BOLETÍN DE LITERATURA ORAL, 11 (2024), PP. 498-516

Effects of kinesio taping on plantar flexors spasticity after 48 hours of application Among spastic cerebral palsy children

Ms. Dipsa Shah, Dr. Keerthi Rao
(22MPT10005) Mpt sports final year Chandigarh Universityss
Guided by (Mpt-ortho) Professor, Chandigarh University

ABSTRACT:

Background: Cerebral Palsy describes as a group of permanent disorders of the development of movements and posture, causing activity limitation, that are attributed to non progressive disturbances that occurred in the developing fetal or infant brain. Spastic cerebral palsy is the most common type of cerebral palsy. Spasticity is the most common movement disorder of children with cerebralpalsy. The Modified Ashworth Scale (MAS) is a clinical scale used to assess muscle spasticity that is in commonly used in many rehabilitation facilities and spasticity clinics. The instrument, which is used for measuring the range of motion of the joint, is called as "Goniometer". Kinesiotape is an alternative taping technique commonly used clinically to try and achieve reduce pain, drain swelling, improve posture, improve function, facilitate early return to activity or sport, improve sporting performance, and improve range of motion and function.

Objective: The objective of the present study is to improve the range of motion (ROM) of Plantar Flexion and Dorsi Flexion of ankle joint and to determine the effects of Kinesio Taping to reduce the Plantar Flexors spasticity after 48 hours of application among Spastic Cerebral Palsy Children.

Study Design: Pre and Post Experimental Study

Methodology: 20 children (Boys and Girls) with spastic cerebral palsy, aged between 1 to 6 years with spasticity grade 1, 1+, and 2 for plantar flexors muscle were selected from different clinics and colleges in Surat for the study. All parents were assigned to fill up an informed consent form. MAS was used to check the spasticity to see whether they can be included in this study or not and Goniometer was used to measure the ROM for Plantar Flexors and Dorsi Flexors. Kinesio Tape was applied and the parents were asked to keep it for 48 hours. No treatment or other orthotic devices were allowed. After 48 hours, tape was removed and ROM for Plantar Flexion and Dorsi Flexion were taken again.

Results: Paired t- test was used for statistical analysis. Results were considered to be significant at $p<0.05$ and confidence interval was set at 95 %. All statistical analysis was performed using SPSS version 16. The t-value for Pair-1 was - 11.388, Pair-2 was -13.545, Pair-3 was 21.081 and Pair-4 was 15.755 with associated significance value $p=0.000$ ($p<0.05$).

Conclusion: There was improvement in ROM of PF and DF of ankle joint and decrease in the spasticity of the plantar flexors after 48 hours of application of KT among spastic CP children.

KEYWORDS: Spastic Cerebral Palsy, Range of Motion, Goniometer, Kinesio tape, Modified Ashworth Scale.

Introduction

The provision of service delivery can be greatly enhanced and simplified by utilising appropriate digital technological processes such as artificial intelligence (AI). Globally, the use of AI has been

shown to be highly beneficial for enhancing the quality, efficiency and affordability of municipal services in countries such as the USA, the United Kingdom, China, Singapore, India, Japan, Germany and South Korea (Roberts, Babuta, Morley, Thomas, Taddeo & Floridi, 2023). The study conducted by Lund, Wang, Mannuru, Nie, Shimray and Wang (2023) shows the numerous benefits of using digital technology and AI processes in the services industry of South Africa. Advances achieved in the fields of digital technology and AI in the developed world can also be achieved in developing nations such as South Africa by investing on digital infrastructure, skills-based training, and the acquisition of digital equipment and software (Corno, La Ferrara & Burns, 2022). The world's advanced economies have managed to acquire the capability to offer predictable, affordable and efficient municipal services to their communities by using digital technology and AI applications in the services sector. The common characteristic among these nations is their ability to adopt, master and internalise appropriate digital technologies for providing municipal services. In each one of these countries, formal education is provided to learners starting at an early age in which the curriculum used for teaching young learners includes the early adoption of digital technology and information and communication processes (Crawford, Cowling & Allen, 2023).

Overview:

Cerebral Palsy (CP) is a well recognized neuro-developmental condition beginning in early childhood and persisting throughout the lifespan. Originally reported by William J. Little in 1861 and originally called "Cerebral Paresis" (1). The term CP, constitutes 5 main classes of handicapped children, of which the olden term, cerebral spastic paralysis, is only one of the group (2). "Cerebral" refers to the brain, while "Palsy" refers to a physical disorder, such as lack of muscle control (3). CP is a term used to describe a broad spectrum of motor disability which is non- progressive and is caused by damage to brain at oraround birth (4). CP describes as a group of permanent disorders of the development of movements and posture, causing activity limitation, that are attributed to non progressive disturbances that occurred in the developing fetal orinfant brain (1). The characteristics of the cerebral palsy child are paralysis, weakness, in coordination, on any other aberration of motor function due to malfunction of the motor centers of the brain. He may also have other symptoms which reflect a damaged brain (2). The motor disorders of CP are often accompanied by disturbances of sensation, perception, cognition, communication, and behavior; by epilepsy, and any secondary musculoskeletal problem (1).

The different types of cerebral palsy:

(A) Physiological:
1. Spastic Cerebral Palsy
2. Athetoid Cerebral Palsy
3. Rigid Cerebral Palsy
4. Ataxic Cerebral Palsy
5. Tremor
6. Atonic Cerebral Palsy
7. Mixed Cerebral Palsy
8. Unclassified Cerebral Palsy

(B) Topographical:
1. Monoplegia
2. Paraplegic
3. Hemiplegic
4. Triplegia
5. Quadriplegia
6. Diplegia
7. Double Hemiplegia

(C) Etiological:
1. Prenatal

ISSN: 2173-0695

2. Natal
3. Postnatal (2)

CP takes many forms; in fact, no two spastic children are precisely alike (3).

Historical Background: There are references in history and literature which crippled from Egypt through the darkness of middle ages, in 1843, the crippling condition being now known as Cerebral Palsy which was first described by the English surgeon, William J Little who believed that deformities in these cases were due to the nervous affections or paralysis. It was observed that diarrheaand other internal upsets were also responsible for it, even a large proportion were in first pregnancy, and that many patients were immature/premature weighing only 40 ounces at birth. The birth palsies of cerebral origin were commonly referred to as Little's disease. The term CP was very carefully designed by the Dr. Phelps to dissociate feeble mindedness from motor handicap. He also demonstrated that such children could be rehabilitated to lead useful happy life. In the 1860s William J Little wrote the first medical descriptions of a puzzling disorder that struck children in the first years of life, causing stiff, spastic muscles in their legs and, to a lesser degree, their arms. These children had difficulty in grasping objects, crawling, and walking. They did not get betteras they grew up nor did they become worse. Their condition, which was called little's disease for many years, is now known as "Spastic displegia". It is just one of several disorders that affect control of movement and are grouped together under the term cerebral palsy (3).

