirical data from well-designed clinical voice studies are an essential component of evidence-based medicine. Such data are needed to know the common use of postoperative voice rest. Based on the basic and clinical perspectives mentioned above, we hypothesized that voice rest should be necessary during the inflammatory phase (3 days), but early initiation of phonatory stimulation may lead to better wound healing. The purpose of the present study is to examine the optimal duration of voice rest and the effect of early initiation of voice therapy on vocal fold wound healing. All procedures were approved by the institutional review boards at Kyoto University. The experiment employed a prospective randomized controlled design.

## METHODS

### Subjects

Patients more than 20 years old who underwent phonomicrosurgery for leukoplakia, carcinoma *in situ* (CIS), polyp, Reinke's edema (RE), or cyst were enrolled. A microflap technique was used for the removal of benign lesions. The epithelium was also resected in cases of leukoplakia and CIS, but the superficial layer of the lamina propria was preserved intact. Leukoplakia and CIS were included, although voice rest after epithelial excisions for CIS/leukoplakia varies due to institutions. Many institutions in Japan adopt voice rest, and Koufman and Blalock<sup>6</sup> also performed a retrospective review of the patients who had undergone microlaryngeal surgery for the same lesions with postoperative voice rest. Another reason is that leukoplakia and CIS are thought to be a good model to know about the wound healing mechanism after shallow resection of the vocal fold mucosa. Patients with a history of radiation therapy for the larynx were excluded.

### Procedures

Participants were randomly assigned to two groups according to the absolute voice rest period, either 3 or 7 days. Both groups

received voice therapy for 6 weeks following the voice rest periods. The 6-week period of voice therapy was designed to span the entire proliferative phase of wound healing. This period was also selected based on a report indicating that dropout from voice therapy increases after 6 weeks.<sup>33</sup> Vocal function was evaluated prior to surgery and at 1, 3, and 6 months post operation.

Voice therapy consisted of vocal hygiene and tube phonation. All participants were counseled on the aspects of voice hygiene including education about the anatomy and physiology of voice, hydration, laryngopharyngeal reflux diet modification, environmental modification, and stretches and relaxation.<sup>34</sup> Regarding tube phonation, the subjects were instructed to phonate sustained vowel-like sounds through a tube (21 cm in length and 10 mm in inner diameter) as follows: (1) sustain the musical note middle C for 5 seconds using /o:/; (2) repeat this note 12 times; (3) sustain the musical notes middle C, D, E, F, and G using /o:/ for 5 seconds, respectively; then (4) repeat these notes four times. The subjects were encouraged to produce all tones softly, with frontal focus, and to complete these tube phonations twice a day.

The patients received one session (40 minutes) of this tube phonation therapy preoperatively. It has been reported that during tube phonation, the larynx is lowered and mean glottal flow is modified, which facilitates vocal fold vibration. This method was reported to attenuate acute vocal fold inflammation.<sup>35–37</sup> Also, *in vitro* and human studies gave us the possibilities that tube phonation with alternative pitches and current time course seems to be appropriate as stimulus to the vocal fold during wound healing.<sup>38,39</sup>

The patients were also instructed to fill in daily records of their postoperative voice rest, phonation, and voice therapy for 6 weeks. They sent it to us by mail, and we confirmed their postoperative compliance of the voice therapy and vocal situation. All voice therapy was performed by a single trained speech language pathologist (MK).

Table 1 shows the background data for each group. The 3-day group included 16 subjects who underwent analysis. Their lesions

**TABLE 1.**  
**Demographic Data for Each Group**

	3-Day Group	7-Day Group
Subject	16	15
Pathology	3 leukoplakias	2 leukoplakias 1 CIS
	2 cysts	1 cyst
	10 polyps	9 polyps
	1 RE	2 REs
Mean age (years)	54	53
Age range (years)		
20–29	1	0
30–39	3	2
40–49	3	5
50–59	2	4
60–69	3	2
70–79	4	2
Gender	12M, 4F	7M, 8F
Smoker	1	2

Abbreviations: CIS, carcinoma *in situ*; F, female; M, male; RE, Reinke's edema.

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