

**COMPUTED TOMOGRAPHIC ANALYSIS OF THORACIC
SPINE FOR EVALUATION OF SAFE LENGTH AND SAFE
TRAJECTORY FOR ANTERIOR AND POSTERIOR SCREW
INSTRUMENTATION**

DISSERTATION SUBMITTED TO

THE TAMILNADU DR. M.G.R MEDICAL UNIVERSITY

IN THE PARTIAL FULFILMENT OF THE REQUIREMENT FOR

THE AWARD OF DEGREE OF

MASTER OF CHIRURGIE - BRANCH – II

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MADURAI MEDICAL COLLEGE, MADURAI

THE TAMILNADU DR.M.G.R. MEDICAL UNIVERSITY

CHENNAI, TAMILNADU

CERTIFICATE

This is to certify that this dissertation entitled submitted by **Dr.Pragadhees R** to the faculty of Neurosurgery, The Tamil Nadu Dr. M.G.R Medical University, Chennai in the partial fulfilment of the requirement in the award of degree of **MASTER OF CHIRURGIE IN NEUROSURGERY, Branch – II**, for the **August 2014** examination is a bonafide research work carried out by him under our direct supervision and guidance.

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DECLARATION

I, **Dr Pragadhees R** solemnly declare that the dissertation titled **“COMPUTED TOMOGRAPHIC ANALYSIS OF THORACIC SPINE FOR EVALUATION OF SAFE LENGTH AND SAFE TRAJECTORY FOR ANTERIOR AND POSTERIOR SCREW INSTRUMENTATION”** has been prepared by me under supervision of Professor and Head of the Department of Neurosurgery, Madurai Medical College and Government Rajaji Hospital, Madurai between 2011 and 2014.

This is submitted to The Tamil Nadu Dr. M.G.R Medical University, Chennai, in partial fulfilment of the requirement for the award of **MASTER OF CHIRURGIE, M.Ch., NEUROSURGERY**, degree examination to be held in **AUGUST 2014**.

Place: Madurai

Date:

Dr Pragadhees R

This is to certify that the dissertation entitled **“COMPUTED TOMOGRAPHIC ANALYSIS OF THORACIC SPINE FOR EVALUATION OF SAFE LENGTH AND SAFE TRAJECTORY FOR ANTERIOR AND POSTERIOR SCREW INSTRUMENTATION”** is a bonafide work done **Dr Pragadhees R, Madurai Medical College** in partial fulfilment of the University rules and regulations for award of **MASTER OF CHIRURGIE IN NEUROSURGERY, Branch – II** under my guidance and supervision during the academic year 2011 - 2014

Name & Signature of the Guide

Name & Signature of the Head of Department

Name & Signature of the Dean

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I thank my colleagues, family, friends and well-wishers for their unequivocal support they gave me during this process.

I owe my prayers to The Lord, who gave me the inner strength to complete this work.

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INTRODUCTION

Instability is the abnormal response of spine caused by excessive motion of segments to applied load. Instability of thoracic spine occurs due to many causes. Instability is stabilised by instrumentation of spine. Spinal instrumentation is implantation of artificial devices which are attached to vertebral column. These implants provide spinal stability at unstable segment and promote bony fusion at unstable segment.

Instrumentation of thoracic spine is done either anteriorly or posteriorly sometimes combined depending upon the columns of vertebra involved. Three column described by Denis et al³, two column by Holdsworth⁶.

Anterior instrumentation first reported by Humphries and Hawk in 1958 for Pott's disease. Anterior instrumentation is done through thoracotomy or thoracoscopy. Instrumentation devices are screws with rods, plates or cables. Screws are inserted into vertebral body and are connected to construct.

Posterior instrumentation uses wire-rod, hook-rod or screw-rod construct. Because of advantages such as stabilisation of all the columns, no need for intact posterior elements and biomechanically superior screw-rod constructs are popular. Posterior screw instrumentation techniques are pedicular described by Roy-Camille²⁰ in 1970 and extrapedicular by Dvorak et al⁴ in 1993.

In both anterior and posterior instrumentation screws are used along with rods or plate construct. During insertion of screws there are chances of screws violating the vertebral body or pedicle causing injury to surrounding neural, vascular structures and internal organs causing permanent and/or life threatening complication

During pre-operative planning CT thoracic spine should be done for measurement of safe length and safe trajectory

This study is an attempt to evaluate safe placement of anterior and posterior screws by computed tomography analysis of length and trajectory for thoracic spine in patients who underwent CT Thorax or thoracic spine in GOVERNMENT RAJAJI HOSPITAL, MADURAI MEDICAL COLLEGE, MADURAI.

AIM & OBJECTIVE

- ❖ To determine the safe length and safe angle for anterior and posterior screw instrumentation in thoracic spine using CT Thorax / CT Thoracic spine in our population.

REVIEW OF LITERATURE

Embryology

The vertebral column develops from the condensation of mesoderm on either side of notochord known as paraxial mesoderm. Initially the pair of paraxial mesoderm is unsegmented. Then segmentation of paraxial mesoderm forms somites. During differentiation somite divides into sclerotome, which forms rudimentary centrum and neural arch and dermatomyotome, which forms dermis and paraspinal muscles. Sclerotomic fissure divides sclerotome into cranial and caudal part. Caudal part of one segment fuses with subsequent segment cranial part forming definitive centrum. Mesenchymal condensation round sclerotomic fissure forms perichordal disc, future intervertebral disc which has nucleus pulposus of notochord origin and annulus fibrous of mesenchymal origin.

Costal element that arise from centrum forms ribs

Anatomy

Thoracic vertebra parts

- Vertebral body
- Pedicle
- Lamina
- Neural arch – pedicle and lamina

- Vertebral canal is bounded by posterior aspect of body anteriorly and neural arch posteriorly
- Spinous process is from junction of laminae, passing downwards and backwards
- Transverse process is from junction of pedicle and lamina, passing laterally
- Articular process - superior and inferior
- Vertebral notches – superior and inferior
- Adjacent vertebrae join to form intervertebral foramina through which segmental spinal nerve exits.

Thoracic vertebrae are twelve in number which are divided into typical and atypical vertebrae, on the basis of shape of vertebra, presence of costal facets and orientation of pedicle, laminae, articular process, etc.

Second to eight vertebrae are typical. 1st, 9th, 10th, 11th, 12th are atypical.

Ligaments of thoracic vertebral column

- Anterior longitudinal ligament extends from atlas to sacrum, attaches to anterior surface of disc and vertebral body. Lateral margin merges with periosteum.
- Posterior longitudinal ligament attaches to posterior surface of disc and adjacent margins of vertebral bodies.

- Ligamentum flavum is yellow, elastic and strong ligament, attached to lamina of adjacent vertebrae.
- Interspinous ligament unites margins of adjacent spine.
- Supraspinous ligament is continuation of posterior aspect of interspinous ligament, attaches to posterior aspect of spine.

Arterial supply is from segmental artery or equivalent. Nutritional vessels reach each vertebra through anterior central, posterior central, prelaminar and postlaminar branches¹⁹.

Motion segment

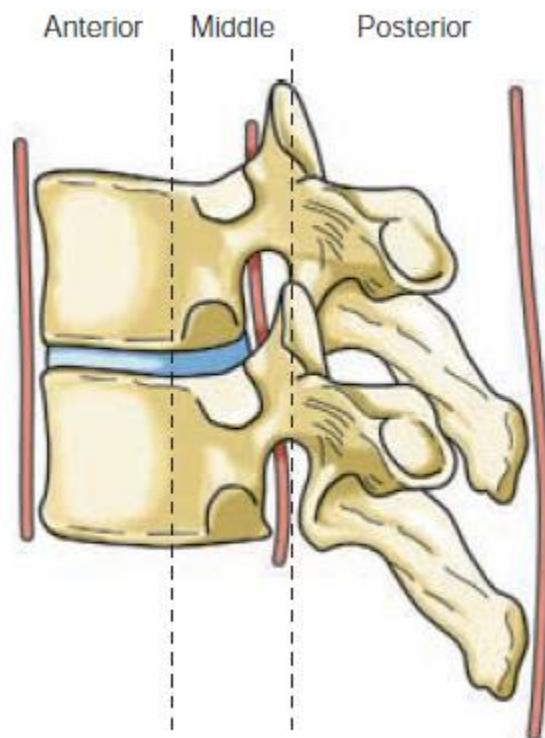
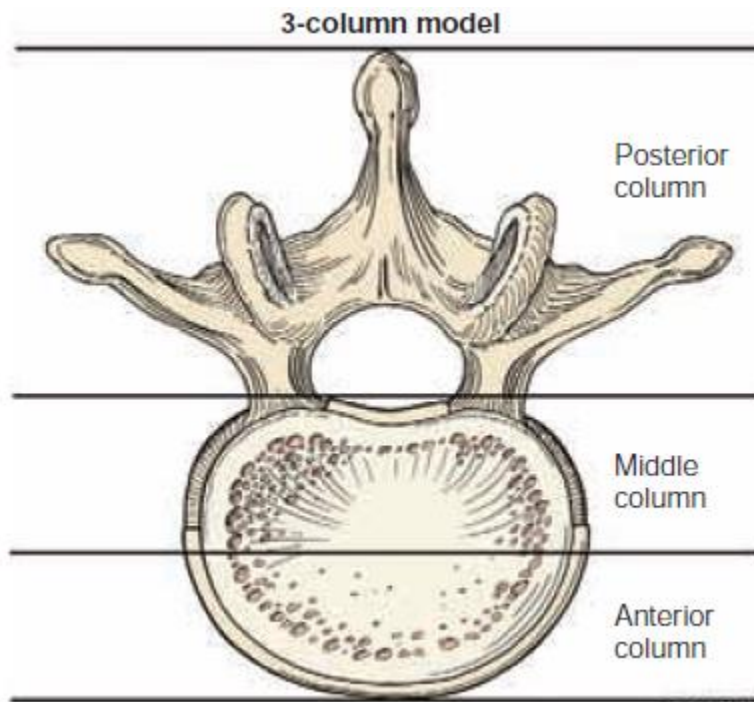
Motion segment is also known as functional spinal unit. It consists of two adjacent vertebra and soft tissue intervening between two vertebra.

