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Systematic Review

Effectiveness of Endoscopic Pitch Raising Surgery in Male to Female Transsexual Individuals

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ABSTRACT

Aim
This study was performed to investigate the effectiveness of two endoscopic techniques for transsexual females.

Method
Web of Science, Google Scholar, and PubMed databases were searched for studies suitable for inclusion in this meta-analysis. Studies in which Wendler's glottoplasty or laser-assisted voice adjustment were analysed for the data criteria. Studies which included pre-operative and post-operative fundamentals frequency values were selected. Five articles were included in the present study (total of 94 cases). As dependent groups were used in these studies, standardized mean differences were obtained using a random effect model. Analyses were performed using the meta for package for the R-statistical program.

Results
Standardized mean values before and after operations were very different and post-operative mean values were significantly higher than the pre-operative mean values.

Conclusion
Endolaryngeal surgical techniques are valuable for pitch elevation.

Keywords
Transgender; Phonosurgery; Voice; Gender and the voice; Endoscopy US version.

INTRODUCTION

Transsexualism is a complex condition characterized by inconsistency between psychological and anatomical gender, and may lead to serious stress in the event of gender dysphoria.[1-3] Individuals can undergo a series of surgeries and hormone therapy to change their gender characteristics.[4] The voice is not only a means of communication, but is also important in the psychological perception of gender, being accepted as a secondary sexual characteristic.[5-7]

The fundamental frequency (F0) is the main parameter responsible the perceived gender of the voice, and is related to the length, mass, and stiffness of the vocal folds.[8-10] Adult male and female F0 ranges from 80-165 Hz and 145-275 Hz,[11] respectively. Thus, there is an overlap in the range 145-165 Hz,[11-14] in which other parameters should be added to determine voice gender; intonation is also important tin this regard.[15] Unlike transsexual males, transsexual females do not achieve satisfactory F0 values with hormone therapy.[12,16,17] Therefore, phonosurgery and voice therapy are suitable options for these patients.[18] The main advantage of voice therapy is that it can address parameters other than the F0.[19] However, laughing, crying, coughing, and other situations where voluntary control is lost can be unpleasant for patients. Phonosurgical options include cricothyroid approximation (CTA), laser assisted voice adjustment, and Wendler's glottoplasty.[18] CTA was

the first of these methods to be introduced, and has been used to achieve the desired feminine voice in many cases. However, it may not always able to create a voice that is sufficiently feminine.[20-22]

This study was performed to investigate the effectiveness of two endoscopic techniques for transsexual females.

MATERIALS AND METHODS

This study was approved by the ethical committee of Cemil Tascioglu City Hospital. Database search in October 2020, the Web of Science, Google Scholar, and PubMed databases were searched for studies suitable for inclusion in this meta-analysis.

The following keywords were searched for: "*transgender*", "*transgendered*", "*transgendered person*", "*transgendered female*", "*transsexual person*", "*transsexual female gender dysphoria*", "*endoscopic surgery*", "*Wendler's glottoplasty*", "*Laser-assisted voice adjustment*", "*laser reduction glottoplasty*", "*laser-assisted pitch raising*", "*pitch raising surgery*" and "*fundamental frequency*".

Data Analysis

Two independent referees reviewed the articles in accordance with the inclusion criteria. A third referee then checked the articles nominated for inclusion. Forty-nine studies were identified.

Forty studies were related to surgical techniques, but only those reporting endoscopic surgery and providing F0 values before and after surgery were included. Nine articles were identified that matched these criteria; three provided the complete data set, so we could calculate correlation coefficients and mean values if they were missing. One article presented mean values but no correlation coefficients, so these were obtained from the authors by e-mail. The entire data set for one article was obtained from the authors by e-mail and all relevant calculations were performed. Thus, five articles were finally included in the present study (total of 94 cases; Table 1. As dependent groups were used in these studies, standardized mean differences were obtained using a random effect model. Analyses were performed using the metafor package for the R statistical program (R Development Core Team, Vienna, Austria).

