

Research Article

Open Access

Application of Glycerin Poultice to the Semitendinous and Semimembranous above the Popliteal Fossa Improves Motor Disturbance in Parkinson Disease

Yuzuru Yasuda*

Department of Neurology, Yasuda Clinic, 62-7, Takenokaido-cho, Takehana, Yamashina-ku, Kyoto 607-8080, Japan

Abstract

It has been reported that application of glycerin poultice to the flexor digitorum profundus in the middle phalanx of the little finger improves motor disturbance of Parkinson disease. I investigated whether the application of glycerin poultice to the semitendinous and semimembranous above the popliteal fossa (GSSP) improved motor disturbance in Parkinson disease. Step length and diameter of the pupil in 20 patients with Parkinson disease and 20 control subjects was evaluated before and after application of GSSP. Motor disturbance in patients with Parkinson disease was evaluated before and after application of GSSP. The application of GSSP increased step length and constricted the pupil in all subjects, which means that application of GSSP caused the decreased tension of the semitendinous and semimembranous and lowered sympathetic nerve activity. With application of GSSP, motor disturbance in patients with Parkinson disease was improved, which is caused by reversing the mechanism of the muscle mechanosensitive reflex.

Keywords: Parkinson disease; Glycerin poultice; Semitendinous and semimembranous above the popliteal fossa, Sympathetic nerve activity; Muscle mechanosensitive reflex

Introduction

It has been reported that patients with Parkinson disease (PD) show improvement of motor disturbance with application of glycerin poultice to the flexor digitorum profundus in the middle phalanx of the little finger (GFML) on both sides [1]. GFML is as follows; glycerin poultice was made by means of gauze (3×7 mm) immersed by 50% glycerin and the poultice was attached precisely to the flexor digitorum profundus in the middle phalanx of the little finger on both sides. In all subjects, application of GFML increased dorsiflexion of the little finger suggesting that the tension of the flexor digitorum profundus was decrease, and application of GFML constricted the pupil suggesting that sympathetic nerve activity was lowered. The rationale of application of GFML is to reverse the mechanism of the muscle mechanosensitive reflex. Because, muscle mechanosensitive reflex is evoked by an increase of muscle tension, which in turn causes sympathetic nerve activity, namely, an increase of mean blood pressure, heart rate, and breathing [2]. Static contraction of the muscle and tendon stretch has the same effect concerning the muscle mechanosensitive reflex [3]. The precise mechanism of the mechanoreceptors response contributing to sympathetic nerve activation remains unknown. Recently it has been reported that muscle mechanosensitive receptors evoking the reflex cardiovascular responses locate close to the myotendinous junction [4].

Thereafter, I thought that application of glycerin poultice to the tendon of the lower extremity may improve motor disturbance in PD as well as application of GFML, and researched which muscle have the principal mechanosensitive receptor. And I found that the tendon of the semitendinous and semimembranous above the popliteal fossa in the most patients with PD is very stiff and investigated whether application of glycerin poultice to the semitendinous and semimembranous above the popliteal fossa (GSSP) will improve motor disturbance in PD.

Patients and Methods**Step length**

20 patients with clinically diagnosed PD (8 males and 12 females,

69.1 ± 8.0 years of age (mean ± SD)), and 20 controls (7 males and 13 females, 66.1 ± 10.1 years of age) participated in this study. Patients with PD did not show an on-off phenomenon or orthostatic hypotension; the duration of PD was 5.2 ± 2.9 years. The Hoehn and Yahr score and the Unified Parkinson's Disease Rating Scale motor examination (full score, 108) [5] was 2.4 ± 0.5, 32.5 ± 6.5, respectively. Anti-parkinsonian drugs were not interrupted during the course of the study. All control subjects had no previous history of neurological disease and were neurologically and physically normal. All subjects were right handed and right footed according to Waterloo Footedness Questionnaire-Revised, and Waterloo Handedness Questionnaire-Revised [6,7] and did not have severe cervical and lumbar spondylosis. All participants gave their consent to participate in this study. The Research Council of Yasuda Clinic approved the study protocol.

Glycerin poultice was formulated and applied as follows: gauze (4×5 cm) was immersed in 50% glycerin and the poultice was attached precisely to the semitendinous and semimembranous with the lower margin of the poultice being one cm above the medial epicondyle of femur. (Figure 1 A and 1B).

