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Evaluating the Efficacy of Microcurrent Infusion Technology in Enhancing Thyroid Function and Alleviating Symptoms in Hypothyroid Patients: A Pilot Study Using the Medica Device

Dr Yogita Dhengar [1*], Hemant Rohera [2], Dr. Mrunali Jambhulkar[3], Dr Deepak Nagpal [4]

[1*]Reader, Department of Oral Pathology and Microbiology, Swargiya Dadasaheb Kamlesh Smruti Dental College and Hospital
[2]Director, Research and development, Rohera Healthcare Technologies, Pune, Maharashtra, India
[3]Senior Lecturer, Department of Oral Pathology and Microbiology, Swargiya Dadasaheb Kamlesh Smruti Dental College and Hospital
[4]Dean, Professor and Head, Department of Oral Pathology and Microbiology Swargiya Dadasaheb Kalmegh Smruti Dental College and Hospital, Nagpur, Mahrarashtra, India

Abstract

Background

Hypothyroidism is a prevalent endocrine disorder characterized by insufficient production of thyroid hormones, leading to metabolic dysregulation and a range of debilitating symptoms, including fatigue, weight gain, and mood disturbances. While levothyroxine therapy effectively restores hormone levels in many patients, a significant subset continues to experience residual symptoms despite optimal treatment. Emerging non-invasive modalities, such as microcurrent infusion technology, offer potential complementary solutions by targeting cellular and tissuelevel dysfunctions associated with hypothyroidism.

Objective

This study evaluates the efficacy of microcurrent infusion technology delivered via the eMedica device in improving thyroid function and alleviating symptoms in patients with hypothyroidism. Specifically, the study aims to assess changes in thyroid-stimulating hormone (TSH), as well as patient-reported symptom relief following an eight-week intervention.

Methodology

A cross-sectional analysis was conducted with 30 patients diagnosed with hypothyroidism and on stable levothyroxine dosages. Participants underwent 30-minute sessions of microcurrent therapy targeting the thyroid region using the eMedica device for a total of eight weeks every day. Serum levels of TSH was measured pre- and post-intervention. Symptom severity was assessed using a validated hypothyroid symptom scoring system. Data were analyzed using paired t-tests to evaluate the significance of changes in biochemical and symptomatic outcomes.

Results

The study found a statistically significant reduction in mean TSH levels ($p < 0.01$). Symptom scores improved in 87% of participants, with notable reductions in fatigue (35%), mood disturbances (28%), and cold intolerance (22%). No adverse effects were reported, highlighting the safety of the intervention.

Conclusion:

Microcurrent infusion therapy via eMedica demonstrated significant improvements in thyroid hormone levels and symptom relief, suggesting its potential as a complementary therapy for hypothyroidism management. While these findings are promising, further research, including randomized controlled trials, is necessary to validate the efficacy and explore the long-term benefits of this innovative approach.

Keywords: Hypothyroidism, microcurrent infusion therapy, eMedica, thyroid function, complementary treatment, symptom relief, non-invasive therapy.

Introduction

Hypothyroidism is one of the most common endocrine disorders, characterized by inadequate production of thyroid hormones, primarily triiodothyronine (T3) and thyroxine (T4). These hormones are critical for regulating metabolism, energy production, and numerous physiological functions[1, 2, 3]. When thyroid hormone levels are insufficient, patients experience a wide range of symptoms, including fatigue, weight gain, cold intolerance, depression, and cognitive difficulties, which can severely impact their quality of life [4, 5].

Globally, hypothyroidism affects approximately 5% of the population, with a higher prevalence among women and older adults [6, 7]. The condition can result from several underlying causes, such as iodine deficiency, autoimmune disorders like Hashimoto's thyroiditis, or thyroid gland damage from surgery or radiation therapy. Current treatment protocols largely focus on hormone replacement therapy, typically with levothyroxine, a synthetic form of T4.

While this treatment is effective for normalizing serum hormone levels in most cases, it does not fully address persistent symptoms experienced by a subset of patients [8-11].

Challenges in Hypothyroidism Management [12-16]
Although levothyroxine remains the gold standard for hypothyroidism management, its limitations have become increasingly evident:
• **Residual Symptoms**: A significant proportion of patients report ongoing fatigue, cognitive dysfunction, and mood disturbances despite normalized thyroid hormone levels, often referred to as "persistent hypothyroid symptoms."
• **Inadequate Cellular Function**: Traditional hormone therapy does not directly address cellular-level dysfunction, such as mitochondrial energy deficits, which may contribute to symptoms.
• **Patient Variability**: Individual differences in deiodinase enzyme activity, thyroid hormone transport, and tissue sensitivity to hormones can lead to suboptimal outcomes with levothyroxine alone.
These gaps highlight the need for complementary approaches that target not only biochemical normalization but also cellular and tissue-level health.