Causes:

(A) Antenatal Causes:
1. Genetic causes
2. Intrauterine virus infection
3. Hypoglycemia
4. Trauma to mother
5. Infection to mother
6. Prolonged use of medications like steroids by mother
7. Malnourishment of the fetus
8. Exposure of the mother's abdominal area to repeated X-ray radiation

(B) Neonatal Causes:
1. Prematurity
2. Vascular disease (occlusion of the internal carotid or midcerebral artery)
3. Asphyxia
4. Neonatal meningitis

(C) Postnatal Causes:
1. Delayed cry
2. Severe jaundice
3. Trauma
4. Infection (4).

The motor disorder of cerebral palsy is often accompanied by disturbances in muscle tone, sensation, perception, cognition, communication, and behavior (5).

Spasticity defined as "Motor disorder characterized by the velocity dependent increase in muscle tone with increased resistance to stretch; the larger and quicker the stretch, the stronger the resistance of the spastic muscle" (6). The definitions sometimes incorporate possible anatomic localization, such as the "upper motor neuron syndrome". It can also be defined by the related clinical observations such as spastic catch, clasp-knife response, or clonus (7).Exaggerated tendon jerks, resulting from hyper excitability of the stretch reflex can also be seen (8). It arises from injury to descending motor pathways from the cortex or brainstem. Chronic spasticity is associated with contracture, abnormal posturing, deformity, functional limitations, and disability. When movements are attempted, the result

ISSN: 2173-0695

is action- induced abnormal movement pattern [6]. It can varydepending on a child's state of alertness, activity, or posture. It can be increased by anxiety, emotional state, pain, surface contact, or other non noxious sensory input. It may worsen with movement of the involved muscles or maintenance of the limb against gravity, but it is not specific to particular attempted tasks [7]. It can make ones movement, posture, and balance difficult.

Spasticity causes:

- Inhibition of movement.
- Inhibition of longitudinal muscle growth.
- Limited stretching of muscles in daily activities.
- Development of muscle and joint deformities.
- Pain [5].

Spastic cerebral palsy is the most common type of cerebral palsy [5]. Spastic CP affects around 70% of children with CP [3]. Spasticity is the most common movement disorder of persons with cerebral palsy, and is attributable to the insufficient release of γ-aminobutyric acid (GABA) in the spinal cord [9]. Cerebral palsy is characterized by impaired motor control resulting from a centrally mediated imbalance of muscle strength and tone [10]. It is caused by the damage or injury to the part of central nervous system i.e. cerebral cortex that controls voluntary movement [5]. In this form a child's muscle are stiffly and permanently contracted, limiting their ROM and causing jerky, unpredictable movement. Often the child has trouble holding or letting go of objects or moving from position to position. Based on the particular areas of the body that are affected, Spastic CP has several manifestations. When both legs are affected, they often turn in and cross at the knees, causing an awkward and stiff walk with a characteristicrhythm, known as the scissors gait. Children may also experience uncontrollable shaking/tremors of the limbs [3]. Spasticity seen in cerebral palsy is usually clasp knife that may change with the change in position, which means that spasticity may vary from supine to prone. In supine we see increase in extensors tone and in prone position we see increase in flexors [4]. Clasp knife response is characterized by initial high resistance (spastic catch) may followed by a sudden inhibition or letting go of the limb (relaxation) in response to a stretch stimulus [6]. The hip flexors and ankle plantar flexors in spastic CP tended to be relatively stronger than their antagonists as compared with the strength ratios of the comparison group [11].

One of the methods that have been proposed for measuring muscle spasticity involves manually moving a limb through the range of motion to passively stretch specific muscle groups. Ashworth has described a five-point ordinal scale called The Modified Ashworth Scale for grading the resistance encountered during such passive muscle stretching [12]. The MAS is a clinical scale used to assess muscle spasticity that is in commonly used in many rehabilitation facilities and spasticity clinics.
Ashworth's scale grades spasticity as follows:

0 = Normal muscle tone;
1 = Slight increase in muscle tone, manifested by a catch n release or by minimal resistance at the end of the range of motion when the affected part(s) is moved in flexion or extension.
1+ = Slight increase in muscle tone, manifested by a catch, followed by minimal resistance throughout the remainder (less than half) of the range of motion.
2 = More marked increase in muscle tone through most of the range of motion, but affected part(s) easily moved.
3 = Considerable increase in muscle tone, passive movement difficult.
4 = Affected part(s) rigid in flexion or extension [6].

Measuring Range Of Motion: Physical Therapists routinely perform active range of motion (AROM)

ISSN: 2173-0695

and passive range of motion (PROM) measurements[13]. The instrument, which is used for measuring the range of motion of the joint, is called as "Goniometer". The term goniometry is derived from the Greek words

Gonio means "Angle" and Metron means "Measurement" [14]. Goniometer refers to the measurement of angles, in particular the measurement of angles created at human joints by the bones of the body [15]. Goniometric measurements are used by physical therapists to quantify baseline limitations of motion, decide on appropriate therapeutic interventions, and document the effectiveness of these interventions. Historically, goniometry developed over the last 60 years in conjunction with the rapid growth of the field of physical medicine and rehabilitation. Reliability in goniometry simply means the consistency or the repeatability of the ROM measurements, that is, whether the application of the instrument and the procedures produce the same measurements consistently under the same conditions [16]. The examiner obtains these measurements by placing the parts of the measuring instrument, goniometer along the bones immediately proximal and distal to the joint being evaluated. Goniometry may be used to determine both a particular joint position and the total amount of motion available at a joint. Goniometry is an important part of a comprehensive examination of joints and surrounding soft tissues. A comprehensive examination typically begins by interviewing the subject and reviewing records to obtain an accurate description of current symptom; functional abilities; occupational, social, and recreational activities; and medical history [15].