Instability is defined biomechanically by White and Panjabi²⁶

Loss of ability of spine to maintain pattern of displacement under physiological loads, so there is no major deformity, no initial or additional deficit and no incapacitating pain.

Column concept

Holdsworth⁶ revolutionised the thoracic spine injury concept by introduction of column concept. Two column concept by Holdsworth was expansion of the Nicoll's system.



Three column concept by Denis

- Anterior column: vertebral body and disc.
- Posterior column: posterior ligament complex and facet joint

With CT scan, Denis³ made modification of Holdsworth 2 column concept into three column concept.

- Anterior column: anterior part of vertebral body, anterior annulus, anterior longitudinal ligament.
- Middle column: posterior half of vertebral body with annulus and posterior longitudinal ligament.
- Posterior column: posterior ligamentous complex with osseous posterior elements.

AO Classification:

AO/ASIF classification is introduced by Magerl et al¹⁴ in 1994, which is based on Holdsworth two column concept

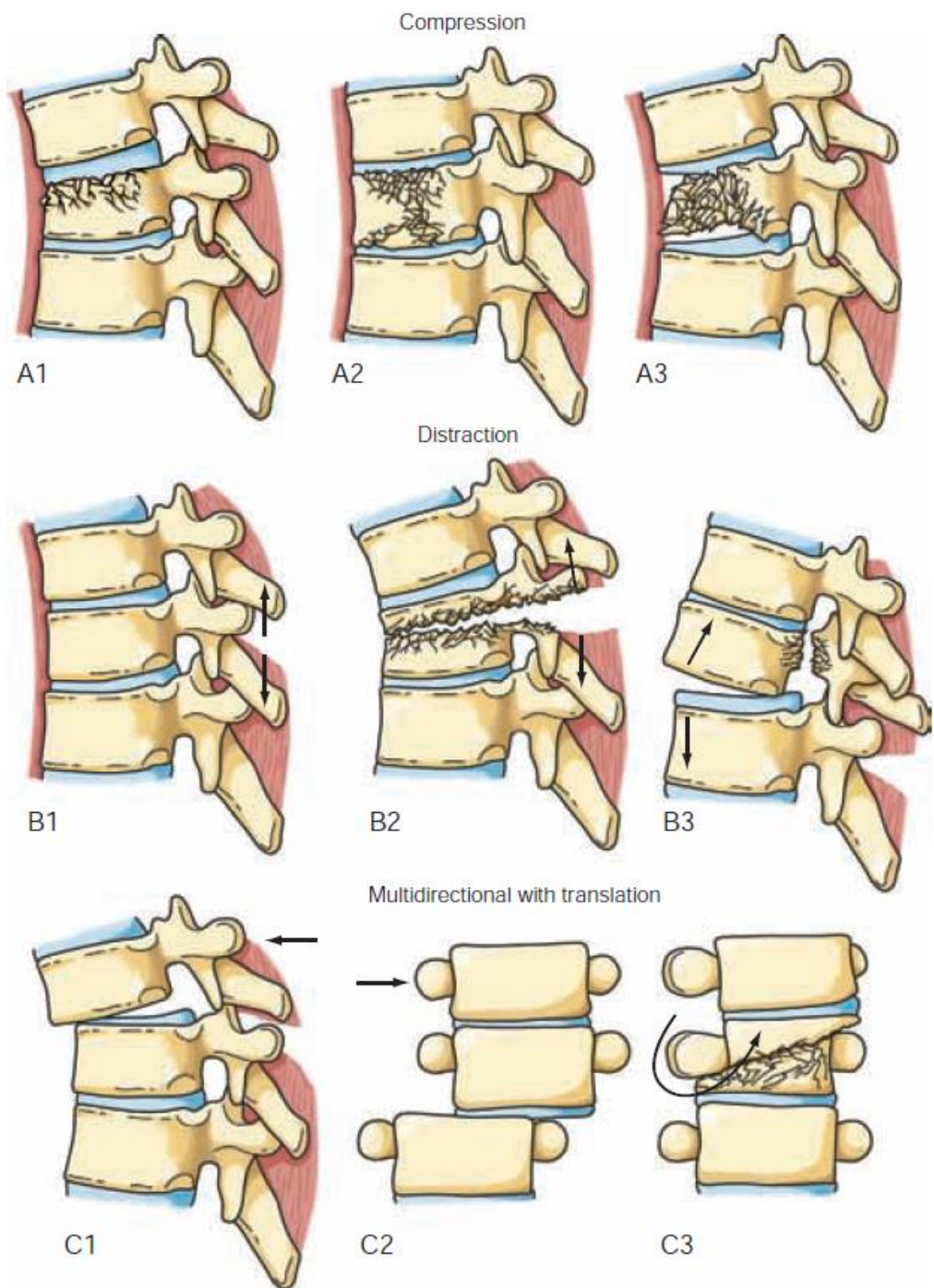
Type A: compression injury

Type B: distraction injury

Type C: rotational injury

Spinal instrumentation

Surgical treatment for instability is by promoting bony fusion to correct pathological instability at affected level. Bony fusion is achieved with



AO classification by Magerl

immobilisation. Immobilisation is done with orthotic internal fixation. Advantage of internal fixation is early mobilisation.

The goals of fixation are to reconstruct columns that are compromised, with motion segment using metallic or non-metallic materials to afford stabilisation and immobilisation until bony fusion develops²⁹.

Cantilever beam

Cantilever beam is the most common construct for spinal immobilisation especially at bone screw interface. Cantilever beam is a rigid beam supported only at one end

In rod-screw cantilever, screw and rod act as cantilever. Screw attached to vertebral body act as bone screw cantilever. Rod attached to screw act as screw-rod cantilever²¹.

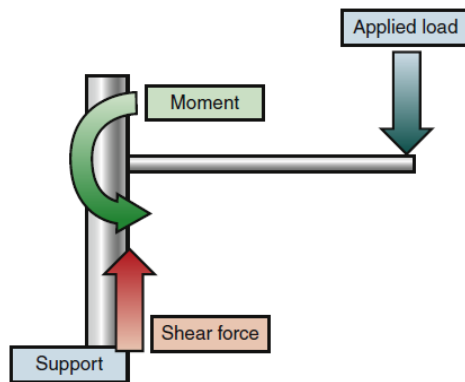
Screw

Screw forms important part in spinal instrumentation. Screw has

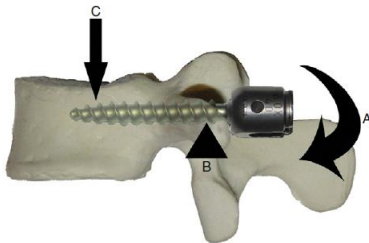
- Head
- Shaft
- Threaded portion
- Diameter - major and minor diameter.

