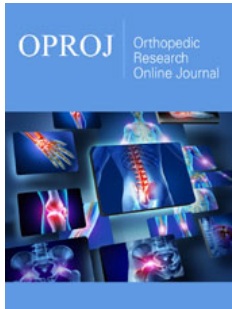


Effect of the Alpinia Zerumbet oil on the Hypertonia of Children with Cerebral Palsy

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Abstract

The Alpinia Zerumbet oil acts on contractility of muscles decreasing tonus. Hypertonia is common in individuals with Cerebral Palsy (CP). This study aims to investigate if the dermal local application of Alpinia Zerumbet oil can decrease the neural hypertonia in individuals with CP. Methods: 19 individuals with CP, mean age of 18.1 years-old (DP=11.24), 14 levels IV/V and 5 I/II/III of GMFCS, with hypertonia in biceps brachii and adductors of hip. Each subject was assessed through Ashworth and Tardieu modified scales and received the dermal application of Alpinia Zerumbet oil or placebo. After 30 minutes the patient was assessed again. The application was randomized and the evaluators were blind. Same protocol was repeated after one week. Differences between angles before and after applications were calculated for angle of catch seen at fast velocity (R1) and full range of motion at slow velocity (R2), measured by a goniometer. Anova was performed. Results: Differences between angles in R1 were bigger than R2 ($p=0.049$) and Ziclague was bigger than placebo ($p=0,012$). From 32 assessments, 11 showed gains over 5° in R2 and 13 in R1. Conclusion: One dermal application of the Alpinia Zerumbet oil was able to reduce hypertonia after 30 minutes. We suggest a study with the assessments longer than 30 minutes after the application to confirm these results.

Keywords: Cerebral palsy; Hypertonia; Spasticity; Alpinia zerumbet oil; Ziclague

Abbreviations: CP: Cerebral Palsy; SCPE: Surveillance of Cerebral Palsy in Europe

Introduction

Cerebral Palsy (CP) comprises a group of disorders in the development of posture and movement, causing limitation of activities due to non-progressive disorders that occurred in the brain in the fetal period or childhood. Motor disorders are often accompanied by sensory, cognitive, perceptual, communicative and behavioral disorders, as well as epilepsy and secondary musculoskeletal problems [1].

The incidence of CP ranges from 2 to 2.5 per 1000 live births in the United States [2]. It is the most common movement disorder, with a prevalence of 3.6 cases per 1,000 live births [3]. Although the prevalence of CP is not found in Brazil, it is estimated that developing countries have 7 cases per 1,000 live births [4].

The classification of CP, according to the recommendations of the Surveillance of Cerebral Palsy in Europe (SCPE) and the Collaboration Group for the Definition and Classification of Cerebral Palsy with Research Records in Europe, comprises three main groups based on neurological signs: spastic (unilateral and bilateral), dyskinetic (dystonic and choreoathetoid), and ataxic. Mixed conditions are also recognized [5]. According to the nature and type of the motor disorder, the type of muscle tone abnormality or involuntary movement observed

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or elicited is usually associated with the pathophysiology of CP. Tone is assessed during a passive movement in the direction of the muscle stretching. It can be normal, increased or decreased. Hypertonia is the abnormally increased resistance seen during a passive movement imposed externally on the joint, which can be caused by spasticity, dystonia, rigidity, or a combination of these characteristics. Hypotonia, in turn, is the decrease in resistance during passive movement [6]. The spastic type is the most common and is characterized by abnormal patterns of posture and movement, increased tone - not necessarily constant -, pathological reflexes, hyperreflexia or pyramidal signs, such as Babinski's sign, and increased resistance to movement dependent on speed [5,7].

CP can compromise several systems, and its treatment should be based on the primary deficiencies related to each case. The neuromuscular system may present alteration in tone, often hypertonia, which, in addition to limiting coordinated muscle action for a functional task, also causes inadequate alignment in the osteoarticular structures, compromising postural control and movement control. The continuity of joint positioning in restricted amplitudes results in shortened muscles and joints with limited amplitude. To provide and prolong adequate osteo-articular and muscular positioning, we need to guide the use of resources that facilitate this objective, such as orthoses, stabilizers for standing posture, adapted chairs, splints that keep the knee and elbow joints in extension, elastic bands that favours the positioning of a segment, etc. [8].

In spasticity, hyperactivity of L-type calcium channels associated to an inadequate regulation of these channels in spastic muscles leads to chronic enlargement of these in the sarcoplasmic reticulum [9]. From the physiological point of view, the excess calcium causes extensive injuries and changes in the contractile properties of muscles, in addition to increasing passive tension and reinforcing cross-links [10,11]. Since collagen is directly dependent on cross-links for muscle flexibility, it will reflect in a rigid muscle [12].