Types of Goniometer:

1. Universal Goniometer
2. Gravity Dependent Goniometer or Fluid Goniometer
3. Pendulum Goniometer
4. Electrogoniometer [14]

The universal goniometer (UC) is commonly used to measure range of motion (ROM) of the ankle. UG is designed by Mr. Moore. This is very commonest variety. It is having a body which resembles like a half or full circle protractor, movable arm which is aligned with the distal segment of the measuring joint, and a stationary arm which does not have any motion and is aligned with the proximalsegment of the measuring joint [14]. The literature offers evidence that PROM measurements of ankle dorsiflexion (ADF) and ankle plantar flexion (APF) obtained with a UC are reliable in patients with ankle joint complaints [13]. Goniometric measurements are an available and easily applied method which assesses muscle shortening and joint contracture and can also give an ideaabout the spasticity [17].

Kinesiotape: An alternative taping technique was introduced by Kenzo Kase in 1996. It is thin, latex free, anti-allergenic and can be stretched in the longitudinal axis [18]. The Kinesio tape is elastic [19]. Kinesiotaping is currently used in rehabilitation as an adjuvant therapy method due to positive effects on pain and gait pattern. Although the exact mechanism of action is not clear, neuro facilitation and mechanical restraint have been proposed as possible underlying mechanisms [18]. The tape is made of tightly woven elasticated cotton (97%) and nylon (3%) fibres. The glue on the tape is acrylic, highly durable and waterproofso tape can be worn for up to a week withstanding vigorous movement, sweatand total emersion in water. When applied in a vaguely correct manner tape canlead various positive changes including less pain, improved function, more power, better muscular endurance.

Kinesiology tape is commonly used clinically to try and achieve the following:

- Reduce pain
- Drain swelling
- Improve posture

ISSN: 2173-0695

- Improve function
- Facilitate early return to activity or sport
- Improve sporting performance.
- Improve pain, range of motion and function
- Improve power and strengthening uninjured muscles
- Raise the anaerobic threshold of muscle during endurance activity

The popularity of KT has grown and spread worldwide based on its clinical effectiveness to reduce pain and enhance performance rather hard tangible evidence about how the effects are achieved [20]. Kinesio Taping, when applied properly, can theoretically improve the following: strengthen weakened muscles, control joint instability, assist with postural alignment, and relax an over-used muscle. With the Kinesio Tape applied, patients often report symptom relief, improved comfort level, or stability of the involved joint. The elasticity of Kinesio Tape conforms to the body, allowing for movement [19].
There were many studies found which check the effect of Kinesio tape on stroke patients for the long duration, so to check the effect of same in Spastic Cerebral Palsy children after 24 hours of application this study is being carried out.

1.1 Research Question:

- Is there any effect of Kinesio taping on plantar flexors spasticity after 48 hours of application among spastic cerebral palsy children?

1.2 Hypothesis:

1.2.1 Null Hypothesis (H0):

- There is no significant decrease in Spasticity of Plantar Flexors and improvement in ROM of Plantar Flexion and Dorsi Flexion after 48 hours of application of Kinesio Tape among Spastic Cerebral Palsy Children.

1.2.2 Alternative Hypothesis (H1):

There is significant decrease in Spasticity of Plantar Flexors and improvement in ROM of Plantar Flexion and Dorsi Flexion after 48 hours of application of Kinesio Tape among Spastic Cerebral Palsy Children.

Objective of the Study:

1.2.3.Primary objective:

- The primary objective of the study is to improve the Plantar Flexion and Dorsi Flexion range of motion of ankle joint among the Spastic Cerebral Palsy Children after 48 hours of application of Kinesio tape.

1.1.2 Secondary objective:

- The secondary objective of the study is to reduce the Plantar Flexors Spasticity among the Spastic Cerebral Palsy Children after 48 hours of application of Kinesio tape.

Chapter 2

Literature Review

This chapter contains the review of the related literature to the research question. Researcher searched literature from Shrimad Rajchandra college of Physiotherapy library, Google books (www.books.google.co.in), Google scholar (www.scholar.google.co.in), and pub med (www.pubmedcentral.com).

Review Of Literature

Evrim Karadag-Saygi; et.al., (2010), conducted study on The Role of Kinesiotaping Combined with Botulinum Toxin to Reduce Plantar Flexors Spasticity after Stroke. In this study, twenty hemiplegic patients with spastic equinus foot were enrolled into the study and randomized into 2 groups. The first

ISSN: 2173-0695

group (n=10) received BTX-A injection and kinesiotaping, and the second group (n=10) received BTX-A injection and sham-taping. Clinical assessment was done before injection and at 2 weeks and 1, 3, and 6 months. Outcome measures were modified Ashworth scale (MAS), passive ankle dorsiflexion, gait velocity, and step length. The result showed improvement in both kinesiotaping and sham groups for all outcome variables. No significant difference was found between groups other than passive range of motion (ROM),which was found to have increased more in the kinesiotaping group at2 weeks (18).

Audrey Yasukawa; et.al., (2006), conducted study on investigating the Effects of Kinesio Taping in an Acute Pediatric Rehabilitation Setting. In this study, fifteen children, who were receiving rehabilitation services at the Rehabilitation Institute of Chicago participated. The Melbourne Assessment of Unilateral Upper Limb Function (Melbourne Assessment) was used to measure upper-limb functional change prior to use of Kinesio Tape, immediately after application of the tape, and 3 days after wearing tape. Children's upper-limb function was compared over the three assessments using analysis of variance. The improvement from pre- to post- taping was statistically significant. These results suggest that Kinesio Tape may be associated with improvement in upper extremity control and function in the acute pediatric rehabilitation setting

1. (19).

Richard W. Bohannaon and Melissa B. Smith, (1986), conducted study on Interrater Reliability of a Modified Ashworth Scale of Muscle Spasticity. In this study, they independently graded the elbow flexors muscle spasticity of 30 patients with intracranial lesions. Two raters, performed manual tests of elbow flexors muscle spasticity, agreed on 86.7% of their ratings of the level of spasticity. Their ratings, based on a Modified Ashworth Scale, were significantly correlated. This study concluded the reliability and usefulness of a Modified Ashworth Scale merit further clinical investigations (12).

Akmer Mutlu; et.al., (2007), conducted study on Reliability of goniometric measurements in children with spastic cerebral palsy. In this study, the study included 38 children with spastic diplegic CP. Passive range of motion (PROM) of hip extension, abduction, and external rotation, hip flexion with knee extended, and ankle dorsi flexion was measured using universal goniometry. Each child was assessed by three physical therapists once in each session on two different sessions a week apart. The mean absolute differences for all measures between sessions ranged from 0.10–4.86 degrees for the three physical therapists. There was no statistical significance in the mean differences between the physical therapists in all measurements ($p>0.05$) except for hip flexion with the knee extended ($p<0.05$). Inter- test reliability was high ($p<0.01$). Although the intra-testing reliability scores were high for all the physiotherapists, the most experienced physiotherapists' results were higher compared with the others. The results from this study encourage the use of goniometric measurements in assessing children with spastic diplegic CP (17).