Screw pull-out strength depends on

Cantilever Beam Fixation

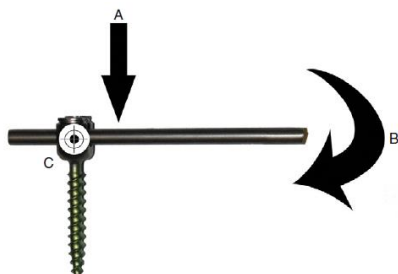


Idealised Cantilever beam



Bone-Screw interface

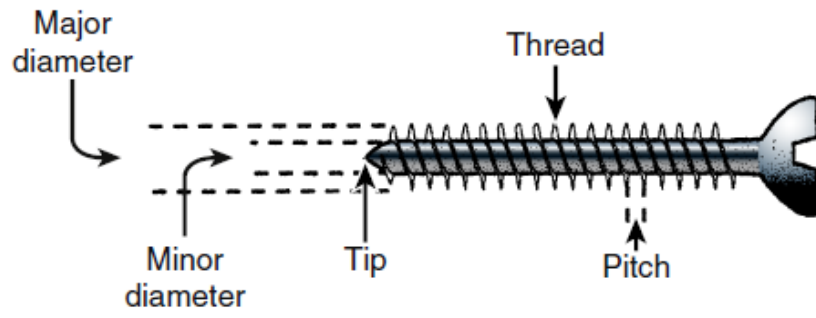
A- Moment, B- Fulcrum, C- Proportional resistive Force



Screw-Rod interface

A- Shear Stress, B- Bending Moment, C-Screw-Rod interface

Screw



- Screw-bone interface
- Quality of bone
- Depth of screw inserted into bone
- Screw major diameter

Instrumentation of thoracic spine

- Anterior instrumentation
- Posterior instrumentation
- Combined

Anterior instrumentation

History

In 1958, Hawk and Humphries published reports on ventral instrumentation for Pott's disease through transperitoneal debridement. In 1970, Dwyer screw-cable construct and Zielke screw-rod construct were introduced. In late 1970, Dunn double rod double screw construct was developed which had superior stability over previous constructs³⁰.

Indications:

Instability due to following conditions

- Neoplasm
- Trauma

- Infections
- Deformity and degenerative conditions

Approaches to thoracic spine for anterior instrumentation

- Trans-sternal approach
- Lateral extracavitary approach
- Retropleural thoracotomy
- Transpleural thoracotomy
- Thoracoscopic approach

Biomechanical consideration

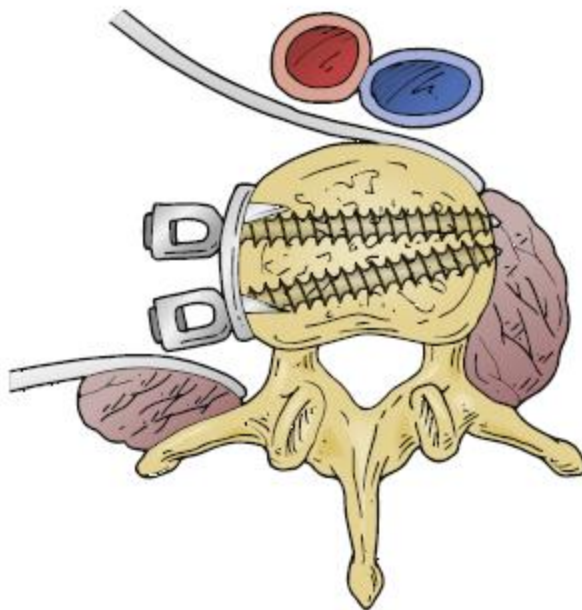
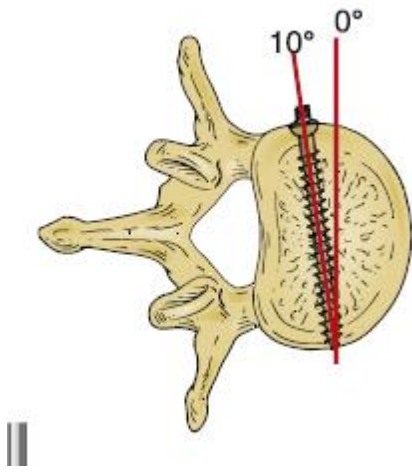
The most resistance to loading in axial direction is provided by anterior and middle columns. So spinal instability and kyphotic deformity occurs in destruction of anterior and middle column. Anterior and middle columns are optimally reconstructed with ventral approach.

Instrumentation

The basic principle for insertion of rod and plate constructs is same. In both systems instrumentation is done on ventrolateral aspect of body. Instrumentation is done to stabilise reconstruction model²⁹.

In all types of anterior instrumentation, screw is inserted into ventrolateral aspect of vertebral body. During screw instrumentation into ventrolateral aspect, screw is directed anteriorly to avoid entry of screw into

Dorsal Bolt Trajectory



10 degrees away from the Spinal Canal

spinal canal and causing neurological deficit, because of concave shape of spinal canal in anterior aspect of spinal canal (posterior cortex of vertebral body). Screw insertion point is anterior to posterior superior aspect of vertebral body 4 to 5mm. Vertebral body has outer cortical bone and inner cancellous bone. Pre-operative CT scan of thoracic spine is necessary to estimate screw length, because bicortical purchase has maximum stability as compared to unicortical purchase³⁰.

Recent research on single screw, as used in thoracoscopic approach and two screws construct by biomechanical means showed no statistically significant³⁰.

Complication

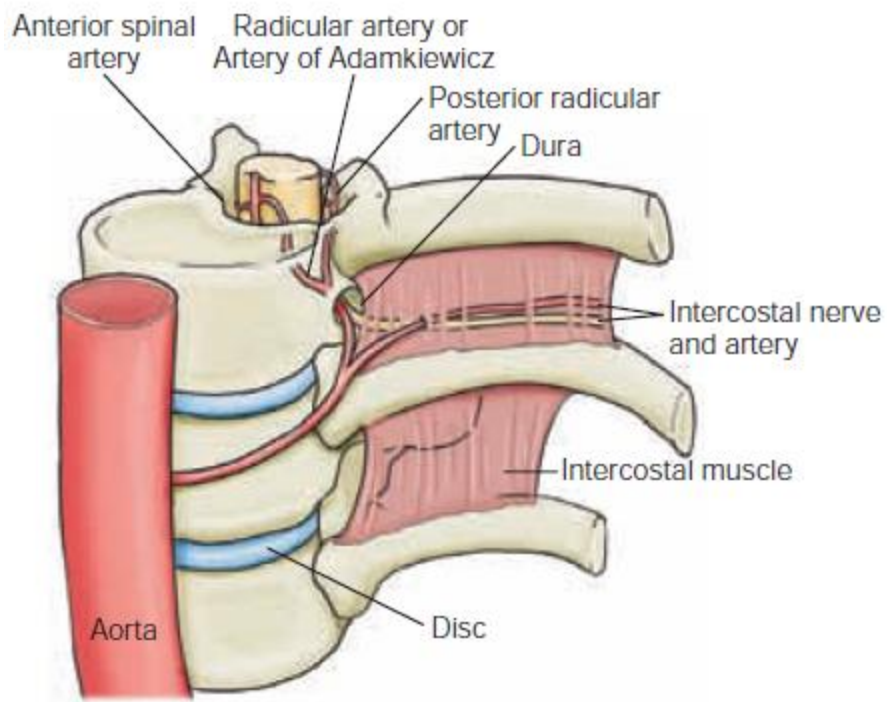
- Injury to internal organs
- Injury to great vessels
- Injury to spinal cord
- Instrumentation failure

Artery of Adamkiewicz

The largest feeder of lumbar cord usually located left and enters the spinal canal through intervertebral foramina anywhere from T9 – T11. Injury to the artery causes neurological deficit².

So during anterior spinal surgeries

Artery of Adamkiewicz



- Segmental spinal arteries are ligated only as necessary to gain exposure
- Segmental spinal arteries are ligated near aorta
- Segmental arteries are ligated on one side only
- Limit dissection around foramina to one level

Posterior screw instrumentation²²

- Pedicle screw fixation
- Extrapedicular screw fixation

Pedicle screw fixation

History

Boucher¹ was the first person to use pedicle screw. In 1963 Roy-Camille²⁰ used pedicle screw in thoracic spine.

Biomechanically pedicle screw fixation system is superior to other construct by Panjabi et al.

Pedicle screw is inserted into vertebral body through pedicle. So during pedicle screw instrumentation, screw traverses through all the three column and rigidly stabilises all the columns. The pull strength of the screw is related to bone density and is increased by convergent screw trajectory as it increases screw insertion length.

Indications:

Thoracic pedicle screw positioning



Exrtapedicular and Intrapedicular Screw Trajectory

Instability due to trauma, tumour, infection, degenerative process

Scoliosis and deformity correction

Advantages:

- More secure than other construct
- Stability in 5 planes of motion
- To achieve stabilisation at instability level fewer motion segments are incorporated.
- Multidirectional corrective forces are applied to pedicle screw for correction of deformity
- No need for intact posterior elements for pedicle screw fixation
- Avoids instrumentation placement in spinal cord as in hooks and sublaminar wires

Disadvantage

- Steep learning curve
- Caudal penetration causes nerve root injury
- Medial penetration causes durotomy
- Requires extensive muscle dissection before instrumentation
- Lengthy operating time with increased risk for infection and blood loss
- Adjacent segment degeneration

Pedicle anatomy²⁴

Pedicle is a cylindrical, strong & anatomical bridge between posterior elements and vertebral body. Pedicle is composed of inner core of cancellous bone surrounded by outer shell of cortical bone.

