PASSIVE STRETCHING, SERIAL CASTING, AND AFOS FOR A 9-MONTH-OLD CHILD WITH PLANTARFLEXION-CONTRACTURE ON SELF-REFERRAL PHYSIOTHERAPY IN NIGERIA.

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Abstract

Tendoachilles contracture causes ankle dorsiflexion (DF) limitation and puts it in plantarflexion position, which in infants results in toe-walking. A mother of a 9-month old boy with bilateral plantarflexion-contracture (PFC) sought for private physiotherapy intervention for her child who was unable to stand, having sought physician’s opinion in a government hospital in Nigeria. His ankle DF angles were: (right: 15° and left: 20°).

Passive stretching (PS), serial casting (SC), and application of ankle foot orthoses (AFOs) were performed for 6 weeks and home exercise programmes encouraged for 3 months. The ankle DF angles improved with 85 points from baseline to 6 weeks bilaterally. The child could stand after three months and initiated gaits at age 14 months without toe-walking. This demonstrates the importance of early PS, SC and AFOs in infants with bilateral PFC before initiation of independent walking. It could increase the prognosis and/or prevention of toe-walking. A direct access physiotherapy service in government hospitals is advocated in Nigeria.

Keywords: Early physiotherapy, Self-referral, Tendoachilles contracture, Infants, Nigeria.

INTRODUCTION

Plantarflexion-contracture (PFC) is usually characterized with limitations in dorsiflexion (DF), which may be hereditary/congenital, developmental or neurological in children (Katz and Mubarak, 1984; Natarajan and Ribbons, 2016). Plantarflexion or tendoachilles (TA) contracture often results in toe-walking in children at the time of initiation of independent ambulation (Sala et al, 1999). The contracture could grow worse with age (Shulman et al, 1997). Persistent toe-walking could further result in adaptive shortening of the gastrocnemius muscle, impartment on knee extension, poor or development of abnormal gait pattern, and balance (Shulman et al, 1997; Cras et al, 2011; Leung et al, 2014).

Two major measurements for ankle dorsiflexion range of motion (ankle DF ROM) are known – the weight bearing and non-weight bearing ankle DF ROM measurements (Alalen et al, 2001; Konor et al, 2012). The weight bearing lunge position measurement with standard (universal) goniometer amongst others have been described to have good intrarater reliability (i.e., 0.85 and 0.96 on the right and left limbs respectively) (Konor et al, 2012). Non-weight bearing ankle DF ROM with the use of universal goniometer has also been reported (Alalen, et al, 2001). Hastings-Isom and colleagues (2014) reported on the need to use universal goniometer for the assessment of the passive ankle DF angle as a routine clinical outcome measure.

Purpose

Information from literature on non-invasive management of PFC in infants (0-1year old) before they start independent walking is sparse. Available evidence showed intervention instituted on older children with limitations in DF (Stricker and Angulo, 1998; Sala et al, 1999; Autili-Ramo et al, 2006; Cras et al, 2011; Rose et al, 2010; Dietz and Khunser, 2012). Also, first contact (direct access) physiotherapy service has not been fully integrated in Nigerian health system (Ganiyu, 2008). This does not allow for prompt medical attention/rehabilitation for neuromusculoskeletal impairments where necessary in preventing secondary complications that may arise in that population (Alalen et al, 2001; Ganiyu, 2008). However, 97% of physiotherapists in the country assert that extant legislation allows for patients’ self-referral, presumably to private physiotherapy centers. Patients needing physiotherapy services are often not referred and when they do, are referred late (Igwezi-Chidobe, 2015; Mbada et al, 2015). This case report is therefore to demonstrate early physiotherapy with passive stretching, serial casting, and application of AFOs on self-referral private physiotherapy consultation in an infant with PFC (without bony involvement) before the initiation of the first independent walking. A search for literature on physiotherapy management of PFCs on children before the initiation of gait was made through Pubmed and PEDro databases. Search terms include: plantarflexion OR tendoachilles AND contracture AND toe-walking. Three records were retrieved with pubmed and 31 with PEDro [Advanced search- last updated 7 December, 2015. The fielded information include - Therapy: orthoses, taping, splinting; Problem: muscle shortening, reduced joint compliance; Body Part: foot or ankle; Subdiscipline: pediatrics; Topic: no appropriate value in this field; Published since: 2005; and When searching: match all search terms (AND)]. In both databases, 7 items were relevant for the report. Other sources of literatures include books and peer reviewed journals, and articles from relevant health web sites which were sought via Google scholar due to sparse collection of data via the databases. We found very useful information on first contact physiotherapy practice (i.e., direct access and self-referral issues) in the Nigeria through this process. We also found some references of the journals invaluable.