Pravin P Gawali; et.al., (2016), conducted study on Immediate Effect of Sustain Stretching on Plantar Flexors Spasticity in CP Children. In this study, 30 spastic paraplegic CP children between age 10 to 20 years with spastic grade 1+ & more are selected. Study started with the assessment of two outcome measures this pre test which includes Modified Ashworth scale to measure the spasticity of plantar flexors, assessment of functional outcome measures using GMFM score and measurement of Passive ROM of plantar flexors has been taken. Treatment session including, 30 mins of sustain stretching to plantar flexors by using dynamic AFO, Ankle wedges and push knee braces. Child was made to stand with the ankle maintaining in dorsi flexion. Post test was done on all three outcomes measures. From the study they concluded that there is very few minimal effect of sustain stretching on reduction of plantar flexors spasticity, but there is significant reduction in passive resistance & improvement in P-ROM. Also there was less change in function outcome measure interpretedby GMFM score (5).

Peter Rosenbaum; et.al., (2006), A report: the definition and classification of cerebral palsy. This

ISSN: 2173-0695

material was authored by the members of the Executive Committee functioning in panels enriched with expertise from consultants and by comments and suggestions from many reviewers responding to drafts provided to the international community. The Definition and Classification of Cerebral Palsy, document is offered for international consensus and adoption, with the intent of providing a broad spectrum of audiences with a common conceptualization about cerebral palsy (1).

Mary Elizabeth Wiley PCS MA PT and Diane L. Damiano PT, PhD, (1998), conducted study on Lower-Extremity strength profiles in spastic cerebral palsy. The maximum voluntary contraction of eight muscle groups in the lower extremities of 15 children with spastic diplegia, 15 with spastic hemiplegia, and 16 age-matched peers was determined using a hand-held dynamometer. Children with spastic diplegia were shown to be weaker than age-matched peers in all muscles tested, as were the children with hemiplegia on the involved side, with strength differences also noted on the uninvolved side. Weakness was more pronounced distally in the groups with CP, and the hip flexors andankle plantar flexors in spastic CP tended to be relatively stronger than their antagonists as compared with the strength ratios of the comparison group. In conclusion, children with spastic CP demonstratequantifiable lower-extremity weakness and muscle imbalance across joints (11).

Paul Coker, (2013), shared views on Kinesio Tape — what is it, what does it do and what's the evidence? When they reviewed kinesiology tape, they gave Rocktape a bit of a hard time. So they thought it was only fair to give a chance to share their views on the topic. Medical Director of Rocktape UK and Physiotherapist Paul Coker had agreedto give the lowdown on all things kinesiology tape. Few people had failed to notice the rise and rise of this often brightly coloured tape. While some people remain skeptical, and doubtful that is nothing more than a passing fad, convinced that all its reported positive effects are down to a heady cocktail of placebo effect and vanity. Others and Mr. Coker included, have seen and felt its unique effects to reduce pain and enhance performance. For many people, at the point they realize their pain/problem feels better when wearing tape (20).

Terence D. Sanger; et.al., (2003), a report on Classification and Definition of Disorders Causing Hypertonia in Childhood. This report described the consensus outcome of an interdisciplinary workshop that was held at the National Institutes of Health in April 2001. The purpose of the workshop and this article was to define the terms "spasticity," "dystonia," and "rigidity" as they are used to describe clinical features of Hypertonia in children. The definitions presented were designed to allow differentiation of clinical features even when more than 1 is present simultaneously. In conclusion, they had provided a set of definitions for the purpose of identifying different components of childhood hypertonia. They encouraged the development of clinical rating scales that are based on these definitions, and they encouraged research to relate the degree of hypertonia to the degree of functional ability, change over time, and societal participation in children with motor disorders (7).

James W. Youdas, et.al., (1993), conducted the study on the Reliability of Goniometric Measurements and Visual Estimates of AnkleJoint Active Range of Motion Obtained in a Clinical Setting. They examined intratester and intertester reliability for goniometric measurements of ankle dorsiflexion (ADF) and ankle plantar flexion (APF) active range of motion (AROM). Parallel-forms intratester reliability for ankle AROM measurements obtained by the universal goniometer (UC) and by visual estimation (VE) and intertester reliability for VE of ADF and APF was examined. Repeated measurements were obtained on 38 patients with orthopedic problems by 10 physical therapists in a clinical setting. For intratester reliability of measurements obtained with l.G, intraclass correlation coefficients (ICC) for all physical therapists were 0.64 to 0.92 (median, 0.825) for ADF and 0.47 to 0.96 (median, 0.865) for APF. Intertester reliability was quantified with use of ICC. ICCs for measurements obtained by UG were 0.28 for ADF and 0.25 for APF; ICC of VE for ADF was 0.34 and was 0.48 for APF. ICC for parallel-forms intratester reliability obtained with UG and VE ranged

ISSN: 2173-0695

from 0 to 0.94 (median, 0.58) for ADF and 0 to 0.X6 (median, 0.625) for APF. Thus, a physical therapist should use a goniometer when making repeated measurements ofankle joint AROM [13].

Richard L. Gajdosik and Richard W. Bohannon, (1987), conducted study on Clinical Measurement of Range of Motion, Review of Goniometry Emphasizing Reliability and Validity. Objective measurements of ROM and correct interpretation of the measurement results can have a substantial impact on the development of the scientific basis of therapeutic interventions. The purpose of this article was to review the related literature on the reliability and validity of goniometric measurements of the extremities. Special emphasis was placed on how the reliability of goniometry influenced by instrumentation and procedures, differences among joint actions and body regions, passive versus active measurements, intratester versus intertester measurements, and different patient types. Discussion of validity encourages objective interpretation of the meaning of ROM measurements in light of the purposes and the limitations of goniometry. They concluded that clinicians should adopt standardized methods of testing and should interpret and report goniometric results as ROM measurements only, not as measurements of factors that may affect ROM [16].

W. L. Minear, (1956), published Special article: a classification of cerebral palsy in Official Journal of the American Academy of Pediatrics. Review of literature reveals confusion in nomenclature and classification in the field of CP. Using as a basis of majority opinion from questionnaires sent to the members of the American Academy for CP during 1953 by the Nomenclature and Classification Committee,the following classification for CP was presented [2].