Throughout vertebral column angulation and size of pedicle varies. The transverse pedicle angle or angulation in coronal plane decreases from T1 downwards.

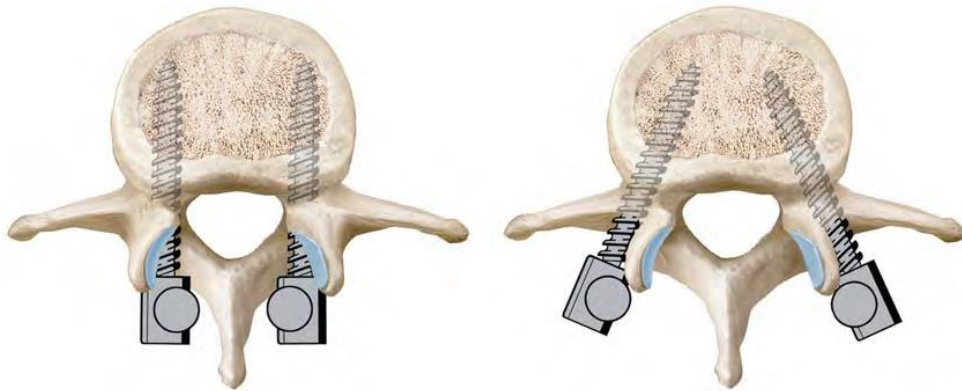
Screw insertion

During pedicle screw insertion, lateral view is useful to assess the depth of screw penetration into vertebral body. Screw penetration of 50 to 80% of AP diameter of vertebral body is sufficient. Beyond 80% penetration of body on lateral view, ventral penetration of cortex is suspected because of convex shape of ventral aspect of vertebral body²².

Complication

- Misplaced screws
- Neurological injury
- Pedicle fracture
- CSF leakage
- Infection
- Retroperitoneal injury

Pedicle screw positioning



Convergent screw trajectory increases the pull-out strength and overall stability of pedicle screw construct in comparison with parallel screw insertion

- Implant failure

Pedicle violation

Postoperative CT thoracic spine is useful Pedicle violation grading⁵

- Grade I: screw within pedicle
- Grade II: screw violates lateral border of pedicle, but tip within body of vertebra
- Grade III: screw tip breaches either anterior or lateral cortex of vertebral body
- Grade IV: screw violates medial border or lateral border
- Grade V: screw penetrates vertebral body or breaches pedicle and endangers nerve root, spinal cord, or great vessels

Grading of pedicle screw insertion¹⁰

- Grade I: pedicular cortex replaced by screw
- Grade II: screw extends less than 2 mm from pedicular cortex
- Grade III: screw extends more than 2mm from pedicular cortex

Extrapedicular screw instrumentation²³

In 1993, Dvorak et al⁴ described extrapedicular screw instrumentation

Indication

- Hyperkyphosis
- Congenital /acquired kyphotic deformity
- Fracture stabilisation
- Scoliosis
- Instability after Tumour removal

Contraindication

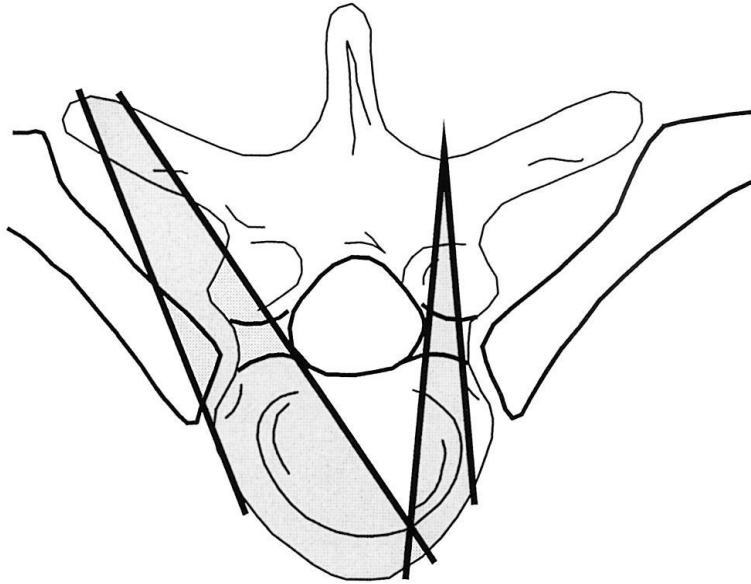
- Severe rotation
- Dysplasia around screw insertion zone
- Fixed deformity

Advantages^{8, 25, 27}

- Decreased risk to spinal canal due to increased distance
- Multiple cortex penetration improves fixation
- Pull-out strength of screw is increased due to long screw and due to large diameter of screw
- Higher variability of angle of insertion

Screw insertion⁷

The entry point is transverse process tip, then through rib-pedicle unit into lateral cortex of vertebral body



Boundaries for safe pedicular screw placement in the thoracic vertebra using an extrapedicular approach (left) and an intrapedicular approach (right). The extrapedicular technique allows greater flexibility in the selection of the screw entry point

Grading of Extrapedicular screw insertion^{10, 25}

- Grade I: screw within rib-pedicle unit
- Grade II: less than 2mm violation of rib-pedicle unit medially
- Grade III: screw penetration more than 2mm into spinal canal.

Complication same as pedicle screw insertion but in less degree

Salvage option

Extrapedicular screw instrumentation is used as alternative, if pedicle screw placement is anatomically not possible²⁸.

Combined:

In presence of comminution of anterior column along with involvement of posterior column, posterior stabilisation alone lead to early failure¹⁵. Therefore anterior stabilisation is done in addition to posterior stabilisation either in one stage or two stages. If two stages, first posterior followed anterior surgery.

MATERIAL AND METHODS

Totally 100 patients of which 50 male and 50 female patients were included in my study, who underwent CT thorax / CT thoracic spine for evaluation of suspected thorax / thoracic spine lesion due trauma, infections, malignancy or degenerative process. This study was conducted in Department of Neurosurgery and Department of Radiodiagnosis, Madurai Medical College, Madurai during 2013 – 2014.

Inclusion criteria:

- Age greater than 18 years
- Agreed to participate in the study and sign the consent form
- All CT Thorax / Thoracic spine studies done in patient with suspected Thoracic injury / Thoracic lesion

Exclusion criteria:

- Patient refuses to participate in the study
- Patient with thoracic spine spondylotic changes
- Patient with thoracic spine inflammatory changes
- Patient with thoracic spine fracture
- Patient with thoracic spine dislocation
- Patient with thoracic vertebral body destruction

All CT studies that satisfied inclusion criteria with slice thickness of 5mm were evaluated. CT scans were viewed with 32-bit research version Osirix application in Apple Macintosh computer. Thoracic spines from T1 to T12 were analysed from both sides for anterior instrumentation and both sides for posterior instrumentation.

Axial views are analysed for measurement of length and angle. Multiplanar reconstruction mode is used to precisely locate the vertebral level.

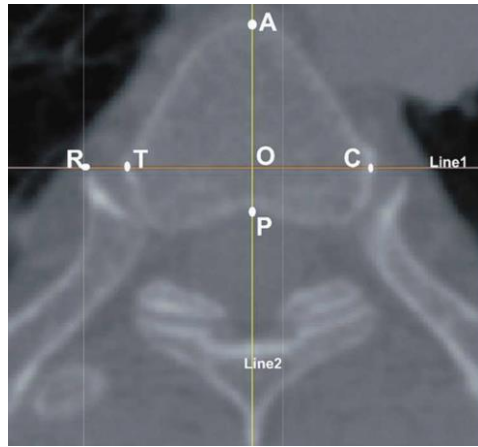
Instability of thoracic spine is stabilized by anterior, posterior instrumentation, or both. In both anterior and posterior instrumentation spinal cord, major vascular structures such as aorta and IVC are at risk due to close proximity to thoracic spine. So during instrumentation length and trajectory are important to avoid neurologic and vascular injury. In this study my aim is to define length of screw and angle of screw for safe anterior and posterior screw instrumentation

For anterior instrumentation, Transverse dimension and vertebral angle are measured

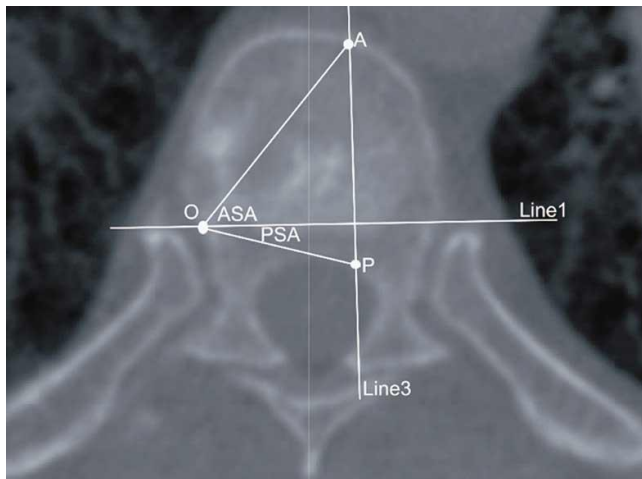
Transverse dimension:

Distance from rib head anterior border to vertebral body lateral cortex

Posterior safe Angle:



Transverse Diameter



PSA- Posterior Safe Angle

Angle subtended by line which connects anterior convex aspect of the rib heads with a line connect most concave antero-lateral aspect of vertebral canal to anterior convex aspect of the rib

For posterior instrumentation, pedicular chord length, extrapedicular cord length, pedicular angle and extrapedicular angles are measured.