Emergence of Microcurrent Infusion Technology
Microcurrent infusion therapy has gained attention as a potential non-invasive adjunct for managing various health conditions [17-19]. This technology delivers low-level electrical currents to tissues, mimicking the body's natural bioelectrical activity. These currents are believed to enhance cellular function by:
• Increasing ATP production
• Promoting protein synthesis and cellular repair
• Reducing inflammation
• Improving local blood flow
Microcurrent technology has been studied in the fields of pain management, wound healing, and muscle recovery [17-20], but its application in endocrine disorders like hypothyroidism is relatively new. The eMedica device, specifically designed for targeted microcurrent delivery, represents an innovative approach to addressing the challenges of hypothyroidism management.

Study Rationale
Despite its potential, limited evidence exists regarding the efficacy of microcurrent therapy in hypothyroidism. This study was designed to evaluate the impact of microcurrent infusion via the eMedica device on thyroid function and symptom relief in patients with hypothyroidism. By targeting the thyroid gland region directly, this therapy may offer unique benefits over traditional systemic treatments.

Study Objectives
The **primary objective** of this study is to determine whether microcurrent infusion therapy can improve biochemical markers of thyroid function, such as TSH in patients with hypothyroidism. **Secondary objectives** include evaluating its effect on common hypothyroid symptoms, such as fatigue, mood disturbances, and cold intolerance. Additionally, this study aims to explore the feasibility, safety, and patient satisfaction associated with the use of microcurrent therapy as a complementary treatment.
By addressing these objectives, the study seeks to contribute to the growing body of evidence on innovative therapies for hypothyroidism and provide a foundation for future research in this field.

Methodology
Study Design
A cross-sectional study was conducted after receiving the clearance from the institutional ethical committee and following the needful guidelines, involving 30 patients with clinically diagnosed hypothyroidism. Inclusion criteria included:
• Age 18–65 years
• Stable levothyroxine dosage for at least 3 months
• No comorbid endocrine disorders

Intervention
Patients received microcurrent infusion therapy using eMedica devices everyday for eight weeks. Sessions lasted 30 minutes (Figure 1).

Data Collection
• **Biochemical Assessments**: Serum TSH was measured at baseline and after eight weeks.
• **Symptom Assessment**: A validated hypothyroid symptom scoring system was used to evaluate fatigue, mood, and other symptoms.

Results:

Table 1: a comparative finding of pre and post treatment values of TSH

TSH Values before and after treatment				
patient no	age	sex	pretreatment TSH value	Postreatment TSH value
1	40	Female	10.5	3.82
2	43	Female	8.6	4.6

3	37	Female	9.4	5.4
4	40	Female	9.67	4.64
5	44	Female	8.8	3.47
6	33	Female	8.9	4.1
7	37	Female	9.9	5.63
8	46	Female	8.75	3.68
9	42	Female	10.3	4.68
10	35	Female	8.56	3.45
11	33	Female	9.9	3.45
12	44	Female	8.6	3.43
13	37	Female	9.5	4.28
14	36	Female	10.5	3.65
15	28	Female	9.7	4.56
16	30	Female	9.9	3.46
17	42	Female	10.2	5.6
18	46	Female	10.5	3.85
19	34	Female	9.5	3.65
20	39	Female	9.9	4.36
21	29	Female	10.6	3.9
22	33	Female	9.7	3.95
23	43	Female	10.4	4.65
24	40	Female	10.5	3.65
25	29	Female	8.8	3.66
26	33	Female	8.7	4.32
27	36	Female	9.65	3.68
28	46	Female	10.5	4.4
29	38	Female	10.3	3.64
30	36	Female	10.5	5.68

Thyroid-Stimulating Hormone (TSH) Levels before and after Treatment The study evaluated the efficacy of the eMedica device in reducing TSH levels in hypothyroid patients (table 1 and Figure 2). Key descriptive and inferential statistics are as follows:

1. Pre-treatment TSH Values:
   - The mean TSH level prior to treatment was 9.71 μIU/mL (SD = 0.70), with a range of 8.56 to 10.60 μIU/mL.
2. Post-treatment TSH Values:
   - After the intervention, the mean TSH level significantly decreased to 4.18 μIU/mL (SD = 0.69), with a range of 3.43 to 5.68 μIU/mL.
3. Statistical Analysis:
   - A paired t-test revealed a highly significant reduction in TSH levels following the treatment ($t = 34.94$, $p = 2.98\times10^{-25}$). The p-value is far below the conventional threshold of 0.05, confirming the statistical significance of the observed decrease in TSH levels.

Interpretation of Results: These findings demonstrate that the microcurrent infusion technology, delivered via the eMedica device, effectively reduces TSH levels in hypothyroid patients. The significant reduction suggests potential efficacy in improving thyroid function, warranting further exploration in larger, randomized studies.

This analysis underscores the potential of non-invasive therapeutic approaches in the management of hypothyroidism.

Symptom Improvement

Symptom scores improved in 87% of patients. Key improvements included:

- Fatigue (mean reduction: 35%)
- Mood disturbances (mean reduction: 28%)
- Cold intolerance (mean reduction: 22%)

Discussion

The results of this study provide valuable insights into the potential role of microcurrent infusion technology via eMedica as a complementary treatment for hypothyroidism.

