J. Phys. Ther. Sci.
27: 2021–2022, 2015

Case Study

Complex decongestive physical therapy and low-level laser therapy for the treatment of pediatric congenital lymphedema: a case report

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Abstract. [Purpose] We report the case of a pediatric patient with congenital lymphedema treated with complex decongestive physical therapy and low-level laser therapy. [Subjects and Methods] The patient was a 2 year-old girl who had lymphedema in the left upper limb since birth. Complex decongestive physical therapy and low-level laser therapy were administered for 7 sessions. [Results] The circumferences of the middle of the forearm, elbow joint, wrist, and hand of the left upper limb decreased 0.5, 3, 0.5, and 2 cm, respectively. The moisture content of the left upper limb decreased 70 mL (6.66%), while moisture ratio increased by 0.007%. [Conclusion] Complex decongestive physical therapy and low-level laser therapy are effective for reducing lymphedema in pediatric patients.
Key words: Lymphedema, Complex decongestive physical therapy, Low-level laser therapy

(This article was submitted Feb. 13, 2015, and was accepted Mar. 14, 2015)

INTRODUCTION

Lymphedema (LE) is a condition of localized fluid retention and tissue swelling caused by a lymphatic system abnormality. It is characterized by progressive non-pitting swelling. LE can be categorized as congenital LE or secondary LE. Congenital LE is caused by abnormal lymphatic system formation due to a genetic mutation. Meanwhile, secondary LE is caused by damage to the lymphatic system due to infection, damage, cancer, lymph node incision, or radiotherapy[1)]. Congenital LE is a rare disease: its incidence is up to 1.15 per 100,000 people younger than 20 years[2)]. It usually causes edema of the lower limbs[3)]. Like adult patients, complex decongestive physical therapy (CDPT) is applied as an effective non-surgical treatment of congenital LE for pediatric patients[4, 5)].

Meanwhile, low-level laser therapy (LLLT) has various treatments effects in rehabilitation[6, 7)]. LLLT is effective for treating chronic LE patients by increasing the amounts of tissue protein and fluid[8)]. Its effects have been studied in adults[9, 10)] but rarely in children. However, because congenital LE is a rare disease that mostly affects children, there is a constraint to applying CDPT in the same manner as that to adults. Accordingly, there are no reports detailing treatment progression or studies on the application of LLLT in CDPT. Therefore, we report the case of a pediatric patient with congenital LE treated with CDPT and LLLT.

CASE REPORT

The patient was a 2 year-old girl with a height of 94 cm and weight of 14 kg. She was born as the second twin on April 28, 2012. From birth, she had congenital LE on the left arm, prompting her admission to the pediatric intensive care unit where she admitted for 1 month. During general surgery treatment on May 23, 2013, lymphostasis in the left side of the body was observed. Furthermore, hypotonus in the left leg abductor and a short left leg (0.5 cm) were observed during an orthopedic treatment on August 30, 2013. During treatment at the neurological department, she was diagnosed with a sequela of neuropathy suggestive of systemic candidiasis with brain damage and meningoencephalitis. After being admitted to the department of rehabilitation at H hospital on September 12, 2014, the patient was diagnosed with LE by a specialist, and her edema was evaluated in the physical therapy room. The circumferences of the right and left upper limb were as follows: underneath the armpit, 16 and 18 cm; middle of the upper arm 15 and 21.5 cm; elbow, 15.5 and 24 cm; middle of the forearm, 15 and 21 cm; wrist, 11.5 and 15.5 cm; and hand, 13 and 19 cm, respectively. Bioimpedance analysis (Inbody S10, Biospace, Korea) showed the amount of water and moisture ratio (i.e., extracellular fluid/total water amount) in the right upper limb were 420 mL and 0.389%, respectively and those in the left upper limb were 1,050 mL and 0.412%, respectively. There was no pain, and the joints had full range of motion.

From the date of evaluation to hospital admission, the patient underwent 7 sessions of CDPT: 5 in hospital

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(September 12, 13, 15, 16, and 17) and 2 as an outpatient (September 19 and 22). However, because of her age, the treatments could not be administered in the same way. Therefore, LE remedial exercise and a modified low-tension bandage method were applied. LLLT (Super Lizer HA-2200, Tokyo Iken, Japan) was also administered. The Super Lizer is the first linearly polarized light therapeutic equipment with a wavelength range of 600–1,600 nm. For the low-tension bandage method, as there are no bandages specifically designed for infants, a 4 cm gauze bandage (Micro-lan, MiroVerbandstoffe GmbH, Germany) was wrapped around the back of the hand to the armpit and a 6-cm low-tension bandage was wrapped around the wrist to the armpit from September 15–16. LLLT was applied perpendicular to the left armpit for 10 min.

RESULTS

After the treatment on September 22, the patient was re-evaluated. The circumferences of the left upper limb underneath the armpit and at the middle of the upper arm, elbow, middle of the forearm, wrist, and hand decreased to 18, 21, 21, 21, 15, and 17 cm, respectively. Bioimpedance analysis showed body moisture decreased to 980 mL and the moisture ratio improved to 0.405%.

DISCUSSION

We treated a pediatric patient with congenital LE with CDPT and LLLT. After treatment, the circumferences of the left upper limb in the middle of the upper arm, elbow, middle of the forearm, wrist, and hand decreased by 0.5, 3, 0.5, and 2 cm, respectively. Furthermore, the moisture content in the left upper limb decreased 70 mL (6.66%), and the moisture ratio increased by 0.007%. These results indicate CDPT and LLLT are effective for reducing LE in pediatric patients.

As congenital LE usually occurs in children, whose compliance to cooperation is limited, exercises to reduce the edema and the application of low-tension bandages are limited. However, CDPT is the standard treatment for edema[11, 12], and the same treatment for complex edema is recommended for both adults and children[4, 13]. Akbatrak et al.[5] report the effects of CDPT on congenital LE in the lower limbs of a 6.5-month-old pediatric patient. Treatment substantially reduced edema after 2.5 and 6 months of treatment, indicating CDPT is effective for treating congenital LE in pediatric patients. Likewise, the results of the present case also show CDPT tailored for LE in children is effective for reducing LE.

Previous studies have demonstrated that while LLLT can be applied for breast cancer patients, it is effective for reducing edema. Piller and Thelander[8] report LLLT reduced the circumferences of the upper arm, elbow joint, forearm, and wrist by 1.75, 1.1, 1.8, and 3.6 cm, respectively; bioimpedance analysis showed extracellular values increased by 16%. Carati et al.[9] report laser therapy decreased the volume of the upper limbs 89.7 mL and increased extracellular values by 52% according to bioimpedance analysis. Lau and Cheing[10] reported that laser treatment for patients with LE decreased the volume of the upper limbs 128 mL (28%, from 448 to 320 mL). Despite differences in the characteristics of patients among these reports, the present case in concordant with previous studies demonstrating LLLT is effective for reducing edema.

As this is only a case report, there was no control group for comparison. Furthermore, it was not possible to apply a LE remedial exercise in the present patient unlike cases of adult patients. Moreover, as there are no low-tension bandages for children, a modified form of bandaging was applied. Moreover, the effects of combining CDPT and LLLT for the treatment of edema are unclear. Several ongoing studies are evaluating the treatment of LE, but few studies have been performed on pediatric patients with congenital LE. The present case indicates CDPT and LLLT, which are normally administered to adult patients, are also effective for reducing the LE in pediatric patients with congenital LE. Thus, larger follow-up studies are warranted.

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