The step length (the distance from left ankle to right one) was photographed by digital movie camera, (SANYO DMX-HD1; shutter speed, 1/60 second). The distance between the camera and the subjects was 3m and the axis of the lens was situated 80 cm from the floor, therefore the step length was adequately evaluated. Two markers at a distance of 95 cm which were not clearly visible by the subjects, were situated on the floor. To avoid paradoxical movement, any visible lines were not present on the floor. To overcome placebo effects, the subject was not given previous notice about any effects with application of

*Corresponding author: Yuzuru Yasuda, Department of Neurology, Yasuda Clinic, 62-7, Takenokaido-cho, Takehana, Yamashina-ku, Kyoto 607-8080, Japan, Tel: +81 75 583 2288; Fax: +81 75 583 2228; E-mail: yuzuru-yasuda@mra.biglobe.ne.jp

Received August 18, 2012; Accepted September 18, 2012; Published September 21, 2012

Citation: Yasuda Y (2012) Application of Glycerin Poultice to the Semitendinous and Semimembranous above the Popliteal Fossa Improves Motor Disturbance in Parkinson Disease. J Nov Physiother S1:005. doi:10.4172/2165-7025.S1-005

Copyright: © 2012 Yasuda Y. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

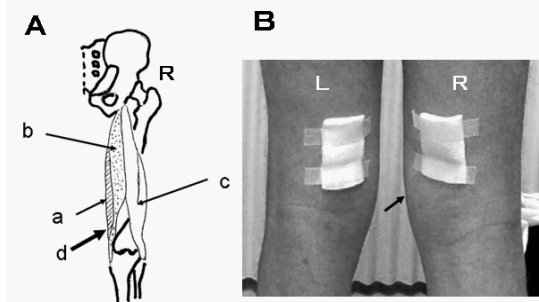


Figure 1: Schematic presentation of the thigh (A) and glycerin poultice to the semitendinous and semimembranosus above the popliteal fossa (GSSP) (B) (A) Schematic presentation of the right thigh. a; semitendinous, b; semimembranosus, c; biceps femoris, d; place to which glycerin poultice was applied. (B) Glycerin poultice was attached precisely to the semitendinous and semimembranosus with the lower margin of the poultice being one cm above the medial epicondyle of femur (arrow). R; right, L; left.

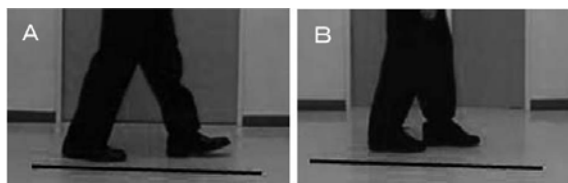


Figure 2: Step length of normal controls and patients with Parkinson Disease (PD). A: Normal control. B: PD. The length of the bar which was not visible by the subjects: 95 cm.

GSSP and was requested to walk naturally. Right step length (the distance by which the right foot moved forward in front of the left one) and left step length (vice versa) were photographed four times, respectively, to gain the mean step length. The same maneuver was carried out ten minutes after GSSP was applied on both sides. The step length was measured on the screen of a personal computer and the true value was calculated by the ratio to the distance of two markers (Figure 2).

Diameter of the pupil

To avoid accommodation reflex, the subject was requested with an easy manner to look at a mark which is 4 m away. The subject's left pupil was photographed at a close distance with SANYO DMX-HD1 digital camera and the indicator, with a length of 20 mm, was situated on the lower eye lid. Ten minutes after GSSP was applied on both sides, the left pupil was also photographed. The diameter of the left pupil was measured on the screen of a personal computer and the true value was calculated by the ratio to the indicator.

Motor disturbance in PD

The motor disturbance was measured according to UPDRS motor examination [5] in the patients with PD before GSSP was applied to both sides. Ten minutes after GSSP was applied bilaterally, the score was also measured.

Statistical analysis

Statistical analysis was performed with the ANOVA in the groups and conditions (Student *t*-test as a post hoc test) and with paired Student *t*-test in two conditions. Significance was assumed at a $p < 0.05$.

Results

Increase of the step length

In patients with PD, step length was 32.7 ± 10.8 cm and 36.7 ± 9.5 cm before and after application of GSSP ($p < 0.001$), respectively. In controls, step length was 41.7 ± 6.4 cm and 45.5 ± 6.0 cm before and after application of GSSP ($p < 0.001$), respectively.

Step length of patients with PD was less than that of controls before and after application of GSSP ($p < 0.01$, $p < 0.01$, respectively) (Table 1).

Constriction of the pupil

The diameters of the left pupil was 3.28 ± 0.65 mm and 2.91 ± 0.67 mm before and after application of GSSP, respectively ($p < 0.001$) and that of the control was 3.27 ± 0.59 mm and 2.87 ± 0.51 mm, respectively ($p < 0.001$). The pupil was constricted in all subjects with application of GSSP.

