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Research Article

Effect of Intrinsic Foot Muscle (IFM) Training on Balance, Physical Activity and Quality Of Life (Qol) in Down's syndrome Children – A Case Report.

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ABSTRACT

Down's syndrome is the abnormality of the 21st chromosome which is most commonly seen in children. The foot abnormalities are seen in majority of them but its least addressed due to attaining of motor development. Intrinsic foot muscles are the key muscles to maintain balance and movement. The aim of this study is to see the benefits of IFM training on balance, physical activity and quality of life in Down's syndrome children. This single case report is focusing on the effect of IFM training along with the regular physiotherapy exercise protocols on the balance, physical activity and quality of life in Down's syndrome children. Regular physiotherapy exercise protocols along with 30 minutes of IFM training were given to the Down's syndrome children with foot abnormalities 3 sessions a week for 12 weeks followed by a follow up after 3 months. The pre and post test values were measured using Pediatric balance scale (PBS), Children's Physical activity questionnaire (C - PAQ), Pediatric Quality of Life (QoL) questionnaire and Foot Posture Index (FPI) showed remarkable changes in the balance and physical activity of this child with Down's syndrome.

Key words: Down's syndrome, intrinsic foot muscle, foot abnormality, balance, physical activity.

Introduction:

Down's syndrome is the abnormality. It is the presence of one additional fragment of the 21st chromosome seen commonly in children.They achieves mobility but at least a year later than the normal kids. This delay has been due to the muscle dystonia as a result of delayed and unorganised muscle activation patterns[1]. Even after achieving walking there will be difficulty in balance activities like running, single leg standing, reverse walking etc. if addressed least the impact of this will increase as the age progresses[2]. Nearly 30 percent of musculoskeletal disorders reported are mostly related to pes planus (flat foot).Although flat foot remains most common issue in Down's syndrome it still remains least addressed compared to other issues like scoliosis, knee malalignment and spine instability[3].

The foot arches are mainly formed and supported by Extrinsic and intrinsic foot muscles. Out of which the extrinsic foot muscles are responsible for osteokinematics movements, whereas the intrinsic foot muscles are responsible to maintain the arch deformation thus providing static and dynamic posture control[4].The compression and relaxation of the arches are responsible for saving the mechanical energy during every step. Intrinsic foot muscles can be strengthened using several methods. Through this strengthening we activate the

weak or inhibited muscle which in turn improves the neuro-muscular control. Thus the far possible injuries like foot pronation and ankle instability can be minimised[5].

Methods:

A thorough explanation was given about the entire protocol to the parents of these children and consent forms obtained from them expressing their interest towards the participation. Subjects were selected based on the criteria. Pre-treatment assessment was done using Pediatric Balance Scale (PBS), Foot Posture Index. Children's Physical activities Questionnaire (C-PAQ), Pediatric quality of Life scale (PedsQoL) were obtained from the parents. These children were treated with regular physiotherapy exercise protocols followed by a 30 minutes session of Intrinsic Foot Muscle training/3 times week for a period of 12 weeks followed by a follow-up after 3 months Post treatment assessment was done. Data were documented and reported for analysis.

Basic physiotherapy exercises:
1. Standing balance with bolster
2. Standing balance with BOSU ball (See Figure 2)
3. Balance board exercises (See Figure 1)
4. Wobble board activities.

Intrinsic Foot Muscle strengthening[6]:
1. Plantar fascia stretch
2. Short foot exercises(Doming)
3. Towel curl exercises
4. Toe extension and spread out exercises
5. Marble pick up exercises

Case presentation:

7 year old girl child diagnosed with Down's syndrome with pes planus, presenting with complaints of alteration in gait pattern, difficulty in one leg standing, climbing up and down the stairs without support, difficulty in using alternate leg patterns climbing up and down the stairs. She also did not achieve the maximum functional activity of jumping off the floor. She has been advised about this case study benefits. After getting their parent written consent on accordance with assent of the child, she has been recruited for this study. Subject's photo consent was taken also. This case study was ethically approved and followed Human ethics by adopting Declaration of Helsinki 2013 on Human studies.

Table 1: Pre and Post Intervention Outcome Measures Values

Outcome Measures	**Pre Intervention**	**Post Intervention**
Paediatric Balance Scale(PBS) Score	36/56	**44/56**
Foot Posture Index (FPI) (Overall)	-2	**-1**
Children's Physical Activity Questionnaire (C-PAQ) Score	2/5	**3/5**
Pediatric Quality of Life scale (PedsQoL) Score (Overall)	58/100	**74/100**

Figure 1: Subject performing balance board exercises (Source: Author)

Figure 2: Subject performing standing balance with BOSU Ball (Source: Author)

Data Analysis and Discussion:

There was significant improvement in post intervention values of outcome measures of Pediatric Balance Scale (PBS), Foot Posture Index. Children's Physical activity Questionnaire (C-PAQ), Pediatric quality of Life scale (PedsQoL) (See Table 1). This study results stated that intrinsic foot muscle training improved balance, physical activity and quality of life (QoL) in a Down's syndrome child.

Outcome of this case study strengthening the concepts of combining any form of other types of exercises like pilates with regular physiotherapy exercises proved to improve their physical activity in Down's syndrome children compared to administering of single designed physiotherapy exercises which was concluded in previous published results by A.AL-Nemr etal (2024)[7]. Intrinsic foot muscle training (IFMT) gave improvement like ACSM guidelines for muscle strengthening of individuals with intellectual disability say to stretch the muscle groups to avoid shortening and also to engage each muscle group at least 2 to 3 times a week[8]. Intrinsic foot muscle exercises given to Down's syndrome children proved to be an alternate for conventional methodby this study results. In this case study we see significant changes with paediatric balance scale and foot posture index scores.

Conclusion:

Post intervention changes in the outcomes of Pediatric Balance Scale (PBS), Foot Posture Index. Children's Physical activity Questionnaire (C-PAQ), Pediatric quality of Life scale (PedsQoL) concluded that intrinsic foot muscle training (IFMT) had significant improvement in balance, physical activity and quality of life in Down's syndrome child.

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Ethical Approval: Srinivas University Ethics Committee - 18/Physiotherapy/2023.

Credit AUTHORSHIP CONTRIBUTION STATEMENT:
Author 1: Conceptualization, Formal Analysis, Methodology, Writing – Original Draft, Project Administration.
Author 2: Conceptualization, Investigation, Writing – Original Draft, Writing – Review and Editing, Investigation, Project Supervision.
Author 3: Conceptualization, Investigation, Writing – Original Draft, Writing – Review and Editing, Investigation, Project Supervision
Author 4: Formal Analysis, Data Collection, Methodology, Investigation.
Author 5: Formal Analysis, Data Collection, Writing – Review and Editing, Investigation, Project Supervision.

Conflict of Interest: The authors declare no conflict of interest.

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