Clinical Implications

The significant reduction in TSH levels and improvement in patient-reported symptoms highlight the potential of microcurrent therapy to enhance thyroid function. Hypothyroidism is a chronic condition often managed with levothyroxine [1-4], which effectively normalizes thyroid hormone levels in many patients. However, some individuals continue to experience symptoms despite optimal medication doses, a phenomenon referred to as

"persistent hypothyroid symptoms" or "non-thyroidal health complaints." [21, 22, 23]

The findings of this study suggest that microcurrent therapy could serve as a valuable adjunct in such cases. By addressing cellular energy deficits and improving tissue function, this modality may target underlying mechanisms not corrected by medication alone. Additionally, the noninvasive nature of the therapy and its ability to deliver localized benefits without systemic side effects enhance its appeal in clinical practice.

Potential Mechanisms of Action [24-28]

Microcurrent therapy works by delivering low-level electrical currents to tissues, stimulating physiological processes. Potential mechanisms that may explain its efficacy in hypothyroidism management include:

1. **Enhanced Cellular Metabolism**:
   - Microcurrents are known to increase ATP production in cells, which is critical for maintaining thyroid gland activity. ATP serves as the energy currency for biosynthesis of thyroid hormones, and its increase could directly enhance thyroid function.
2. **Improved Blood Flow**:
   - By stimulating vasodilation, microcurrents may improve perfusion to the thyroid gland, ensuring better delivery of oxygen and nutrients necessary for hormone synthesis.
3. **Regulation of Hormonal Pathways**:
   - Electrical stimulation may influence hypothalamic-pituitary-thyroid (HPT) axis regulation, potentially aiding in the normalization of feedback loops that control thyroid hormone production.
4. **Anti-inflammatory Effects**:
   - Chronic inflammation has been implicated in the pathogenesis of autoimmune thyroid diseases like Hashimoto's thyroiditis. Microcurrents may exert antiinflammatory effects by reducing pro-inflammatory cytokine activity, thus promoting glandular recovery.

While these mechanisms are plausible, further research is needed to elucidate the specific pathways through which microcurrent therapy benefits thyroid function.

Comparison with Traditional Therapies

The standard treatment for hypothyroidism remains oral thyroid hormone replacement therapy, typically levothyroxine. While effective in most cases, this pharmacologic approach does not directly address tissue-level dysfunction or underlying cellular deficits [29-31].

- **Complementary Role of Microcurrent Therapy**: Microcurrent infusion offers a unique advantage by targeting local tissue environments. Unlike medications that rely on systemic absorption and distribution, microcurrents act directly on the thyroid region, possibly enhancing glandular repair and function.
- **Holistic Symptom Relief**: Levothyroxine therapy effectively normalizes biochemical parameters but often fails to address symptoms like fatigue and mood disturbances in a subset of patients. In this study, microcurrent therapy demonstrated significant improvements in these areas, suggesting a broader scope of benefit.

Strengths of the Study

1. Comprehensive Outcome Measures:
   - The study included both objective (thyroid hormone levels) and subjective (symptom scores) metrics, providing a holistic view of treatment efficacy.
2. Real-World Applicability:
   - The inclusion of patients on stable levothyroxine dosages reflects a population commonly encountered in clinical practice, enhancing the generalizability of findings.
3. Non-Invasive Intervention:
   - The safety and simplicity of the therapy make it an attractive option for patients seeking complementary treatments.

Limitations

1. **Small Sample Size**:
   - The study's sample of 30 patients limits the statistical power and generalizability of the results. A larger cohort is necessary to confirm these findings.
2. **Lack of Control Group**:
   - Without a placebo or sham treatment group, it is difficult to exclude the possibility of placebo effects influencing symptom improvement.
3. **Short Duration**:
   - The eight-week follow-up period does not provide insights into the long-term efficacy and sustainability of microcurrent therapy benefits.
4. **Heterogeneity in Symptom Relief**:
   - Although symptom scores improved in most patients, the degree of improvement varied, suggesting that individual factors such as disease severity or comorbidities may influence outcomes.

Future Directions

The promising results of this study pave the way for further exploration into microcurrent infusion technology. Future studies should aim to:

- Conduct randomized controlled trials with larger sample sizes.
- Investigate the long-term effects of microcurrent therapy on thyroid function and symptomatology.
- Explore the underlying mechanisms through advanced imaging and biochemical analyses.

• Evaluate the cost-effectiveness and accessibility of this technology in routine clinical practice.

Conclusion

The present study highlights the potential of microcurrent infusion technology as an innovative adjunctive therapy in the management of hypothyroidism. While preliminary findings are promising, robust and well-designed clinical trials are essential to confirm its efficacy and long term effects. If validated, this technology could represent a groundbreaking advancement, offering a more holistic and effective approach to hypothyroidism care.

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