Cover Page

Official Title: Postoperative Myofunctional Therapy Enhances Surgical Outcomes in Patients with Obstructive Sleep Apnea: A Prospective Comparative Study

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Research Protocol

Part 1: Core Research Content

1. Project Summary

This study aims to prospectively compare surgical outcomes in patients with obstructive sleep apnea (OSA) who receive postoperative myofunctional therapy (OP+MFT) versus those who undergo surgery alone (OP). Obstructive sleep apnea (OSA) is a common disorder characterized by recurrent upper airway collapse. While surgical interventions are a common treatment, they yield variable success rates. Myofunctional therapy (MFT), which utilizes targeted oropharyngeal exercises, has emerged as a promising adjunctive treatment to improve these outcomes. This study will enroll adults with moderate-to-severe OSA. Following surgery, patients will be allocated to either the OP+MFT group, which will begin a 12-week MFT program, or the OP group. Polysomnography (PSG) will be performed at baseline and at 3 and 12 months post-surgery to assess efficacy. It is expected that the OP+MFT group will show significantly greater improvements in key sleep parameters, including the Apnea-Hypopnea Index (AHI), lowest oxygen saturation ($LSaO_2$), and snore index, compared to the OP group. The findings will provide evidence to support the integration of MFT into routine postoperative care for OSA patients.

2. General Information

- **Protocol Title:** Postoperative Myofunctional Therapy Enhances Surgical Outcomes in Patients with Obstructive Sleep Apnea: A Prospective Comparative Study.
- **Protocol Identifying Number:** TMUJIRB No.201912067.
- **Sponsor/Funder:** Taipei Medical University Shuang Ho Hospital Young Scholar Research Grant W114YSR-03 and Taipei Medical University Newly Recruited Faculty Research Grant, Project No. TMU113-AE1-B04
- **Investigator(s) and Site:**
    - **Principal Investigator:** Lok-Yee Joyce Li (Corresponding Author).
    - **Co-Investigators:** Cheng-Jung Wu, Sheng-Yu Wu, Cheng-Yu Tsai, Jinn-Moon Yang. Pin-Zhir Chao
    - **Research Site:** Taipei Medical University-Shuang Ho Hospital.
- **Involved Clinical and/or Technical Departments:**
    - Department of Otolaryngology, Shuang Ho Hospital.
    - Sleep Center, Shuang Ho Hospital.

- Speech-Language Pathologist services.

3. Rationale & Background Information

Obstructive Sleep Apnea (OSA) is a prevalent condition associated with significant morbidity, including hypertension and cardiovascular disease. Continuous positive airway pressure (CPAP) is the first-line treatment, but adherence is notoriously poor, with long-term compliance as low as 10-20%. For patients intolerant to CPAP, surgical options are offered, yet their long-term success rates average only 30%.

Myofunctional therapy (MFT) addresses the functional dimension of OSA by strengthening oropharyngeal muscles to increase airway stability. A meta-analysis has already demonstrated that MFT alone can reduce the AHI by 50% in adults. The rationale for this study is that surgery primarily addresses static anatomical obstructions, while MFT targets the functional deficit of poor neuromuscular tone that surgery alone cannot correct. We hypothesize that a combined, synergistic approach-where surgery provides anatomical relief and MFT enhances dynamic airway stability-will lead to superior treatment outcomes compared to surgery alone.

4. Study Goals and Objectives

- Goal: To determine if adding a structured postoperative MFT program to sleep surgery improves treatment outcomes for patients with moderate-to-severe OSA compared to surgery alone.
- Primary Objective:
  - To compare the reduction in AHI at 3 and 12 months post-surgery between the OP+MFT and OP-only groups, with success defined as >50% AHI reduction and a final AHI <20 events/hour.
- Secondary Objectives:
  - To compare the change in lowest oxygen saturation ($LSaO_2$) between the groups at 3 and 12 months.
  - To compare the change in the snore index between the groups at 3 and 12 months.

5. Study Design

This is a prospective, single-surgeon, non-randomized controlled study conducted at a single medical center.

- **Research Population:** Adults aged 20-65 with moderate-to-severe OSA (AHI ≥15 events/hour) confirmed by PSG.
- **Inclusion Criteria:**
    - Age 20-65 years.
    - Moderate-to-severe OSA (AHI ≥ 15 events/hour)
    - Friedman palate position grade I-II and tonsil size grade III-IV.
    - Patients who refuse or are unable to tolerate CPAP.
- **Exclusion Criteria:**
    - Central or mixed sleep apnea.
    - BMI > 27 kg/m².
    - Severe cardiopulmonary disease or psychiatric illness.
    - Pregnancy or cancer.
    - Significant weight gain during the follow-up period.
- **Study Duration:** The project was conducted between January 2020 and January 2024. Each participant's follow-up duration is 12 months.