History

EE is a 9-month old boy who was carried to full term by his mother and was delivered via spontaneous vaginal delivery on a labor which was not prolonged. EE who weighed 3.5kg at birth cried immediately after delivery. The mother claimed to have attended the

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antenatal clinic and that her child (EE) met the necessary developmental milestone for his age until he was 9 months when she observed that EE could not stand with both feet flat on the ground (Effgen, 2013; Child Development Milestones/Pathways, 2015). Instead, he stood on his toes when placed on flat surface (see A in Figure 1). The mother sought pediatric physician’s advice in a governments’ hospital where he was examined with no identifiable cause. The physician’s opinion was that the child would outgrow the problem with age. However, the mother noticed EE’s condition worsened by the day and therefore sought physiotherapy intervention on self-referral in a private clinical physiotherapy setting in Nigeria.

Past medical history: At 8th month old, EE had perineal rashes (i.e., perineal candidiasis) and fever. He was later diagnosed to have tonsillitis for which he was treated in a government hospital, Nigeria. He was placed on the following medications: Cefixine syrup - 8mg/kg/day for 2 weeks; Multivitamin syrup - 2.5 mls, trice daily for 2 weeks, Cartexm-dispensable, 1 twice daily for 3 days; and Ibuprofen syrup - 6mg/kg, for 2 days. These showed no drug interaction. Subsequent medications include: Ampiclox - 250mg four times daily for 10 days; Vitamin C- 5ml, trice daily for 1 week; and Muprocin cream application twice daily for 1 week. There was also no drug interaction amongst them.

Family social history: EE was the first child of the family in a monogamous setting. No similar history of DF contracture could be traced to the extended families of respective parents. Parents are both Nigerian civil servants working in different localities in Nigeria.

Figure 1: Pre and post-intervention

A: Plantarflexion contracture when pulled to standing position. Child refused to stand on Day 1

B: Standing on flat surface after 3 months

SYSTEMS REVIEW

Cardiovascular/pulmonary: Weight: 7.95 kg, Respiration rate: 32cm, Pulse 128b/m.

Musculoskeletal system: EE was unable to stand with both feet due to bilateral TA tightness. Range of movements (ROM) of other joints was within normal limits. The bilateral PFC was confirmed by resistance to the hand when stretched. This test was performed by placing EE’s knee in flexion position and then putting the foot in DF. Gradual knee extension forces the foot into Plantarflexion (Cayaha Polyclinics Patient Education, 2016).

Neuromuscular system: He had a good neck control. He was also able to crawl and sit without support but unable to stand. He resisted standing when propped up to stand. At age 9 months, a typically developing child should be able to crawl and be pulled to stand (Effgen, 2013; Child Development Milestones/Pathways, 2015). There was an increase in the tone of calf muscles of both limbs when EE was pulled to standing position. EE withdrew his lower limbs and cried due to pain when passive stretches of his ankle joints were performed. The Face, Legs, Activity, Cry, Consolability (FLACC) scale was therefore used to assess his pain level (Table 1). The FLACC pain assessment tool is used for preverbal children who cannot express their pain level and this has been reported to be clinically valid for this population (Merkel et al, 1997; Manworren and Hynan, 2003). Deep tonic reflexes were also normal for all the limbs. Modified Ashworth Scale for both hamstring muscles and both calf muscles were 0 and 2 respectively (of a 6 point scale [range 0 to 4]). Although no evidence has been shown on children with PFC in this population, Modified Ashworth Scale was found to be reliable in children with spastic cerebral palsy (Mutu et al, 2008).

Table 1: Tests and measures

<table>
<thead>
<tr>
<th>Goniometry: Non-weight bearing ankle dorsiflexion</th>
<th>Baseline</th>
<th>2 Weeks</th>
<th>4 Weeks</th>
<th>6 Weeks</th>
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<tr>
<td>RF : LF</td>
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| EE was placed on supine lying position with each foot extending over the exam table. Then, the PROM of each ankle DF was measured with the knee extended [i.e., the long shaft of the goniometer was placed parallel to the fibula while the other shaft was placed on the lateral side of the foot along the 5th metatarsal bone] (Aluonen et al, 2001).
| Note: Plantigrade position = 90°                | 15° : 20° | 25° : 30° | 30° : 43° | 100° : 105° |
| FLACC Scale score                                | 15 : 15  | 12 : 12  | 9 : 9  | 5 : 5  |
| PROM: Passive range of motion; RF: Right foot; LF: Left foot; FLACC: Face, legs, activity, cry and consolability |

Parent goals: EE could not verbalize his needs; however, the mother’s goal for him was to stand with his feet flat on the ground and walk normally at the time of initiation of walking (BMJ Best Practice, 2015).