Chapter 3
Materials And Methods

3.1 Source of Data:

- O. H. Nazar, Ayurvedic College, Surat.
- Sparc Clinic, Surat.

3.2 Study Design:

- Pre and Post Experimental Study

3.3 Sample size:

- The sample size was 20

3.4 Participants:

- Children with Spastic Cerebral Palsy were selected on the basis of inclusion and exclusion criteria.

3.5 Sampling Method:

- Convenient Sampling

3.6 Materials used:

- Informed Consent form
- Data recording sheet
- Kinesio tape
- Universal Goniometer
- Petroleum jelly
- Measuring tape
- Scissor
- Lotion
- Pen

ISSN: 2173-0695

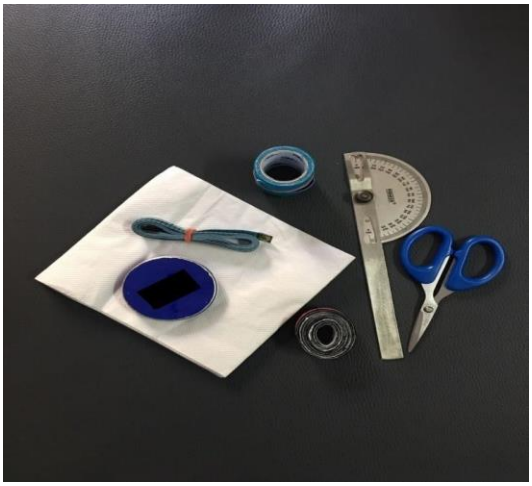


Figure 1: Materials

3.7 Inclusion criteria:

- Age from 1 to 6 years
- Girls and boys
- Children with spastic cerebral palsy
- Child taking treatment since 1 year
- Child with spastic grade 1, 1+ and 2

3.8 Exclusion criteria:

- Child who is not co-operative
- Child with any surgical condition
- Child with any complain of pain
- Child with any skin allergy

3.9 Outcome measures:

The study mainly focused on the children's spasticity and range of motion. The instrument used to measure the ROM is reliable and valid.

- Goniometer (17)

3.10 Procedure:

The study was a pre and post experimental study. 20 Spastic Cerebral Palsy children, aged between 1 to 6 years with spasticity were selected. All parents were signed an informed consent form. All children were assessed and procedure, benefits & potential risk of the study were explained to children's parents before signing the consent form & starting of the treatment session.

Method:

Preliminary measurements and demographic data were taken prior to the study which included age, sex, height and weight. MAS was used to check the spasticity of Plantar Flexors to see whether they can be included in this study or not. Goniometer was used to measure the Range Of Motion for Plantar Flexion and Dorsi Flexion of ankle joint. Then application of Kinesio Tape was done for 48 hours of duration. After 48 hours, removal of Kinesio Tape was done and again range of motion was measured for PF and DF of ankle joint.

Taping Technique:

The area of ankle was washed, dried in the downward direction. Removal of oil was done for better adhesion. The tape was applied with the ankle in neutral position in 4 steps. Strip-1: The first strip of tape was placed from the anterior midfoot stretched approximately to 120% of its maximum length and attached just below the fibular head over the tibialis anterior muscle. Strip-2: The second strip began from the heel and attached medial and lateral heads of gastrocnemius muscle. Strip-3: The third strip originated at the arch and stretched slightly above both the medial and lateral malleolus. Strip-4: The last strip stretched across the anterior ankle, covering both the medial and lateral malleolus. Taping was given for 48 hours. Instruction was given to the parentsthat (1) not to remove

ISSN: 2173-0695

the tape,
(2) don't give any treatment and (3) don't wear any orthotic devices during 48 hours of application. Tape was removed after 48 hours by lubricating the tip with petroleum jelly and slides it parallel to the skin in the natural soft-tissue channels. The skin was checked for damage and if any then applied lotion to restore skin moisture [18].

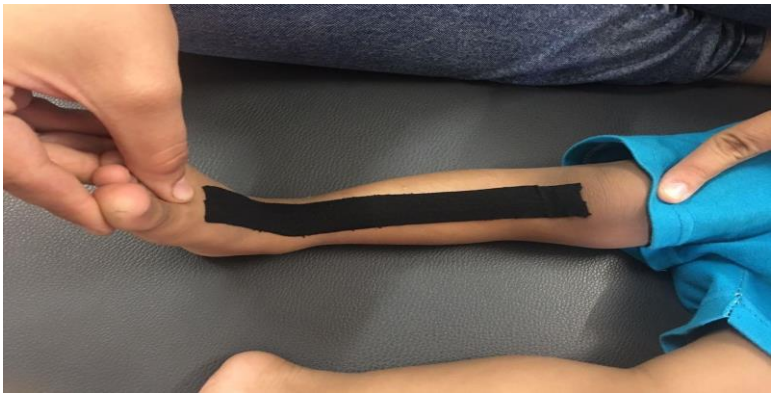


Figure 2: Strip 1

Figure 3: Strip 2

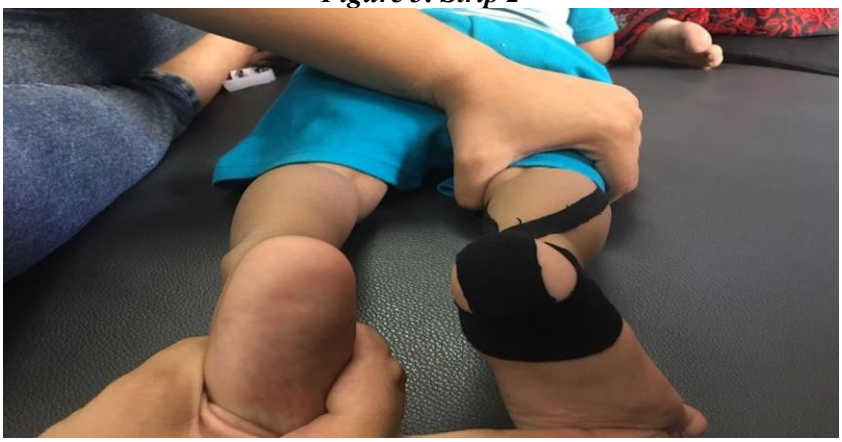


Figure 4: Strip 3

ISSN: 2173-0695

Figure 5: Strip 4

Figure 6: Child with Application of KT

Goniometric Technique (17)

The Range of Motion of the ankle joint was measured by using a Universal goniometer.