6. Methodology

- **Interventions:**
    - **Surgery:** All patients will undergo surgery performed by the same surgeon, including uvulopalatopharyngoplasty (UPPP) and adjunctive nasal turbinate reduction surgery.
    - **Grouping:** After surgery, enrolled patients will be divided into two groups based on personal willingness: Group A (OP+MFT) or Group B (OP-only).
    - **Myofunctional Therapy (MFT):** Group A patients will begin a 12-week MFT program starting at the third postoperative week. The program includes:
        - Initial Instruction: Two face-to-face training sessions with a speech-language pathologist in the first week.
        - Home Practice: Twice-daily sessions of 15 minutes each, guided by instructional videos.
        - Exercises: Tongue elevation and protrusion drills, soft palate elevation, pharyngeal wall contractions, and nasal breathing retraining.
        - Supervision: Biweekly review sessions with the therapist to ensure correct performance and adherence.
- **Outcome Measures & Procedures:**

    - All participants will undergo overnight polysomnography (PSG) at the sleep center at baseline (pre-surgery), and at 3 and 12 months post-surgery.
    - Objective data on AHI, LSaO2, and snore index will be collected.
- **Study Flow Diagram:** [Eligible OSA Patients] -> [Informed Consent] -> [Baseline PSG] -> [Undergo Surgery (UPPP)] -> [Post-op Group Allocation] ---> [Group A: OP+MFT] -> [12-Week MFT Program] ---> [3-Month PSG Follow-up] -> [12-Month PSG Follow-up] -> [Data Analysis] | +--> [Group B: OP-only] -> [Routine Follow-up] --------+

7. Safety Considerations

Participant safety is paramount. MFT is a non-invasive therapy with minimal risk.

- All surgical procedures will be performed by an experienced surgeon, and standard postoperative care protocols will be followed to manage potential complications such as pain or bleeding.
- The intensity of MFT exercises will be introduced gradually to prevent muscle strain.
- During all follow-up visits, researchers will actively monitor and record any adverse events related to either the surgery or the MFT. All adverse events will be reported to the Institutional Review Board (IRB) in accordance with regulations.

8. Data Management and Statistical Analysis

- **Data Management:** All research data will be de-identified and coded. The data will be entered into a password-protected electronic database accessible only to the research team.
- **Statistical Analysis:**
    - Continuous variables will be compared using paired or unpaired t-tests.
    - Categorical outcomes will be compared using the chi-square test.
    - A p-value of <0.05 will be considered statistically significant.

9. Quality Assurance

To ensure the quality and consistency of the study:

- All surgeries will be performed by a single surgeon to standardize the surgical technique.
- All MFT instruction and supervision will be conducted by the same speech-language pathologist to ensure consistency in the training protocol.

- All PSG data will be scored according to the standardized guidelines of the American Academy of Sleep Medicine.
- The study will be conducted in strict adherence to the IRB-approved protocol and Good Clinical Practice (GCP) guidelines.

10. Expected Outcomes of the Study

This study is expected to demonstrate that the addition of postoperative MFT significantly enhances the efficacy of surgical treatment for OSA. The findings will provide strong evidence for a multimodal treatment strategy, potentially influencing future clinical guidelines for OSA management. This research will advance the understanding of OSA pathophysiology by highlighting the importance of addressing both anatomical and neuromuscular functional deficits.

11. Dissemination of Results and Publication Policy

The results of the study will be submitted for publication in a peer-reviewed international medical journal. Authorship will be determined based on the contributions of each member of the research team, as detailed in the "Authors' contributions" section of the manuscript.

12. Duration of the Project

The total duration of the project is four years, from January 2020 to January 2024.

- Year 1: Patient recruitment, surgical interventions, and early postoperative follow-up.
- Years 2-3: Continued recruitment and completion of all 3-month and 12-month follow-up assessments.
- Year 4: Data compilation, statistical analysis, and manuscript preparation and submission.

13. Problems Anticipated

- **Problem:** The modest sample size may limit statistical power.
    - **Solution:** Future research could be designed as a larger, multi-center trial.
- **Problem:** The 12-month follow-up period does not capture long-term recurrence.
    - **Solution:** Future studies should extend the follow-up period to three to five years.
- **Problem:** Adherence to MFT was based on self-report, which could introduce bias.

- **Solution:** Future protocols could incorporate digital tools, such as smartphone apps, for more objective adherence monitoring.

14. Project Management

- **Conceptualization & Supervision:** C.-J.W., L.-Y.J.L.
- **Data Curation:** S.-Y.W., C.-Y.T.
- **Formal Analysis & Methodology:** C.-J.W., J.-M.Y., L.-Y.J.L.
- **Investigation:** C.-J.W.
- **Writing & Editing:** All authors contributed.

15. Ethics

The study protocol has received ethical approval from the Taipei Medical University Joint Institutional Review Board (TMUJIRB No.201912067). All participants will provide written informed consent before enrollment. Participants will be informed of the study's purpose, procedures, potential risks, and benefits, and will be notified that they can withdraw from the study at any time without penalty.

16. Informed Consent Forms

Copies of the IRB-approved Informed Consent Forms (in both English and Traditional Chinese) will be appended to this protocol. The forms will ensure that participants have all the necessary information to make a voluntary and informed decision about their participation.

Part 2: Administrative and Supporting Documents

1. Budget

This research is funded by the Taipei Medical University Shuang Ho Hospital Young Scholar Research Grant W114YSR-03 and Taipei Medical University Newly Recruited Faculty Research Grant, Project No. TMU113-AE1-B04

2. Other Support for the Project

None.

3. Collaboration with other scientists or research institutions

This project involves collaboration between researchers at Taipei Medical University, Shuang Ho Hospital, National Yang Ming Chiao Tung University, and National Tsing Hua University.

4. Curriculum Vitae of Investigators

The CVs of the Principal Investigator and co-investigators are attached.

5. Financing and Insurance

Participants in this study are covered by the clinical trial liability insurance of the conducting institution, Taipei Medical University-Shuang Ho Hospital