RESULTS

Kocak et al[23] described cases of CTA at least 12-months before laser reduction glottoplasty, although three patients were not transsexual. Orloff et al[24] included previously operated patients. Yılmaz et al[25] reported 27 cases, including 21 transsexual patients.

Table 1. *Pre-operative and Post-operative Fundamental Frequencies of the Studies*

Authors	Technique	N	Pre-operative F0	SD	Post-operative F0	SD	Correlation Co-efficient
Orloff et al[24]	Laser-assisted voice adjustment	31	141,94	38,89	167,88	35,69	0,65
Kocak et al[23]	CTA+laser reduction glottoplasti	6	158,33	12,14	203,50	13,34	0,93
Yılmaz et al[25]	Wendler's glottoplasty	27	152	12	195	14	0,42
Casado et al[26]	Wendler's glottoplasty	10	137,32	9,81	243,22	18.35	0,71
Paltura et al[5]	Wendler's glottoplasty	20	143,64	18,47	229,66	55,05	-0.21

Fo: Fundamental frequency, SD: standard deviation, CTA: cricothyroid approximation

Figure 1. *Forest Plot*

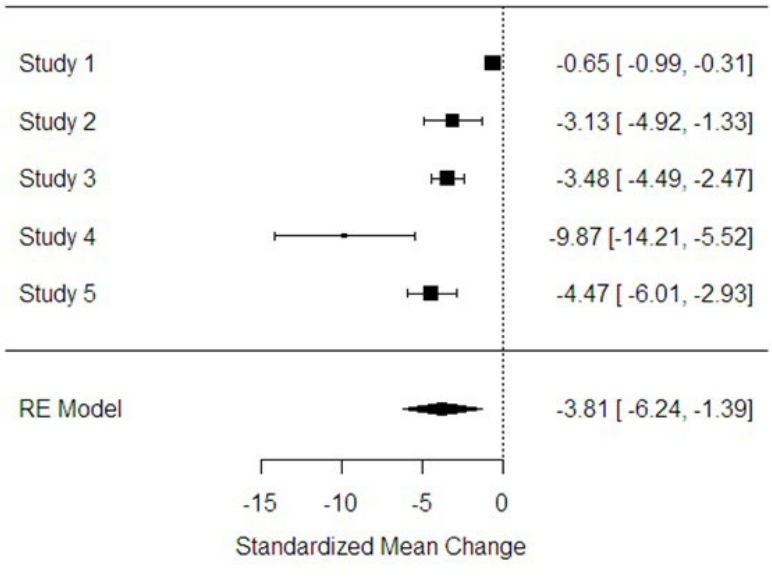

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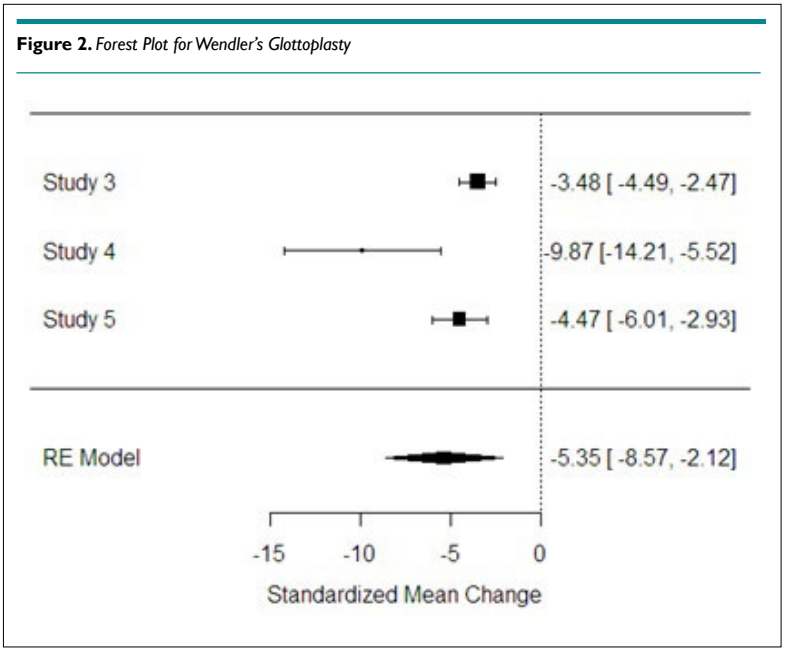
Figure 2. *Forest Plot for Wendler's Glottoplasty*



As shown by the forest plot in Figure 1, the study performed by Orloff et al[24] had the greatest contribution to the meta-analysis. The general effect range did not include 0 (zero) so the general effect was statistically significant. Standardized mean values before and after operations were very different and post-operative mean values were significantly higher than the pre-operative mean values.