It is possible that morphological changes in collagen, both in the perimysium and endomysium, alter muscle mechanics, which may contribute directly or indirectly to the development of contractures, thus playing an important role in mobility problems in spastic patients [13]. Collagen has an important influence on passive muscle elasticity and force transmission between muscle and tendon [14]. It is understood that the quantity and quality of muscle collagen can influence the contractile and elastic capacity of the muscle [15]. Muscles with reduced trophism, as well as spastic muscles, show a significant reduction in the amount of type III collagen in experimental studies [16].

Fríden and Lieber [17] performed muscle biopsy in healthy individuals with spastic CP to quantify type I collagen through immunohistochemical study, finding: higher concentration of collagen present in spastic muscles. These findings corroborate the research by [18] in which the presence of type I collagen was classified as intense in the CTR group. The low concentration of this type of collagen in the FTaz and Az groups may indicate the

effectiveness of the proposed treatment. The TF group, on the other hand, presented values classified as frequent of type I collagen.

Therapeutic resources with the purpose of reducing muscle tone in cases of children with CP who have spasticity may contribute beneficially to habilitation and rehabilitation treatment, such as the essential oil of *Alpinia Zerumbet* (ZiclagueR). Known as a colony, due to its characteristic odor, *Alpinia Zerumbet* is a herbaceous plant of the Zingiberaceae family, commonly found in northeastern Brazil, popularly used as a diuretic, sedative and hypotensive [19,20]. The substance *Alpinia Zerumbet* has effects that act on the contractility properties of skeletal muscle fibers. Studies have observed its effects on L-type calcium channels, with consequent modulation of calcium concentration, as well as antispasmodic and basal tone relaxation activity [21,22]. The inherent properties of *Alpinia Zerumbet* essential oil of modulating the influx of calcium to the sarcoplasm promotes greater relaxation of the spastic muscles. The reduction of spasticity can contribute to the increase of muscle flexibility, minimizing the risk of neuromyogenic contractures, reduce the muscles imbalance between agonists and antagonists, as well as decrease the untimely co-contraction of agonists and antagonists for activities that require movement, with consequent functional gain [23,24]. This characteristic induces muscle relaxation with normalization of tone, which can be beneficial for the treatment of spasticity in clinical conditions such as CP [21,22,24].

A study by Cerqueira et al. [18] evaluate the effect of kinesiotherapy associated with the bioproduct based on the essential oil of *Alpinia Zerumbet* on the collagen of spastic muscle tissues. It was an experimental research carried out in with 30 rats divided into five groups of six animals: group Az (treated with the bioproduct), FT (treated with physiotherapy), FTaz (treated with the bioproduct and physiotherapy), CTR (control 1 - no treatment) and SHAN (control 2 - no spinal cord injury). Only the SHAN group was not submitted to spinal cord injury. This study demonstrated that physical therapy exercises associated with the essential oil-based bioproduct *Alpinia Zerumbet* proved to be effective in reversing changes in collagen thickness and organization caused by spasticity after spinal cord injury in this model. The three proposed treatments showed a reduction in collagen fiber thickening when compared to the CTR group, reaching values statistically like the SHAN group, without neural injury. A prospective, clinical and randomized study verified the effect of the essential oil *Alpinia Zerumbet* associated with physiotherapy in 24 children with cerebral palsy. Results showed that the essential oil associated with kinesiotherapy modulated muscle tone and led to functional gain [24]. To confirm the positive effect of the *Alpinia Zerumbet* on muscular tonus, this study aimed to verify whether local dermal application of *Alpinia Zerumbet* (Ziclague) oil to the spastic muscle decreases neural hypertonia in individuals with CP.

Materials and Methods

This cross-sectional clinical study was developed in accordance with the Guidelines and Regulatory Standards for Research Involving Human Beings (Normative Resolution 466/12, of the

National Health Council/MS) and was submitted to and approved by the Research Ethics Committee of UNIFESP (protocol n. 2.351.096). The study was carried out at the Therapeutic Support Center and Association of Cerebral Palsy in Santos, São Paulo, Brazil.

Nineteen individuals with CP, aged 18.1 years (SD=11.24), 14 of whom were levels IV/V of the GMFCS (Gross Motor Function Classification System) and 5 of levels I/II/III, with hypertonia in the biceps brachii and/or hip adductors participated in this study.

Individuals diagnosed with CP, with hypertonia of neural origin and the acceptance of the parents and the child himself, proven by the signing of the Informed Consent Form, were included in the study. Exclusion criteria was patients who underwent orthopedic surgery and/or botulinum toxin application in a period of less than six months.

Participants were assessed through modified Ashworth and Tardieu scales. The Modified Ashworth Scale is a measurement scale for muscle tone, performed passively by moving a joint through the possible range of motion and scoring the perceived resistance for movement on a 6-point scale ranging from 0 (no increase in tone) to 4 (parts affected rigidly in flexion or extension). The evaluation at different speeds helps to distinguish between hypertonia and muscle shortening [25,26,27,28,29]. On the Tardieu scale, spasticity is clinically assessed during passive movement at three specific speeds (V) (slow, in favor of gravity and fast), measuring the intensity and duration of the muscle's reaction to

stretching (X) on a 5-point scale ranging from 0 (no resistance) to 4 (contraction or clonus), and the joint angle (Y) at which catch (resistance or interruption to movement) is observed [30,31,32]. Range of movements were calculated for the angle of interruption (catch) verified at fast speed (R1) and range of motion at slow speed (R2) measured by a goniometer.