Improvement of motor disturbance in PD

UPDRS motor examination [5] showed improvement of all categories (Table 2) with application of GSSP. Total score of UPDRS before application of GSSP was 32.65 ± 5.96 , and that after application of GSSP was 15.05 ± 4.59 ($p < 0.001$). Scores regarding tremor at rest (/20), rigidity (/20), leg agility (/8) before application of GSSP were 1.65 ± 2.10 , 7.40 ± 0.88 , and 2.85 ± 0.74 , respectively, and those after application with GSSP were 0.60 ± 0.88 , 3.75 ± 1.01 , and 1.35 ± 0.81 , respectively ($p = 0.001$, $p < 0.001$, $p < 0.001$, respectively).

Discussion

With application of GSSP, step length increased in all subjects,

	PD (n=20)	Controls (n=20)
Before (cm, Mean \pm SD)	32.7 ± 10.2 a)c)	41.7 ± 6.4 b)c)
After (cm, Mean \pm SD)	36.7 ± 9.5 a)d)	45.5 ± 6.0 b)d)

PD=Parkinson disease, Before=step length before application of GSSP, After=Step length after application of GSSP, GSSP=Glycerin poultice to the semitendinous and semimembranosus above the popliteal fossa, a,b < 0.001 , c,d < 0.01

Table 1: Step length in patients with PD and controls.

	Before	After	<i>p</i> -value
18 language(/4)	1.20 ± 0.61	0.85 ± 0.48	< 0.001
19Facial expression(/4)	1.50 ± 0.51	1.10 ± 0.30	0.001
20Tremor at rest(/20)	1.65 ± 2.10	0.60 ± 0.88	0.001
21Action or postural tremor of hands(/8)	1.40 ± 1.04	0.50 ± 0.68	< 0.001
22Rigidity(/20)	7.40 ± 0.88	3.75 ± 1.01	< 0.001
23Finger taps(/8)	2.90 ± 0.64	1.25 ± 0.63	< 0.001
24Hand movements(/8)	2.85 ± 0.48	1.25 ± 0.55	< 0.001
25Rapid alternating movements of hands(/8)	3.05 ± 0.39	1.40 ± 0.59	< 0.001
26Leg agility(/8)	2.85 ± 0.74	1.35 ± 0.81	< 0.001
27Arising from chair(/4)	1.55 ± 0.51	0.50 ± 0.51	< 0.001
28Posture(/4)	1.50 ± 0.51	0.65 ± 0.48	< 0.001
29Gait(/4)	1.60 ± 0.50	0.60 ± 0.50	< 0.001
30Postural stability(/4)	1.55 ± 0.51	0.60 ± 0.50	< 0.001
31Body bradykinesia and hypokinesia(/4)	1.65 ± 0.48	0.65 ± 0.48	< 0.001
32 Total(/108)	32.65 ± 5.96	15.05 ± 4.99	< 0.001

Mean \pm standard deviation; PD=Parkinson disease; GSSP=glycerin poultice to the semitendinous and semimembranosus above the popliteal fossa; UPDRS part III=Unified Parkinson's Disease Rating Scale motor examination

Table 2: Improvement of motor disturbance in PD (n=20) with application of GSSP to both sides (UPDRS part III).

which indicates that the tension of both thigh flexors decreased. Although precise mechanism of action of glycerin is not clear, it has been reported that topical glycerin application improves skin moisture [8] and plasticity [9]. With application of GSSP, glycerin immersed the tendon of semitendinous and semimembranous and softened them through the skin, which is the cause of decreased tension of the thigh flexors. Moreover, with application of GSSP, the pupil was constricted in all subjects. Application of GSSP produced two significant findings; decreased tension of semitendinous and semimembranous, and constriction of the pupil.

The mechanism of the effect with application of GSSP is concerned with muscle mechanosensitive reflex. The muscle mechanosensitive reflex is evoked by an increase of muscle tension, which in turn causes sympathetic nerve activity [2-4] and application of GSSP decreased the tension of the semitendinous and semimembranous, which in turn reduced sympathetic nerve activity because pupil was constricted with application of GSSP in all subjects of this study [10]. The rationale of application of GSSP is to reverse the mechanism of the muscle mechanosensitive reflex, which corresponds to decreased activity of muscle mechanosensitive receptor close to the myotendinous junction [4] of the semitendinous and semimembranous.

UPDRS motor examination [5] showed improvement of all categories with application of GSSP. Especially, scores regarding tremor, rigidity and movements of hands were excellent as well as with application of GFML. All scores regarding movement of legs with application of GSSP were more improved than those of GFML. Especially, leg ability was excellent with application of GSSP. The improvement of tremor in patients with PD is due to beta-blocking effect with application of GSSP because beta-blocker is effective in the treatment of tremor by supposedly affecting the muscle spindle by blocking the adrenoreceptor [11]. And the improvement of rigidity of patients with PD is concerned with complex sympathetic modulation of the muscle spindle afferent sensitivity [12,13] which is also derived from lowered sympathetic nerve activity with application of GSSP as well as GFML.

