Section: Orthopedics

Original Research Article

ADAPTATION OF THOMAS SPLINT FOR SOUTH INDIAN POPULATION- DESCRIPTIVE STUDY

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Abstract

Background: The aim of this study was to evaluate the adaptation of the Thomas Splint for the South Indian population, focusing on key anatomical measurements, including the oblique thigh circumference and groin-to-heel length. The study also aimed to establish fitting criteria for individualized splint adjustments based on these measurements. **Materials and Methods:** A descriptive study was conducted at the Department of Orthopaedics, Government Medical College (GMC), Palakkad, involving 696 participants over a period of one year. Participants included patients from the Department of Orthopaedics, as well as staff and students from GMC Palakkad. Inclusion criteria consisted of individuals aged 18 years and above, seeking treatment in the orthopaedics department. Exclusion criteria included non-consenting individuals and those with lower limb deformities. Key measurements such as the oblique circumference of the thigh immediately below gluteal fold & ischial tuberosity and the distance from crotch to heel were recorded. Statistical analysis was performed to summarize and identify trends. **Result:** The study found that the largest proportion of participants fell within the 18-30 age group (56.3%), and the gender distribution showed a predominance of male participants (44.4 %). The measurements of thigh circumference and groin-to-heel length provided essential data for determining appropriate Thomas splint sizes. The mean crotch-to-heel length was 80.44 cm with a standard deviation of 7.80 cm, and the mean oblique circumference of the thigh was 64.97 cm with a standard deviation of 9.13 cm. The findings provided a solid basis for sizing adjustments of the Thomas splint. This study provides six sizes of Thomas splints which can be generalised for use in femur fracture stabilisation especially in Indian population. **Conclusion:** This study offers crucial insights into the adaptation of the Thomas Splint size for the South Indian population, demonstrating the importance of accurate measurements for optimal fit. By incorporating individualized measurement-based adjustments, this study contributes to improving splint comfort and clinical outcomes, ultimately enhancing Trauma management.

INTRODUCTION

Huw Owen Thomas (1834–1891) known as the father of British orthopaedics. He developed many splints and appliances, including the Thomas Splint. First recorded in 1890 as a treatment for tuberculosis of the knee joint. [1,2] Only later in 1875 was it used for conservative treatment of isolated femur fractures. Its wider use was implemented in the British army by Sir Robert Jones during the First World War at Level Three facilities.[3] During the First World War, use of Thomas splint was shown to dramatically reduce the mortality of ballistic femoral fractures. Colonel Sir Henry Gray, an RAMC surgeon, noted a reduction in mortality from 80% to 15.6 % during one battle in 1917.[4] Use of Thomas splint for reduction and stabilization of femur fractures is an antiquated yet proven technique. Its significance and advantages are relevant even in modern era. This technique allows for comfortable reduction of the fracture, ease of transport and consideration of further methods of fixation later if thought appropriate. In femoral shaft injuries from Road traffic accidents, the use of the Thomas splint allows early evacuation for internal fixation.[5] Thomas splint continues to be a very effective method of immobilization for shaft of femur

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fractures. The Thomas splint is a cost-effective device, reusable non-invasive, easy to apply.[5] The Thomas splint is an essential piece of equipment in emergency and Orthopaedic units in hospitals worldwide. Its basic design has changed little in 133 years since its description by Hugh Owen Thomas. Various splints which allow traction in shaft of femur fractures have evolved from the original design.[6] Hare traction splints, Sager Traction splints, Kendrick, CT -6, Donaway and Slishman are those. But these splints are not available in our country, and they are expensive and cannot be replicated. Thomas splint too is not readily available in the market. But with its simple design, it can be easily replicated with low cost. Thomas splint need to be made in various standard sizes as it need to match the dimension of limb. Lack of such data about the normal dimensions of limb make the task of replication of Thomas splint difficult. So, this study is to find out the lower limb measurements in Indian population, which may help in standardizing sizes of Thomas splint. Considering Thomas splint as a very essential tool in every Emergency department [6], this study may help in deciding the standard sizes for our population.

MATERIALS AND METHODS

A descriptive study was conducted in the Department of Orthopaedics at Government Medical College (GMC), Palakkad, to evaluate the adaptation of the Thomas Splint for the South Indian population. The study participants included patients reporting to the Department of Orthopaedics, as well as staff and students from GMC Palakkad. A total of 696 participants were selected over a period of one year based on the eligibility criteria, which consisted of individuals aged 18 years and above, those seeking treatment in the Department of Orthopaedics at GMC Palakkad, and staff and students associated with the institution.