Range of motion Measures	**Extremity position**	**Pivot points**	**Stationary Arm Goniometer**	**Movable Arm Goniometer**
Ankle Dorsi-Flexion	Supine	Lateral malleoli	Parallel to long axis of fibula	Parallel to long axis of metatarsal bones
Ankle Plantar-Flexion	Supine	Lateral malleoli	Parallel to long axis of fibula	Parallel to long axis of metatarsal bones

Figure 7: Measuring ROM with Goniometer

ISSN: 2173-0695

BOLETÍN DE LITERATURA ORAL, 11 (2024), PP. 498-516

Chapter 4

Data Analysis And Results

All statistical analysis was performed using SPSS version 16. The paired t-test was used for statistical analysis. This test shows value of pre and post intervention within the group. Results were considered to be significant at $p<0.05$ and confidence interval was set at 95 %.

4.1 Demographic Data:

Table: 4.1.1 Demographic Data of the CP Children (Mean±SD)

Variable	Mean±SD
Age (year)	3.18±1.26
Height (m)	0.94±0.13
Weight (kg)	11.28±2.74
BMI (kg/m^2)	12.86±2.07

Table: 4.1.1 represents Demographic Data which included age (year), height (m), weight (kg) and BMI (kg/m^2) distribution among 20 CP children. Mean±SD were analyzed and values are given in Table.

4.2 Descriptive Statistics:

Table: 4.2.1 Paired samples statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair-1	Pre Left DF	26.10	20	10.01	2.24
	Post Left DF	33.95	20	10.30	2.30
Pair-2	Pre Right DF	28.50	20	11.83	2.64
	Post Right DF	35.95	20	12.08	2.70
Pair-3	Pre Left PF	60.75	20	9.68	2.16
	Post Left PF	51.15	20	9.33	2.09
Pair-4	Pre Right PF	60.90	20	8.77	1.96
	Post Right PF	52.25	20	9.09	2.03

Table: 4.2.1 represents mean and SD of left and right side of DF and PF of CP children. There were increased mean of DF range in both sides right and left in Pair-1 and Pair-2 and there was decreased mean of PF range in both sides right and left in Pair-3 and Pair-4.

Table: 4.2.2 Paired samples-Mean and Standard deviation (SD)

		Paired Differences		
		Mean	Std. Deviation	Std. Error Mean
Pair-1	Pre Left DF – Post Left DF	-7.85	3.08	0.69
Pair-2	Pre Right DF – Post Right DF	-7.45	2.46	0.55
Pair-3	Pre Left PF – Post Left PF	9.60	2.04	0.45

ISSN: 2173-0695

Pair-4	Pre Right PF – Post Right PF	8.65	2.45	0.55

Table: 4.2.2 represents mean and SD of paired samples
The result of this table shows that the mean difference in Pair-1 (Pre Left DF – Post Left DF) was -7.85 and in Pair-2 (Pre Right DF – Post Right DF) were -7.45. This shows that there was increase in Dorsi Flexion ROM after 48 hours of application of Kinesio Tape in Spastic CP children.
The mean difference in Pair-3 (Pre Left PF – Post Left PF) was 9.60 and in Pair- 4 (Pre Right PF – Post Right PF) was 8.65. This shows that there was decrease in Plantar Flexion ROM after 48 hours of application of Kinesio Tape in Spastic CP children.

Table: 4.2.3 Paired samples t-test

					95% Confidence Interval of the Difference	
		t	**df**	**Sig. (2-tailed)**	**Lower**	**Upper**
Pair 1	Pre Left DF – Post Left DF	-11.39	19	.000	-9.29	-6.41
Pair 2	Pre Right DF – Post Right DF	-13.54	19	.000	-8.60	-6.30
Pair 3	Pre Left PF – Post Left PF	21.08	19	.000	8.65	10.55
Pair 4	Pre Right PF – Post Right PF	15.75	19	.000	7.50	9.80

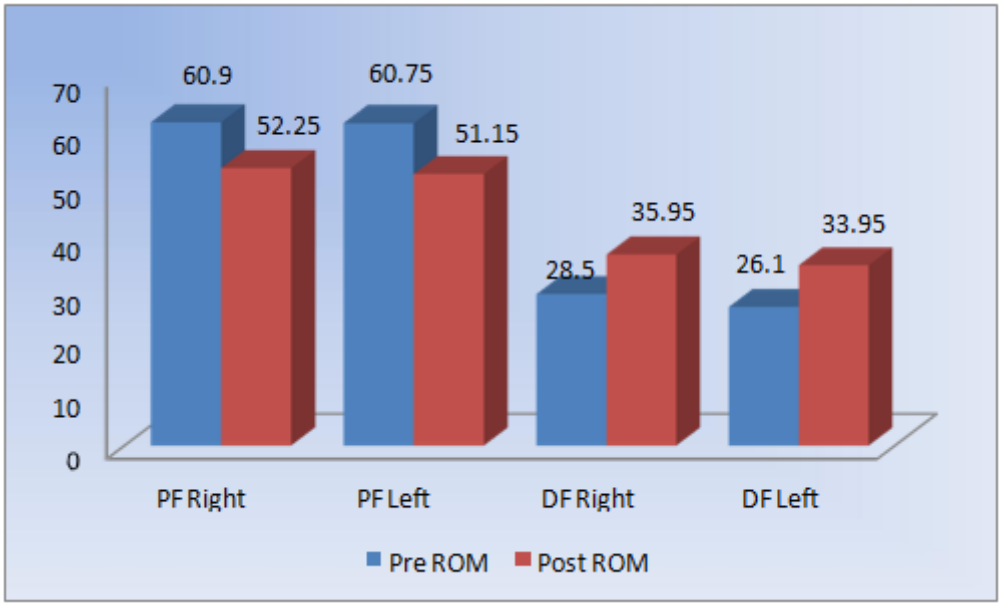
Table: 4.2.3 represents mean comparison of pre and post Dorsi Flexion and Plantar Flexion range of motion of both sides right and left.

The table generated the value of t-statistic.
The t-value for Pair-1 (Pre Left DF – Post Left DF) was -11.39, Pair-2 (Pre Right DF – Post Right DF) was -13.54, Pair-3 (Pre Left PF – Post Left PF) was 21.08 and Pair-4 (Pre Right PF – Post Right PF) was 15.75 with associated significance value $p=0.000$ ($p<0.05$).