As application of GSSP causes sympathetic modulation of the muscle spindle afferent sensitivity as well as GFML, it is beneficial especially to the patients with leg muscle tonus being high, for example, spastic hemiparesis, spastic paraparesis and so on. In fact, many patients with spastic hemiparesis showed marked improvement of gait disturbance with application of GSSP to the side of hemiparesis. Moreover, the patient with transverse myelitis who shows spastic paraparesis showed marked improvement of gait disturbance with application of GSSP to both sides (data not shown). In this study, patients with PD showed improvement of leg movement, especially leg ability, and normal controls also showed increase of step length, which suggests that application of GSSP is effective for prevention of falls of the aged.

As application of GSSP lowers sympathetic nerve activity by reversing the mechanism of muscle mechanosensitive reflex as well as that of GFML, the principal mechanosensitive receptors would exist in or near the tendon of the semitendinous and semimembranous above the popliteal fossa, and of the flexor digitorum profundus in the middle phalanx of the little finger in human. Moreover, another

principal mechanosensitive receptor may exist in human. The future direction for research is to investigate whether application of glycerin poultice to the principal mechanosensitive receptors will become a useful tool for the relief of the disorder whose mechanism is connected with increased sympathetic nerve activity.

References

1. Yasuda Y (2009) A novel method improving motor disturbance in Parkinson disease: application of glycerin poultice to the flexor digitorum profundus in the middle phalanx of the little finger. *NeuroRehabilitation* 24: 219-223.
2. Mitchell JH, Kaufman MP, Iwamoto GA (1983) The exercise pressor reflex: its cardiovascular effects, afferent mechanisms, and central pathways. *Annu Rev Physiol* 45: 229-242.
3. Hayes SG, Kindig AE, Kaufman MP (2005) Comparison between the effect of static contraction and tendon stretch on the discharge of group III and IV muscle afferents. *J Appl Physiol* 99: 1891-1896.
4. Nakamoto T, Matsukawa K (2007) Muscle mechanosensitive receptors close to the myotendinous junction of the Achilles tendon elicit a pressor reflex. *J Appl Physiol* 102: 2112-2120.
5. Fahn S, Elton R (1987) Members of the UPDRS Development Committee. Unified Parkinson's disease rating scale: Recent developments in Parkinson's disease. *Macmillan Health Care Information*, Florham Park, NJ, 153-163.
6. Elias LJ, Bryden MP, Bulman-Fleming MB (1998) Footedness is a better predictor than is handedness of emotional lateralization. *Neuropsychologia* 36: 37-43.
7. Kang Y, Harris LJ (2000) Handedness and footedness in Korean college students. *Brain Cogn* 43: 268-274.
8. Bisset DL, McBride JF (1984) Skin conditioning with glycerol. *J Soc Cosmet Chem* 35: 345-350.
9. Overgaard Olsen L, Jemec GB (1993) The influence of water, glycerin, paraffin oil and ethanol on skin mechanics. *Acta Derm Venereol* 73: 404-406.
10. Yu Y, Koss MC (2002) alpha (1A)-adrenoceptors mediate sympathetically evoked pupillary dilation in rats. *J Pharmacol Exp Ther* 300: 521-525.
11. Rincon F, Louis ED (2005) Benefits and risks of pharmacological and surgical treatments for essential tremor: disease mechanisms and current management. *Expert Opin Drug Saf* 4: 899-913.
12. Hammar I, Jankowska E (2003) Modulatory effects of alpha1-, alpha2-, and beta -receptor agonists on feline spinal interneurons with monosynaptic input from group I muscle afferents. *J Neurosci* 23: 332-338.
13. Roatta S, Windhorst U, Ljubisavljevic M, Johansson H, Passatore M (2002) Sympathetic modulation of muscle spindle afferent sensitivity to stretch in rabbit jaw closing muscles. *J Physiol* 540: 237-248.

Submit your next manuscript and get advantages of OMICS Group submissions

Unique features:

- User friendly/feasible website-translation of your paper to 50 world's leading languages
- Audio Version of published paper
- Digital articles to share and explore

Special features:

- 200 Open Access Journals
- 15,000 editorial team
- 21 days rapid review process
- Quality and quick editorial, review and publication processing
- Indexing at PubMed (partial), Scopus, DOAJ, EBSCO, Index Copernicus and Google Scholar etc
- Sharing Option: Social Networking Enabled
- Authors, Reviewers and Editors rewarded with online Scientific Credits
- Better discount for your subsequent articles

Submit your manuscript at: <http://www.omicsonline.org/submission/>

This article was originally published in a special issue, **Advances in Neurorehabilitation Techniques** handled by Editor(s). Dr. Shu Morioka, Kio University, Japan