Physiotherapy examination: At presentation in the physiotherapy clinic, EE was apparently healthy for his age. He had intact tactile sensation with normal muscle tone globally except for both calf muscles which seemed increased when he was pulled to stand. This is due to the load exerted on the ankles. Both ankle DFs were limited passively due to bilateral Achilles’ tendons shortening. Child refused to stand when pulled to stand on his feet apparently due to ankle joints pain (see A in Figure 1). However, he was able to sit without support. Examination of the lumbrosacral (LS) region showed normal LS lordosis and the feet showed no congenital deformity.

Tests and measures: Non-weight bearing goniometric measurements of ankle DF ROM were taken. The baseline scores were 15° and 20° on right and left limbs respectively (Table 1). Although the validity of non-weight bearing measurement for this age population has not been shown, the use of universal goniometer for the assessment of the passive
ankle DF angle as a routine clinical outcome measure was reported (Hastings-Ison et al., 2014). The FLACC scale would be used to monitor the progress of the ankle DF ROM and it is a valid pain assessment tool to assess pain levels in preverbal children (Manworren and Hynan et al., 2003).

Clinical Impression

The cause of the TA tightness in EE could not be determined. A lot of factors could lead to this condition (Natarajan and Ribbons, 2016). EE did not show any sign of clubfoot (talipes equinovarus) or flatfoot; neither did he show any signs and symptoms suggestive of spinal bifida attributable to the tightness of the tendon. Physical examination showed normal LS. EE also did not present with any sign of cerebral palsy. Therefore, the TA contracture could be idiopathic or hereditary neuropathy (Natarajan and Ribbons, 2016). Infants with PFCs are expected to toe walk at their independent walking stage and this could affect their calf muscles, gait, and balance (Cras et al., 2011). Early physiotherapy intervention for PFC in infants which could be a preventive measure from complications such as impartation on knee extension and likely surgical intervention later in life necessitates this report (Hemo, 2006; Babb and Carlson, 2008; Pistilli et al., 2014).

Prognosis and plan of care

EE would be able to stand on his feet flat on ground for 5 minutes in 6 weeks at first attempt with support, and in 3 months he would be able to walk with flat footed gait pattern at the time of independent walking (BMJ Best Practice, 2015).

The plan of care for EE was to keep and refer him to pediatric physician for further evaluation and treatment. Due to the financial status of the parents, the child was planned to receive serial casting once fortnightly after receiving passive stretching (PS) on each ankle joint. This would be done for one month (Househ, 2013). Application of AFOs would be done to maintain the extensibility of the calf muscles and Achilles’ tendons length gained. Passive movements of the ankle joints 2 times daily would be continued as home exercise programs for three months. A follow-up physiotherapy would continue at the time of independent walking.

The child’s improvement upon intervention would be evaluated with non-weight bearing goniometry. Passive range the ankle angles would be taken fortnightly. Due to the heat rashes on the child’s body, the mother would be counseled to adequately expose the child to some air.

Intervention

The child received 5-10 repetitive PS (with sustained stretch for about 2 seconds each) on both ankle joints on the first day and fortnightly for 6 weeks (Table 2). Below knee Plaster of Paris (POP) casts were applied to both lower limbs after the PS (see A Figure 2). Initial plan for EE was to receive PS and POP casts for one month (Pistilli et al., 2014). However, examination of the ankle joints at 4 weeks still revealed some restrictions in the ankle DF on passive movements. Hence, one more session of PS and POP cast were done for another 2 weeks. At 6 weeks, standing education was commenced.

After 6 weeks, repetitive passive movements of both ankle joints and application of AFOs (see B in Figure 2) were taught and standing education encouraged, both to be continued as home exercise programs for three months. The duration was given as we hoped that the child would have been able to walk independently at that time.

Outcome

After intervention for 6 weeks the child had clinically improvements in ankle DF ROM from baseline values for both limbs. Although there was no comparative figure from the literature to distinguish between stable and improved children, large improvements were noticed to have occurred from baseline to 6 weeks with 85 points on both right and left ankle DF angles respectively (Table 1). Alanen and colleagues (2001) stated that “healthy ankle” in children cannot be used as a reference points when evaluating children ankle injuries. The less pain scores per increase in ankle angle passively confirm the improvement of the PFC. The FLACC scores improved with 10 points from baseline to 6 weeks. After 3 months (at 12 months old), the child was able to stand spontaneously with the feet flat on ground with support by the therapist/parent for 3 minutes at first attempt (see B in Figure 1). He was subsequently able to ambulate independently without toe walking at age 14 months.