Therefore, rejected the null hypothesis, which concluded that there was improvement in ROM of Plantar Flexion and Dorsi Flexion after 48 hours of application of Kinesio Tape among Spastic Cerebral Palsy Children.

ISSN: 2173-0695

Graph



Graph: Mean comparison of Pre and Post Plantar flexion and Dorsi flexion of both sides within the group.

Graph: The value of Pre PF ROM was 60.9 and Post PF ROM was 52.25 which showed that there was decreased PF ROM of right side.
The value of Pre PF ROM was 60.9 and Post PF ROM was 51.15 which showed that there was decreased PF ROM of left side.
The value of Pre DF ROM was 28.5 and Post DF ROM was 35.95 which showed that there was increased PF ROM of right side.
The value of Pre DF ROM was 26.1 and Post DF ROM was 33.95 which showed that there was increased PF ROM of left side.

This concluded that there was improvement in Range of Motion of Plantar Flexion and Dorsi Flexion and decrease in spasticity of Plantar Flexors.

Results:

- Table 4.1.1 showed demographic data which included age, height, weight and BMI distributed among 20 CP children.
- Table 4.2.1 showed that there were increased mean of DF range in both sides right and left in Pair-1 and Pair-2 and there were decreased mean of PF range in both sides right and left in Pair-3 and Pair-4.
- Table 4.2.2 showed mean and SD of paired samples. This showed that there was increase in DF ROM and decrease in PF ROM of both side after 48 hours of application of Kinesio tape in spastic CP children.
- Table 4.2.3 showed mean comparison of pre and post Dorsi Flexion and Plantar Flexion range of motion of both sides right and left. Therefore, rejected the null hypothesis, which concluded that there was improvement in ROM of Plantar Flexion and Dorsi Flexion after 48 hours of application of Kinesio Tape among Spastic Cerebral Palsy Children.
- Graphs showed that there was decrease in PF ROM of left and right both sides and increase in DF ROM of left and right both sides and decrease in spasticity after Pre and Post intervention.

Chapter 5
Discussion

The present study was conducted to determine the effect of Kinesio Taping on Plantar Flexors spasticity after 48 hours of application among Spastic Cerebral Palsy Children between the aged 1 to 6.

ISSN: 2173-0695

The sample size was 20. Goniometer was used to measure the ROM and MAS was used to check the spasticity grade. The aim was to reduce the spasticity and to improve ROM of PF and DF of ankle joint. Cerebral Palsy describes as a group of permanent disorders of the development of movements and posture, causing activity limitation, that are attributed to non progressive disturbances that occurred in the developing fetal or infant brain. Spastic cerebral palsy is the most common type of cerebral palsy. Spasticity is the most common movement disorder of children with cerebralpalsy. Kinesio Tape was used to reduce the spasticity and increase ROM of PF and DF of ankle joint.

Pravin P Gawali; et.al, (5), conducted study on Immediate Effect of Sustain Stretching on Plantar Flexors Spasticity in CP Children. The result of the study showed, there was very few minimal effect of sustain stretching on reduction of plantar flexors spasticity, but there was significant reduction in passive resistance & improvement in P-ROM. Also there was less change in function outcome measure interpreted by GMFM score. The present study concludes that there was no significant reduction of plantar flexors spasticity, but there was significant improvement in the ROM of PF and DF. They used sustain stretching while in present study Kinesio Taping was used which was in contrast to this study.

Evrim Karadag-Saygi; et.al, (21), conducted study on The Role of Kinesiotaping Combined with Botulinum Toxin to Reduce Plantar Flexors Spasticity after Stroke. The study concluded that, there was no clear benefit in adjuvant kinesiotaping application with Botulinum toxin for correction of spastic equinus in stroke. In present study there was significant improvement in the ROM of PF and DF, without any use of Botulinum. The present study was done on CP children instead of stroke patient.

Audrey Yasukawa; et.al, (19), conducted study on investigating the Effects of Kinesio Taping in an Acute Pediatric Rehabilitation Setting. There was improvement from pre- to post- taping which was statistically significant. These results suggested that Kinesio Tape may be associated with improvement in upper extremity control and function in the acute pediatric rehabilitation setting. Inpresent study there was also significant improvement from pre- to post- taping which was statistically significant, but instead of upper extremity, lower extremity was examined and tested.

Akmer Mutlu; et.al, (17), conducted study on Reliability of goniometric measurements in children with spastic cerebral palsy. Inter-test reliability and intra- testing reliability scores were high for all the physiotherapists, the most experienced physiotherapists' results were higher compared with the others. The results from this study encourage the use of goniometric measurements in assessing children with spastic diplegic CP.

James W. Youdas, et.al, (13), conducted the study on the Reliability of Goniometric Measurements and Visual Estimates of Ankle Joint Active Range of Motion Obtained in a Clinical Setting. There was significant result which showed that goniometer was more reliable than visual estimates. Thus, a physical therapist should use a goniometer when making repeated measurements ofankle joint AROM.

So, in present study goniometer was used for measuring the ROM of PF and DF as these both studies showed that goniometer is the most reliable instrument for measuring the ROM.

Richard W. Bohannaon and Melissa B. Smith, (12), conducted study on Interrater Reliability of a Modified Ashworth Scale of Muscle Spasticity. Ratings, based on a Modified Ashworth Scale checked for elbow flexors spasticity, were significantly correlated. This study concluded the reliability and usefulness of a Modified Ashworth Scale for further clinical investigations. In present study, Modified Ashworth Scale was scale is used to measure the ROM of PF and DF.

W. L. Minear, (2), published special article: a classification of cerebral palsy in Official Journal of the American Academy of Pediatrics.

ISSN: 2173-0695

Terence D. Sanger; et.al, [7], gave a report on Classification and Definition of Disorders Causing Hypertonia in Childhood.

Peter Rosenbaum; et.al, [1], published a report: the definition and classification of cerebral palsy.
From these articles, it was concluded that there are many forms of cerebral palsy and rehabilitation of CP children is utmost necessary.

So, in present study, Kinesio Tape was used to improve the PF and DF range of motion of ankle joint and to reduce the spasticity of plantar flexors.

5.1 Clinical Implication:

- Improve range of motion
- Reduce spasticity
- Reduce pain
- Drain swelling
- Facilitate early return to activity or sport
- Improve sporting performance.
- Improve function and posture
- Improve power and strengthening uninjured muscles
- Raise the anaerobic threshold of muscle during endurance activity
- Control joint instability
- Relax an overused muscle

5.2 *Limitation:*

- The study was focused only on the Plantar Flexion and Dorsi Flexion ROM. Eversion and Inversion ROM were not included in the study.
- Only the children with aged between 1 to 6 years were included.
- In this study, MAS was used to check the spasticity. Tardieu Scale can also be used to check the spasticity.
- Study was carried on very less sample size; same study can be done with large sample size to generalized result.