Pedicular Chord Length:

Distance from transverse process lamina junction to anterior convex cortex of vertebral body along the long axis of pedicle

Extrapedicular Cord Length:

Distance from costo-transverse joint to anterior convex cortex of vertebral body through rib-pedicle unit

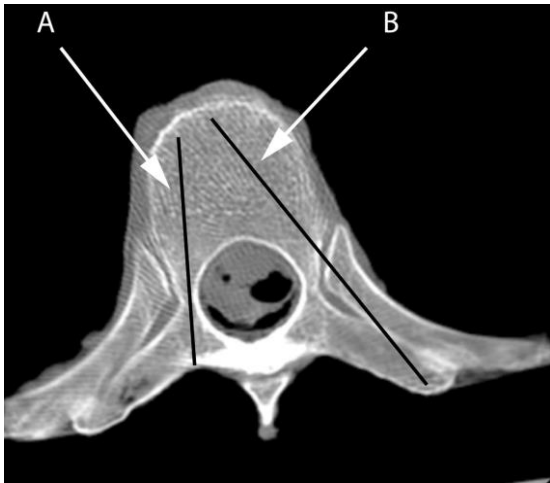
Pedicular Angle:

Angle subtended by line bisecting vertebral canal in AP direction at its midpoint with line along pedicular chord length

Extrapedicular Angle:

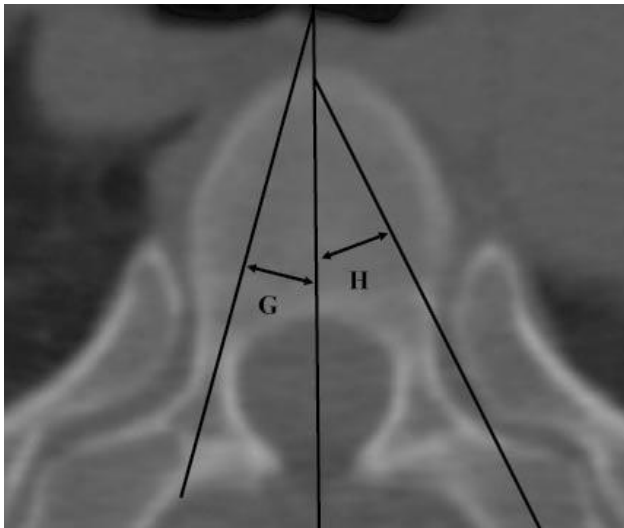
Angle subtended by line bisecting vertebral canal in AP direction at its midpoint with line along pedicular chord length

With these parameters, length of screw and angle of screw for safe anterior and posterior screw instrumentation were measured.



Chord Length

- A- Pedicular Chord Length
- B- Extrapedicular Chord Length



Angle

- G- Pedicular Angle
- H- Extrapedicular Angle

Master chart was used to register the information collected regarding length and angle for safe anterior and posterior instrumentation. Data analysis was done using computer software EPIDEMIOLOGICAL INFORMATION PACKAGE (EPI 2002).

Using this computer software Mean, Standard Deviation and p-value by student t-test were computed at each level for all the twelve thoracic vertebra on both sides for all the 50 male and 50 female patients.

RESULTS

In this study, transverse diameters, posterior safe angle for anterior screw instrumentation and pedicular chord length, extrapedicular chord length, pedicular angle, extrapedicular angle were measured. Mean and Standard deviation and p-value results were computed and analysed for statistical significance.

Sex distribution:

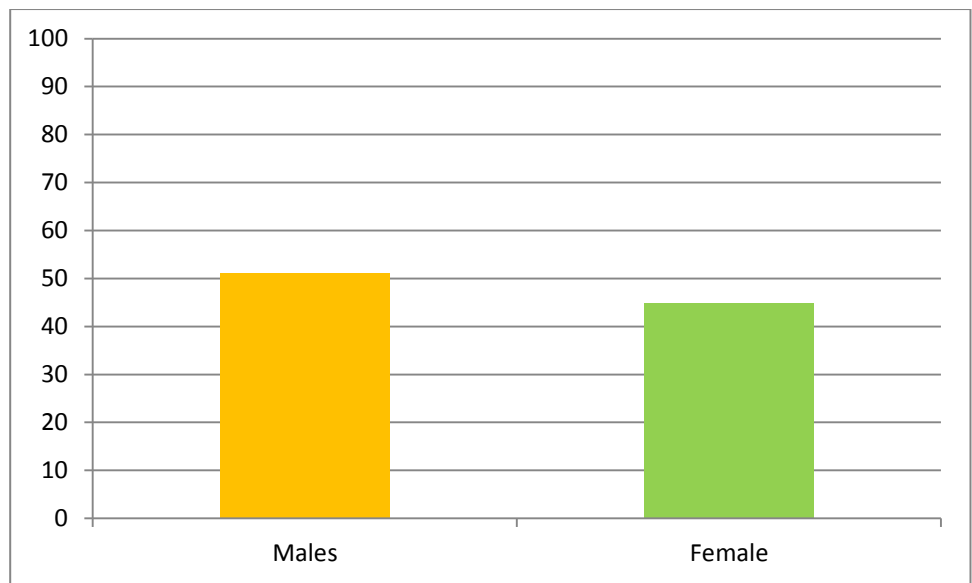
In this study, total 100 patients with equal male and female distribution i.e. 50 male and 50 female patients. Male: Female ratio is 1: 1

Age Distribution:

In this study,

For males, minimum age was 22 years and maximum age was 76 years. The mean was 51.04 years with standard deviation of 10.26.

For females, minimum age was 19 years and maximum age was 80 years. The mean was 44.80 years with standard deviation of 14.69.



Age Distribution

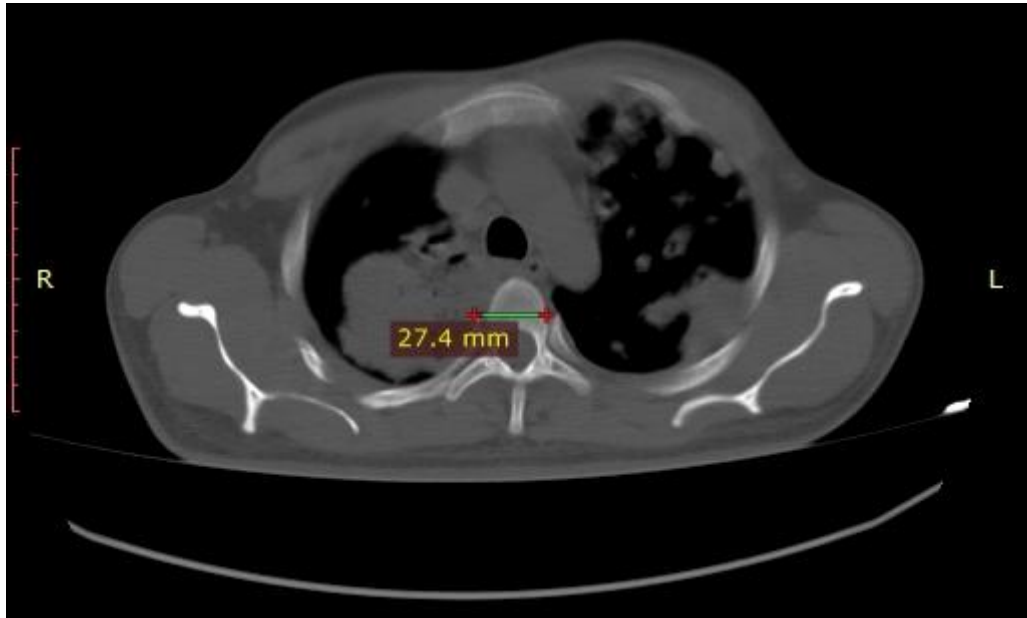
Transverse Diameter:

The transverse diameter was measured from CT scan for placing anterior screw instrumentation on the right side and left side in males and in females. The transverse diameter gradually increased from T1 to T12 for both right and left sides, males and females