Inclusion Criteria

- Patients reporting to the Department of Orthopedics, Government District Hospital, Palakkad
- Staff and students of GMC Palakkad

Exclusion Criteria

- Non-consenting individuals
- Patients with congenital anomalies of the lower limb
- Patients with lower limb amputations
- Patients with hip or knee pathology

The primary objective of the study was to evaluate the adaptation of the Thomas Splint in this specific demography. Lower limb measurements were recorded from the participants, including the oblique circumference of the thigh immediately below the gluteal fold and the ischial tuberosity for patients with shaft of femur fractures. This measurement was equivalent to the internal circumference of the padded ring of the splint. For patients with normal limbs, 5 cm was added to account for any potential swelling. Additionally, the distance from the crotch to the heel was measured, with an extra 15 to 23 cm added to this measurement to account for the length of the inner side of the Thomas splint's bar.

A measuring tape was used for both measurements.

Outcome variables for the study included:

- The oblique circumference of the thigh immediately below the gluteal fold and the ischial tuberosity
- The distance from the crotch to the heel

The study followed ethical guidelines and required informed consent from all participants. Descriptive statistical analysis was applied to summarize the findings and to identify trends in the adaptation of the Thomas Splint for the South Indian population.

RESULTS

[Table 1] Age Distribution

The Age Distribution of participants is detailed in [Table 1] A total of 696 participants were categorized into five age groups. The 18-30 age group accounted for 56.3 % of the total population, with 392 participants. The 31-40 age group had the highest percentage, representing 18.1 % of the participants with 126 individuals. The 41-50 age group also had 83 participants, making up 11.9 % of the study population. The 51-60 age group contributed 7.9 % of the total participants, with 55 individuals. Finally, the 61 and above age group comprised 5.7 % of the participants, amounting to 40 participants.

[Table 2] Gender Distribution

[Table 2] outlines the Gender Distribution of participants. The study had a predominance of female participants, who accounted for 55.6 % of the total sample, totaling 387 individuals. Male participants made up 44.4 % of the sample, with 309 participants. This gender disparity may be reflective of the typical gender distribution in staff and student participants.

[Table 3] Thomas Splint Measurements

[Table 3] presents the Thomas Splint Measurements, which define the sizing criteria based on two factors: the oblique thigh circumference and the groin-to-heel length. The table outlines the six different Thomas splint sizes, ranging from size 1 to size 6. The oblique thigh circumference range for each size is given, with an added 5 cm for the ring circumference, and the groin-to-heel length range is also specified. For example, size 1 has an oblique thigh circumference range of 42-50 cm, with a ring circumference of 55 cm and a groin-to-heel length range of 60-75 cm, which results in an inner side bar length of 90 cm. The increasing sizes reflect larger circumferences and lengths, reaching up to size 6, which accommodates larger limb sizes with a 95 cm ring circumference and an inner side bar length of 115 cm.

[Table 4] Thomas Splint Sizes

[Table 4] provides a simplified breakdown of the Thomas Splint Sizes, detailing the ring circumference and inner side bar length for each size. The ring circumference ranges from 55 cm for size 1 to 95 cm for size 6, and the inner side bar length varies from

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90 cm for size 1 to 115 cm for the larger sizes (size 4-6). This table directly connects the physical characteristics of the splint with its intended use, offering a clear guideline for fitting based on the participant's measurements.

[Table 5] Measurements Recorded

[Table 5] presents a summary of the measurements recorded for the study, including mean values and ranges for several critical dimensions. The oblique circumference below the gluteal fold & ischial tuberosity (measuring thigh circumference) has an average value of 64.97cm, with a range of 42 to 95 cm. The distance from crotch to heel, which reflects the length measurement for the splint, has an mean of 80.44 cm, with a range from 59 to 102 cm. An additional 5 cm was added for swelling in participants with normal limbs, and 15 cm was added to the crotch-heel distance to account for the length of the Thomas splint's inner side bar, with a range of 15 to 23 cm.

These statistics help quantify the variation in measurements within the study group, providing valuable insights for customizing splint sizes for individual participants.

Table 1: Age Distribution.