Chapter 6
Conclusion

CONCLUSION

- There was increase in Dorsi Flexion ROM after 48 hours of application of Kinesio Taping in Spastic CP children.
- There was decrease in Plantar Flexion ROM after 48 hours of application of Kinesio Taping in Spastic CP children.
- From the study, we concluded that there was significant improvement in the ROM of PF and DF but there was minimal effect of Kinesio taping on plantar flexors spasticity after 48 hours of application among spastic cerebral palsy children.

6.1 FURTHER SCOPE:

- Eversion and Inversion can be included in the study
- Tardieu Scale can be used to check the spasticity.
- Age group variation can be done.
- Large sample size can be included to generalize the result.

References

1. A report: the defination and classification of cerebral palsy. peter rosenbaun, et.al. 2006.
2. A classification of cerebral palsy. W.L.Minear. 2012.
3. Slaich, Veena. Cerebral palsy. s.l. : Jaypee Brothers .
4. Raj, Glady Samuel. Physiotherapy in Neuro-conditions. s.l. : Jaypee brothers.
5. Immediate effect of sustain stretching on Plantar flexors spasticity in CP children. Pravin P

ISSN: 2173-0695

Gawali, et al. 2016.
6. Physical Rehabilitation. Susan B. O'Sullivan, et al. s.l. : Jaypee Brothers.
7. Classification and Defination of Disorders causing Hypertonia in Childhood.
8. Terence D. Sanger, et al. 2003.
9. Spasticity. Robert R.Young, et al. 1981.
10. Spastic Cerebral Palsy. Albright, A. Leland. 2012.
11. Muscle response to heavy resistance exercise in children with spastic cerebral palsy. Diane L. Damiano, et al. 1995.
12. Lower-Extremity strength profiles in spastic cerebral palsy. Wiley, Mary Elizabeth. 1998.
13. Interrater reliability of a modified ashworth scale of muscle spasticity . Richard W. Bohannon, et al. 1986.
14. Reliability of goniometric measurements and visual estimates of ankle joint active range of motion obtained in a clinical settings. James W. Youdas, et al. 1993.
15. Narayanan, S Lakshmi. Textbook of Therapeutic Exercises. s.l. : Jaypee.
16. Cynthia C. Norkin, et al. Measurement of Joint Motion: A guide to Goniometry. s.l. : Jaypee Brothers.
17. Clinicle measurement of range of motion: Review of goniometry emphasizing reliability and validity. Richard L.Gajdosik, et al. 1987.
18. Reliability of goniometric measurements in children with spastic cerebral palsy. Akmer Mutlu, et al. 2007.
19. The role of Kinesiotaping combined with botulinum toxin to reduce Plantar flexors spasticity after stroke. Evrim Karadag Saygi, et al. 2010.
20. Pilot study: Investigating the effects of Kinesio Taping in an Acute Pediatric Rehabilitation Setting. Audrey Yasukawa, et al. 2006.
21. Kinesio Tape-what is it, what does it do and what's the evidence? Coker, Paul. 2013.

Chapter 1
APPENDIX
APPENDIX A CONSENT FORM

Name of the Participant: Researcher's Name:Dipsa ShahContact No.**9327615409** Address:
I have read the information in this form (or it has been read to me). I was free to ask any questions and they have been answered. I am over 18 years of age and, exercising my free power of choice, hereby give my consent to be included as a participant in **"Effects of Kinesio Taping on Plantar Flexors**

Spasticity After 48 Hours of Application Among Spastic Cerebral Palsy Children".

(1) I have read and understood this consent form and the information, provided to me.
(2) I have had the consent document explained to me.
(3) My rights and responsibilities have been explained to me by the investigator.
(4) I have been advised about the risks associated with my participation in the study.
(5) I am aware of the fact that I can opt out of the study at any time without having to give any reason.
(6) I hereby give permission to the researchers to release the information obtained from me as result of participation in this study to the Sponsors, Regulatory authorities, Government agencies, and Ethics committee.
(7) My identity will be kept confidential if my data are publicly presented. By signing this consent form, I attest that the information given in this document has been clearly explained to me and understood by me.

Signature of Participant:_____Signature of Researcher:Date: _____

ISSN: 2173-0695

APPENDIX C MASTER CHART

Sr. No.	**Age (year)**	**Gender**	**Height (m)**	**Weight (Kgs)**	**BMI**	**Range Of Motion**							
						Plantar Flexion				Dorsi Flexion			
						Right		Left		Right		Left	
						Pre	Post	Pre	Post	Pre	Post	Pre	Post
1	2.5	Male	0.81	8	12.2	70	60	70	60	37	45	25	35
2	4	Male	0.92	12	14.18	65	55	65	55	40	50	30	45
3	2	Female	0.84	11	15.6	60	55	55	50	35	45	30	40
4	3.5	Male	0.94	10	11.32	60	50	65	53	10	17	15	22
5	1.4	Male	0.97	8.5	9.03	45	35	40	32	15	20	20	25
6	2	Male	0.76	7.2	12.46	70	63	75	67	35	40	40	45
7	3	Male	0.85	8	11.07	75	62	65	54	40	47	40	45
8	3	Male	0.96	12	13.02	70	62	65	55	10	20	15	25
9	3	Male	1.02	14	13.46	52	45	60	52	40	52	35	47
10	2	Male	0.83	9	13.06	60	49	65	54	34	40	40	45
11	1.3	Male	0.69	8	16.8	52	46	62	53	35	42	37	44
12	3	Male	1.03	15	14.14	46	40	42	35	15	22	17	25
13	2	Female	0.77	9.4	15.85	54	42	64	52	40	44	25	32
14	4	Male	0.99	14	14.28	54	44	48	37	27	32	14	18
15	5	Male	1	13.5	13.5	71	66	60	52	14	20	15	25
16	6	Female	1.1	15	12.4	65	59	48	38	23	35	24	37
17	4	Male	1.01	13	12.74	54	42	66	52	30	40	25	32
18	5	Male	1.23	16	10.57	60	52	60	50	10	17	10	15
19	4	Male	0.97	12	12.75	65	55	65	55	40	44	25	32
20	3	Male	1.07	10	8.73	70	63	75	67	40	47	40	45

ISSN: 2173-0695