The Alpinia Zerumbet and placebo applications were randomized, and the evaluators were blinded. Each individual received either Ziclague dermal application or placebo. The Alpinia Zerumbet was applied by a physiotherapist by means of superficial sliding as well as mineral oil for the placebo effect. After application, the patient remained at rest, without therapy for 30 minutes to wait for the effect of the application and was reevaluated by the same scales. The same protocol was repeated after a week using the other oil (Alpinia Zerumbet or placebo). Differences between amplitudes before and after the applications were calculated for the angle of interruption (catch) verified at fast speed (R1) and range of motion at slow speed (R2) measured by a goniometer.

Results and Discussion

Table 1 shows clinical characteristics of individuals who were included in this study. There were no differences in interaction between angles and applications (p= 0.265). Differences between angles in R1 were greater than R2 (p=0.049) and between Ziclague applications were greater than placebo (p=0.012). Out of 32 evaluations, 11 showed gains above 5° in R2 and 13° in R1.

Table 1:

Name	Age	Difference Between R2 Pre and R2 Post Ziclague Application	Difference Between R1 Pre and R1 Post Ziclague Application	Difference Between R2 Pre and R2 Post: placebo Application	Difference Between R1 Pre and R1 Post: Placebo Application	Ashworth Com ziclague	Ashworth Com Placebo
Marina	+R1	MSE (05° - 05°) = 0°	(100° - 70°) = 30°	(04° - 02°) = 02°	(90° - 74°) = 16°	2	2
Misael Arruda	+	MSD (46° - 20°) = 26	(74° - 45°) = 29°	(44° - 44°) = 0°	(76° - 72°) = 04°	1	1
Ryan	MSE + MSD =	MSE (10° - 03°) = 07° MSD (05° - 06°) = - 01°	MSE (65° - 46°) = 19° MSD (55° - 64°) = - 09°	MSE (12° - 12°) = 0° MSD (10° - 10°) = 0°	MSE (64° - 50°) = 14° MSD (58° - 52°) = 06°	2	2
Vitor Savoy	No difference	MSE (20° - 20°) = 0°	(70° - 70°) = 0°	(20° - 10°) = 10°	(70° - 80°) = - 10°	2	2
Daniela Soares	= no difference (contracture)	MSE (20° - 20°) = 0°	(90° - 90°) = 0°	(20° - 20°) = 0°	(90° - 90°) = 0°	4	4
Vitor Rosa	No difference with placebo	MID (20° - 25°) = - 05° MIE (19° - 25°) = - 06°	MID (15° - 15°) = 0° MIE (15° - 15°) = 0°	MID (10° - 05°) = 05° MIE (20° - 25°) = - 05°	MID (10° - 10°) = 0° MIE (10° - 15°) = - 5°	1+	1+
Mariana Cecchi	+	MSD (28°-18°) = 10° MSE (36°-20°) = 16°	MSD (68°-50°) = 18° MSE (70°-56°) = 14°	MSD (30°-30°) = 0° MIE (34°-32°) = 2°	MID (70°-60°) = 10° MIE (72°-78°) = -6°	MID 2 MIE 1+	MID 2 MIE 1+
Manuela	No difference	MID (30°-28°) = 2° MIE (18°-20°) = -2°	MID (18°-20°) = -2° MIE (20°-20°) = 0°	MID (30°-30°) = 0° MIE (34°-38°) = -4°	MID (20°-28°) = 8° MIE (16°-30°) = 14°	2	2

Caroline Chaves	16anos MID + MIE+	MiD (30°-38°) = 8° MIE (28°-40°) = 12°	MID (18°-28°) = 10° MIE (20°- 36°) = 16°	MID (32°-32°) = 0° MIE (30°-30°) = 0°	MID (18°-20°) = 2° MiE (30°-30°) = 0°	1	1
Pedro Paulo	+	MSD (40°-32°) = 8°	MSD (60°-42°) = 18°	MSD (20°-20°) = 0°	MSD (70°-62°) = 8°	3	3

Note: Values in degrees. When it appears with (-) it has worsened. And "0" did not improve.

R2 slow; Fast R1

Discussion

According to BEZERRA (2000), Santos (2011) and Xavier Filho and Cândido (2012) demonstrated that properties inherent to the essential oil *Alpinia Zerumbet* (Ziclague) promotes greater relaxation of the spastic muscles. This characteristic, which induces muscle relaxation with normalization of tone, was observed in our study with a decrease in spasticity in a significant percentage of the muscle groups of the individuals who participated in our study. This study gives an alternative for decrease hipertonia without secondary negatives effects.

Conclusion

A dermal application of Ziclague was able to reduce hypertonia after 30 minutes. We suggest a study with assessments longer than 30 minutes after application to verify gains in range of motion.

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