Figure 2 shows a forest plot for Wendler's glottoplasty. The general effect range did not include 0 (zero) so the general effect was statistically significant. Standardized mean values before and after operations were very different and post-operative mean values were significantly higher than the pre-operative mean values.

DISCUSSION AND CONCLUSION

The voice is a major facet of human identity, particularly with respect to the perception of gender. Therefore, an appropriate voice is of special importance in transgender individuals to avoid psychosocial problems.[4] The production of a feminine voice requires coordination of respiration, vibration, resonation, and articulation, where these aspects are controlled by feedback mechanisms.[27] For voice feminization, retraining of phonophysiological mechanisms and phonatory patterns is needed.

Pitch raising surgical procedures alter vocal fold tension, length, and mass.[28] Laser-assisted voice adjustment and Wendler's glottoplasty, two commonly used methods, are both performed endoscopically.

To our knowledge, this is the third meta-analysis of the English literature on pitch raising surgery in male to female transsexuals, after the studies of Schwarz et al[16] and Song et al.[18] Similar to these previous studies, we were also unable to find any randomized controlled trials, but we did find four prospective studies.[5,23,26] Unlike these studies, we did not include procedures that were not performed endoscopically. All of the studies reported significant pitch elevation in their patients.[5,23-26]

Although CTA is accepted as a form of pitch raising surgery, it is not a true voice feminization surgery because there are no morphological or physiological changes; it only causes a persistent cricothyroid muscle response.[24] In addition, CTA does not change the acoustic tube dimensions, which are different between males and females; moreover, tension after CTA is high after surgery but decreases over time.[23,29-31] Mora et al[22] compared CTA and glottoplasty, and concluded that glottoplasty led to a greater and more persistent F0 increase. Kocak et al[23] performed laser reduction glottoplasty as corrective surgery in cases of CTA failure.

Endolaryngeal procedures affect the vibration length, mass, and tension of the vocal folds. Paltura et al[5] reported that the vocal fold dimensions after Wendler's glottoplasty are closely related to the postoperative F0 value. They also emphasized that an increase in F0 alone was not sufficient for the voice to be perceived as female, and that formant frequencies had an influence on voice gender perception. Their results showed that F1, F3, and F4 were significantly higher after surgery in comparison to the preoperative values.[5]

Yılmaz et al[26] analyzed voice handicap index (VHI) scores and found that patients' emotional distress as it pertained to the voice decreased after surgery; but functional scores increased. They suggested that increased functional VHI score could be attributable to need for increased subglottic pressure required to phonate. However, they emphasized that the vocal range was permanently decreased, while the phonatory effort required for vocalization was increased, such that voice therapy is still needed to ensure that the preoperative voice loudness is retained. As surgery can cause problems in singers and voice professionals, voice therapy may be more suitable in such individuals.

The main limitations of our meta-analysis were the small number of studies included and the heterogeneity of the analyzed data. Two studies included female patients with hormone disorders and ambiguous genitalia.[23,25] Orloff et al[24] included patients who had previously undergone various different surgeries, while Kocak et al[23] included patients who had CTA. Also, none of the studies used a randomized controlled design, while only Paltura et al[5] included a control group. Voice therapy was applied in all patients in the studies of Kocak et al[23] and Casado et al[26] but in none of those in the studies of Yılmaz et al[25] and Paltura et al.[5] Due to the paucity of studies, we could not statistically compare the two techniques. Also, as the authors used different selfreport instruments, it was not possible to analyze quality of life after treatment.

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CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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