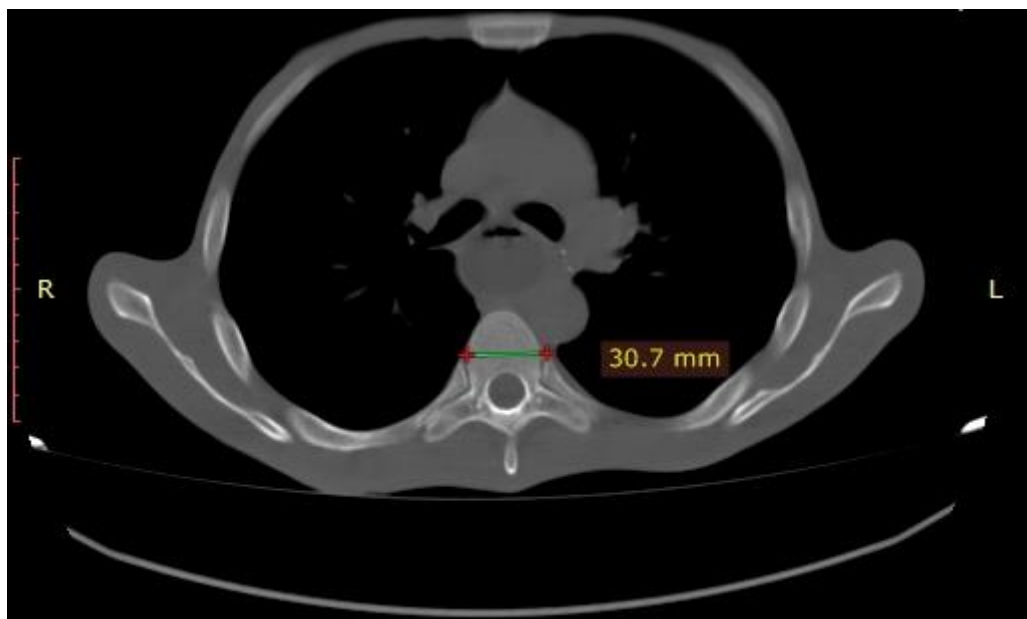
Males	Level	Right		Left	
		Mean (mm)	SD	Mean (mm)	SD
	T1	23.81	2.56	23.50	2.52
	T12	38.60	3.10	38.92	3.40

Females	Level	Right		Left	
		Mean (mm)	SD	Mean (mm)	SD
	T1	21.34	2.48	21.14	2.51
	T12	35.37	2.90	35.12	3.10

Transverse Diameter



Right Side

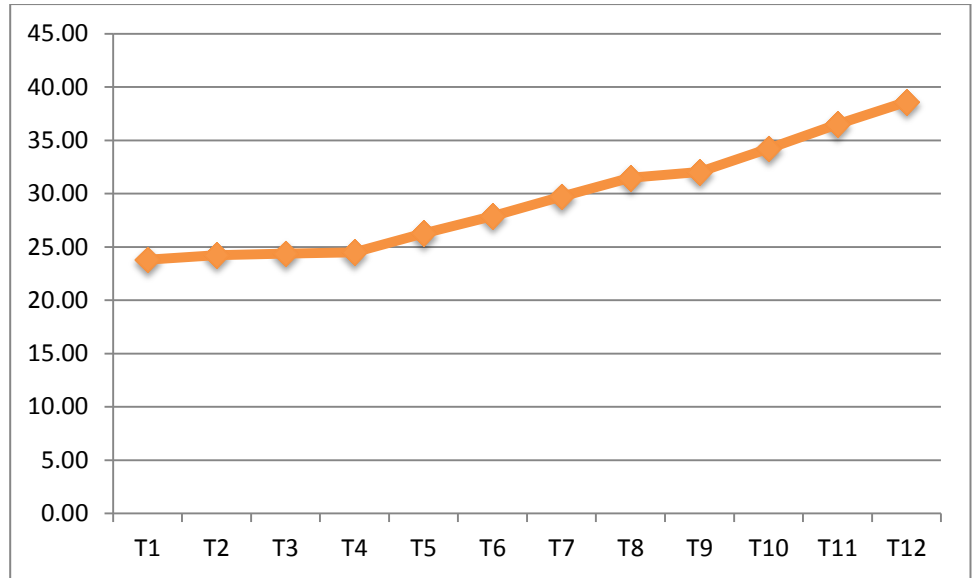


Left Side

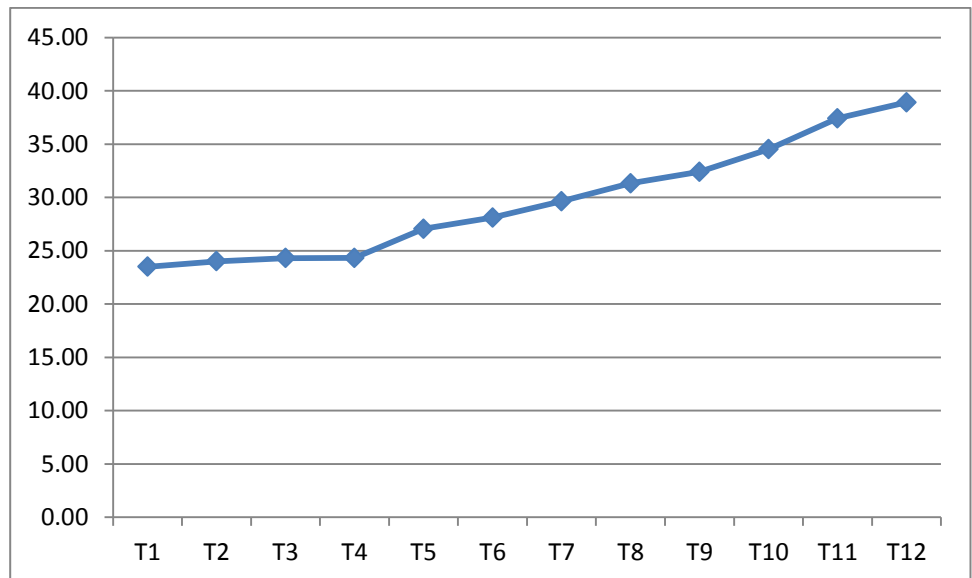
For analysis of statistical significance, the transverse diameter measured from CT scan for placing anterior screw instrumentation on the right side in males was compared with the left side in males.

Measured Transverse Diameter in Males					
Level	Right		Left		p-value
	Mean (mm)	SD	Mean (mm)	SD	
T1	23.81	2.56	23.50	2.52	0.543
T2	24.23	2.49	24.01	2.53	0.662
T3	24.38	2.71	24.30	2.64	0.881
T4	24.50	2.54	24.32	2.57	0.725
T5	26.25	2.57	27.05	2.43	0.113
T6	27.90	2.44	28.11	2.40	0.665
T7	29.71	2.39	29.64	2.36	0.883
T8	31.50	2.51	31.32	2.70	0.731
T9	32.04	3.01	32.39	3.02	0.563
T10	34.21	2.24	34.51	2.92	0.566
T11	36.49	2.30	37.41	2.45	0.056
T12	38.60	3.10	38.92	3.40	0.624

On comparison, there is **no** significant statistical difference with p-value > **0.05** at all levels



Measured Transverse Diameter in Males – Right

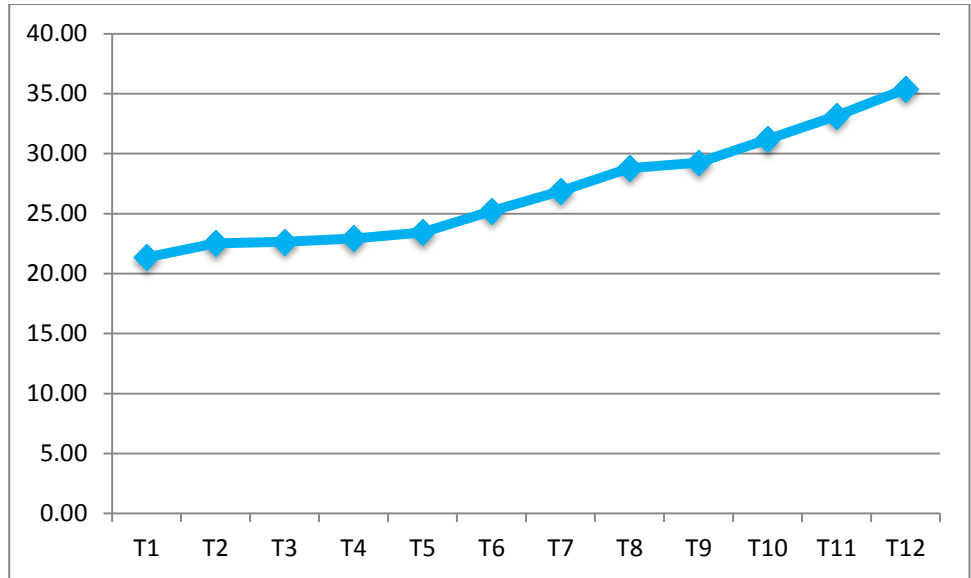


Measured Transverse Diameter in Males – Left

For analysis of statistical significance, the transverse diameter measured from CT scan for placing anterior screw instrumentation on the right side in females was compared with the left side in females.