Category	Count	Percentage (%)
18-30	392	56.3
31-40	126	18.1
41-50	83	11.9
51-60	55	7.9
61 and above	40	5.7

Table 2: Gender Distribution

Gender	Count	Percentage (%)
Male	309	44.4
Female	387	55.6

Table 3: Thomas splint measurements

Thomas splint Sizes	Oblique thigh circumference range (cm)	Thomas splint ring circumference (oblique thigh circumference + 5 cm)	Groin to heel length range (cm)	Thomas splint inner side bar length (Groin to heel length range + 15 cm)
1	42 – 50	50+ 5 = 55	60-75	75+ 15= 90
2	42 – 50	50+ 5= 55	76-90	90+ 15= 105
3	51 - 60	60+ 5= 65	60-90	90+ 15= 105
4	61-70	70+5= 75	70-100	100+15= 115
5	71-80	80+5= 85	70-100	100+15= 115
6	81-90	90+5= 95	65-100	100+ 15= 115

Table 4: Thomas splint Sizes

Thomas splint Sizes	Thomas splint Ring circumference	Thomas splint Inner side bar length
1	55	90
2	55	105
3	65	105
4	75	115
5	85	115
6	95	115

Table 5: Measurements Recorded

Variable	Measurement Type	Mean Value (cm)	Range (cm)
Oblique Circumference Below Gluteal Fold & Ischial Tuberosity	Thigh circumference	64.97 +/- 9.13	42 to 95
Distance from Crotch to Heel	Length measurement from crotch to heel	80.44 +/- 7.80	59 to 102
Length Added for Swelling (Normal Limbs)	Added to thigh circumference	5	-
Length Added for Splint Bar (Thomas Splint)	Added to crotch-heel distance	18	15 to 23

Thomas splint Design

Thomas Splints are made from 8mm mild steel with a chromium finish. Padded oval metal ring, covered with soft leather to which attached inner and outer side bar [3][Fig 1].These side bars which exactly bisect the oval ring , are of unequal length so that the padded ring is set at an angle of 120 degrees to the inner side bar[3]. At the distal end the two bars are joined together in the form of a 'W'. Outer side bar is often angled out 2 inches (5 cm) below the padded ring, to clear a prominent greater trochanter [3].

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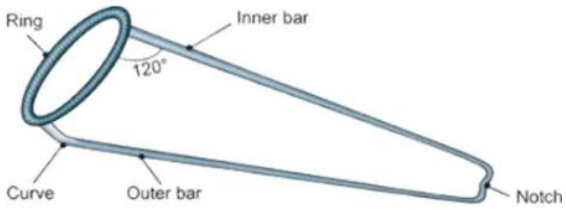

Fig (1)-Thomas splint

DISCUSSION

The results of this study offer valuable insights into the adaptation of the Thomas Splint for the South Indian population.

The Age Distribution of this study revealed that the largest proportion of participants fell into the 18-30 age group (56.3%), followed by the 31-40 group (18.1 %). Students and staff of the institution were participants of this study, which may explain the predominance of young age group. There is higher ratio of female participants in this study (55.6%). This gender disparity mirrors the female predominance among staff and students of the institution.

The Thomas Splint Measurements outlined in this study provide critical sizing information, which is essential for ensuring the appropriate fit for patients. [7]. These measurements were based on the oblique thigh circumference and groin-to-heel length [3].

The Thomas Splint Sizes used in this study provide a breakdown of ring circumference and inner side bar length for each splint size. The measurements recorded in this study—such as the Oblique Circumference Below the Gluteal Fold and Ischial Tuberosity highlight important dimensions for proper splint fitting. Mean oblique thigh circumference is 64.97 cm and mean groin-to-heel length is 80.44 cm. This study provides six sizes of Thomas splints which can be generalised for use in femur fracture stabilisation especially in Indian population. This can be used as a reference value for making the appropriately sized Thomas splints for Indian population.

CONCLUSION

In conclusion, this study provides valuable insights into the adaptation of the Thomas Splint for the South Indian population, focusing on key measurements such as oblique thigh circumference and groin-to-heel length. The measurement data supports the need for individualized adjustments to optimize splint fit, ultimately improving clinical results in trauma management. Thomas splint is an essential armamentarium in every emergency department. This study may guide in arranging the appropriate sizes in Emergency Departments

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