DISCUSSION

It is evident that TA contracture resulting in persistent plantarflexion position in children will cause them to toe walk with possible secondary consequences such as: adaptive gastrocnemius muscle shortening, impartation on knee extension, poor gait pattern, and balance (Sala et al., 1999; Cras et al., 2011; Leung et al., 2014). This report demonstrates a case of PFC with unknown cause in a 9-month old boy who at presentation refused to stand when pulled to erect position on a flat surface due to pain on both ankle joints. Management of this condition has been documented for older children who were toe-walking already (Rose et al., 2010; Pistilli et al., 2014). So, this was considered a major clinical concern.

Passive stretching and POP serial casting were therefore instituted (Table 2) (Woosley et al., 2009). This was followed by AFOs (not labeled) application to maintain the ankle DF ROM gained. Improvements in ankle DF angles were noted after 6 weeks following intervention. The ankle DF angles increased with 85 points bilaterally from baseline to 6 weeks with concomitant decrease in pain levels on passive ROM of ankle joints (Table 1). This is consistent with other findings (Pistilli et al., 2014). The differences in goniometric readings in both ankle joints (Table 1) could be normal because some children have been reported to have left to right differences in ROM of the ankle joint complex (Alanen et al., 2001). The FLACC scale scores for both joints were the same (Table 1). There was no evidence from the literature to explain this. One possible explanation is that the child’s reaction to the passive stretch on one joint was...
exhibited while assessing pain levels on the contralateral joint probably due to fear.

Awareness of patients’ conditions and mode of treatments has greatly been enhanced today by the internet. Today, patients and relatives can access different social media tools (blog, twitter, and wikis, amongst others) available to them to find out what could be done for them regarding their health issues with ease (Ventola, 2014). Health care professionals use these tools to engage with the public and motivate patients, promote, or provide relevant health information to the community and this has been shown to improve patients’ care and health outcomes (Househ, 2013; Bernhardt et al, 2014). This to large extent contributed as to why the mother of this child sought for physiotherapy service directly.

CONCLUSION

This case indicates a prompt intervention: passive stretching, serial casting, and AFOs for PFC in infants before the first initiation of independent walking. The prognosis of toe-walking and its complications could be greatly enhanced by this process. It also demonstrates the importance of self-referral for physiotherapy service in Nigeria. Direct access physiotherapy services should be an important component of healthcare strategy for management of patients with neuromusculoskeletal conditions in both government and private hospitals in Nigeria.

Acknowledgement

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References


Table (2) The child was made to stand with the feet flat on ground supported by the therapist/mother.

<table>
<thead>
<tr>
<th>PERIOD</th>
<th>THERAPY</th>
<th>PROCEDURE</th>
<th>DURATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1, 2 Weeks, 4 Weeks respectively</td>
<td>(1) Passive stretching</td>
<td>Repetitive passive stretching of ankle joints with knee in flexion position.</td>
<td>5-10 repetitions, sustained for approximately 2 seconds between repetitions.</td>
</tr>
<tr>
<td></td>
<td>(2) POP cast</td>
<td>Child sat comfortably on mother’s laps. The knee was flexed and ankle joint dorsiflexed. The POP cast was then applied on each foot maintaining the ankle DF gained.</td>
<td>x2 weeks (each after day 1, 2 weeks, 4 weeks respectively).</td>
</tr>
<tr>
<td>6 Weeks</td>
<td>(1) Passive stretching</td>
<td>Repetitive passive stretching of ankle joints with knee in flexion position.</td>
<td>5-10 repetitions, sustained for approximately 2 seconds between repetitions.</td>
</tr>
<tr>
<td></td>
<td>2) Standing education</td>
<td>Child stood with feet flat on ground with support by therapist</td>
<td>1 minute.</td>
</tr>
<tr>
<td>Post-6 Weeks: HEP</td>
<td>(1) Passive movement</td>
<td>Repetitive passive movements of ankle joints with knee in flexion position</td>
<td>5-10 repetitions, x2 daily for 3 months</td>
</tr>
<tr>
<td></td>
<td>(2) Application of AFOs on both ankle joints</td>
<td>Readymade pediatric AFOs purchased and applied. Sometimes used with moderately over sized shoes</td>
<td>Daily (commenced in the morning or afternoon at mother’s convenience) for 3 months</td>
</tr>
<tr>
<td></td>
<td>(3) Standing education</td>
<td>Standing education with support (i.e., walker, table, or other)</td>
<td>x2 daily (continued till child starts independent walking)</td>
</tr>
</tbody>
</table>