Measured Transverse Diameter in Females					
Level	Right		Left		p-value
	Mean (mm)	SD	Mean (mm)	SD	
T1	21.34	2.48	21.14	2.51	0.689
T2	22.51	2.50	22.20	2.47	0.534
T3	22.65	2.60	22.38	2.59	0.604
T4	22.93	2.52	23.01	2.60	0.876
T5	23.43	2.62	23.34	2.65	0.865
T6	25.22	2.50	24.97	2.73	0.634
T7	26.86	2.40	26.92	2.53	0.903
T8	28.80	2.59	28.51	2.62	0.579
T9	29.24	2.81	28.90	2.67	0.537
T10	31.20	2.25	32.10	2.54	0.064
T11	33.14	2.32	34.01	2.59	0.080
T12	35.37	2.90	35.12	3.10	0.678

On comparison, there is **no** significant statistical difference with p-value > **0.05** at all levels



Measured Transverse Diameter in Females – Right



Measured Transverse Diameter in Females – Left

For analysis of statistical significance, the transverse diameter measured from CT scan for placing anterior screw instrumentation on the right side in males was compared with the right side in females.

Measured Transverse Diameter on Right side					
Level	Male		Female		p-value
	Mean (mm)	SD	Mean (mm)	SD	
T1	23.81	2.56	21.34	2.48	<0.001
T2	24.23	2.49	22.51	2.50	0.001
T3	24.38	2.71	22.65	2.60	0.002
T4	24.50	2.54	22.93	2.52	0.003
T5	26.25	2.57	23.43	2.62	<0.001
T6	27.90	2.44	25.22	2.50	<0.001
T7	29.71	2.39	26.86	2.40	<0.001
T8	31.50	2.51	28.80	2.59	<0.001
T9	32.04	3.01	29.24	2.81	<0.001
T10	34.21	2.24	31.20	2.25	<0.001
T11	36.49	2.30	33.14	2.32	<0.001
T12	38.60	3.10	35.37	2.90	<0.001

On comparison, there is **significant** statistical difference with p-value **<0.05** at all levels

For analysis of statistical significance, the transverse diameter measured from CT scan for placing anterior screw instrumentation on the left side in males was compared with the left side in females.

Measured Transverse Diameter on Left side					
Level	Male		Female		p-value
	Mean (mm)	SD	Mean (mm)	SD	
T1	23.50	2.52	21.14	2.51	<0.001
T2	24.01	2.53	22.20	2.47	<0.001
T3	24.30	2.64	22.38	2.59	<0.001
T4	24.32	2.57	23.01	2.60	0.013
T5	27.05	2.43	23.34	2.65	<0.001
T6	28.11	2.40	24.97	2.73	<0.001
T7	29.64	2.36	26.92	2.53	<0.001
T8	31.32	2.70	28.51	2.62	<0.001
T9	32.39	3.02	28.90	2.67	<0.001
T10	34.51	2.92	32.10	2.54	<0.001
T11	37.41	2.45	34.01	2.59	<0.001
T12	38.92	3.40	35.12	3.10	<0.001

On comparison, there is **significant** statistical difference with p-value **<0.05** at all levels

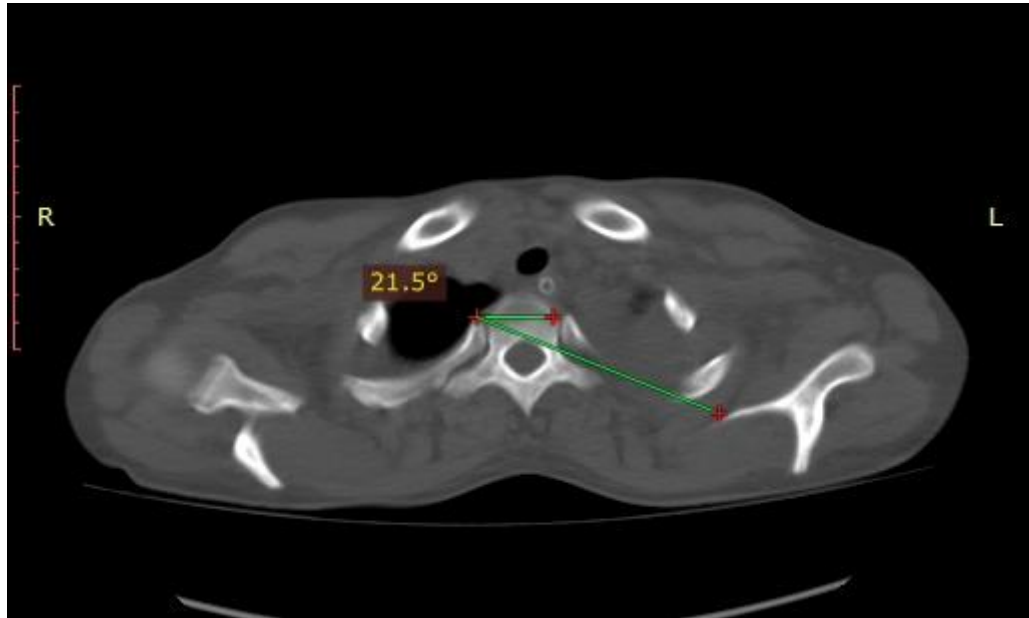
Posterior Safe Angle:

The posterior safe angle was measured from CT scan for placing anterior screw instrumentation on the right side and left side in males and in females. The posterior gradually decreased from T1 to T12 for both right and left sides, males and females.

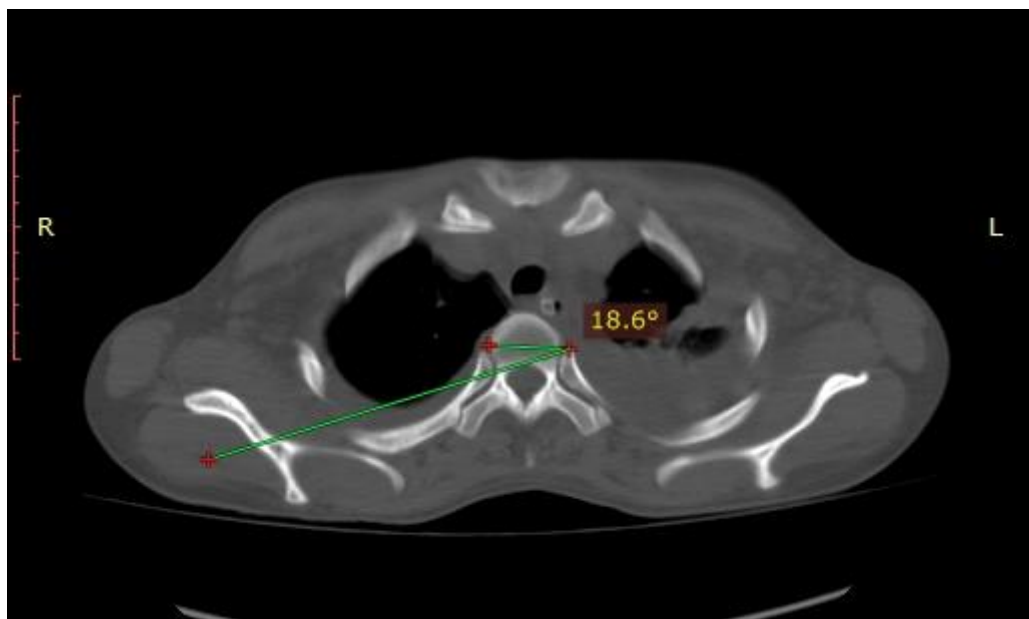
Males	Level	Right		Left	
		Mean (°)	SD	Mean (°)	SD
	T1	31.80	4.13	31.63	4.01
	T12	-4.71	1.59	-5.10	1.86

Females	Level	Right		Left	
		Mean (°)	SD	Mean (°)	SD
	T1	30.62	4.20	31.51	4.16
	T12	-4.60	1.86	-4.95	1.65

Posterior Safe Angle



Right Side

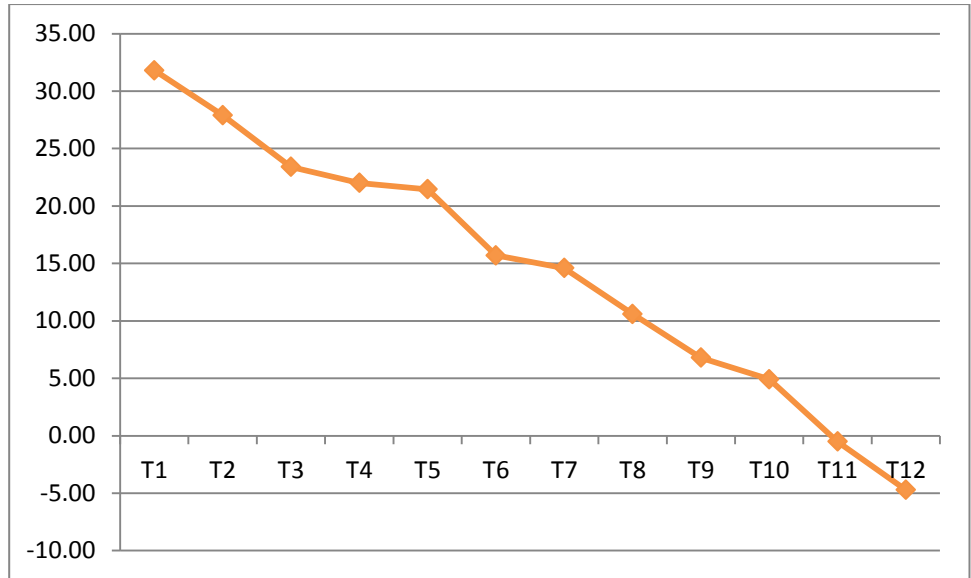


Left Side

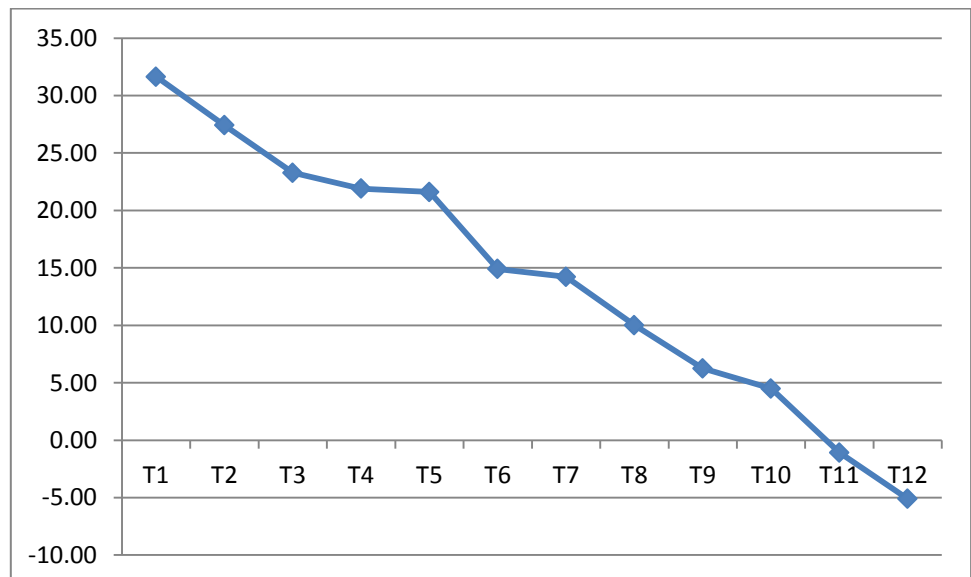
For analysis of statistical significance, the posterior safe angle measured from CT scan for placing anterior screw instrumentation on the right side in males was compared with the left side in males.

Measured Posterior Safe Angle in Males					
Level	Right		Left		p-value
	Mean (°)	SD	Mean (°)	SD	
T1	31.80	4.13	31.63	4.01	0.835
T2	27.90	3.96	27.42	3.81	0.538
T3	23.40	3.26	23.28	3.38	0.845
T4	22.01	3.12	21.90	3.02	0.858
T5	21.45	3.07	21.60	3.10	0.808
T6	15.70	2.01	14.90	2.14	0.057
T7	14.60	1.99	14.22	1.61	0.295
T8	10.60	1.70	10.01	1.31	0.055
T9	6.80	1.49	6.25	1.50	0.690
T10	4.91	1.54	4.50	1.61	0.196
T11	-0.50	1.81	-1.08	1.30	0.069
T12	-4.71	1.59	-5.10	1.86	0.262

On comparison, there is **no** significant statistical difference with p-value **>0.05** at all levels



Measured Posterior Safe Angle in Males – Right

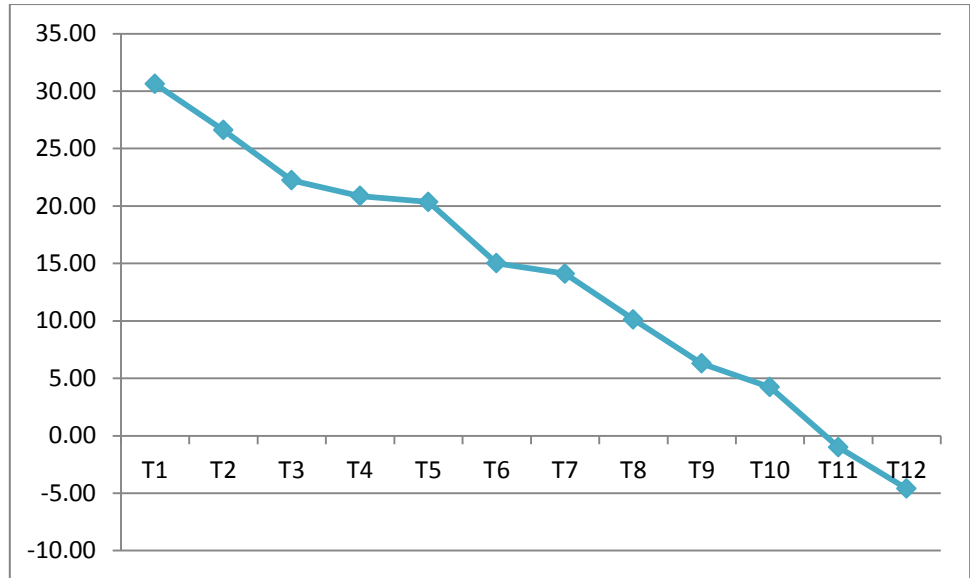


Measured Posterior Safe Angle in Males – Left

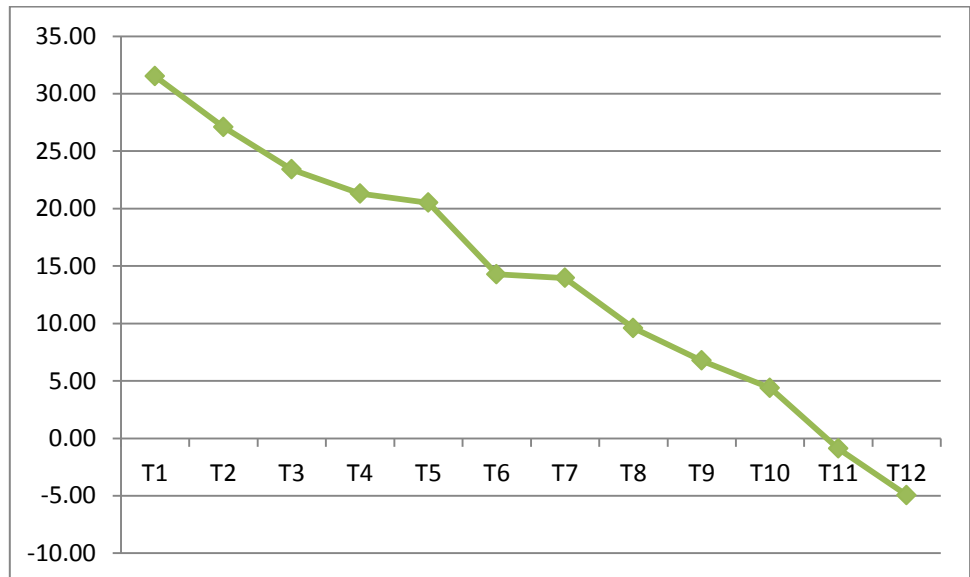
For analysis of statistical significance, the posterior safe angle measured from CT scan for placing anterior screw instrumentation on the right side in females was compared with the left side in females.

Measured Posterior Safe Angle in Females					
Level	Right		Left		p-value
	Mean (°)	SD	Mean (°)	SD	
T1	30.62	4.20	31.51	4.16	0.290
T2	26.60	3.92	27.10	4.03	0.531
T3	22.23	3.21	23.40	3.26	0.074
T4	20.86	3.24	21.30	3.17	0.494
T5	20.35	3.12	20.51	3.38	0.806
T6	15.01	2.18	14.28	2.30	0.107
T7	14.11	1.72	13.95	1.63	0.634
T8	10.13	1.72	9.60	1.37	0.091
T9	6.29	1.37	6.76	1.50	0.150
T10	4.23	1.91	4.38	2.01	0.703
T11	-1.00	1.63	-0.90	1.43	0.745
T12	-4.60	1.86	-4.95	1.65	0.322

On comparison, there is **no** significant statistical difference with p-value **>0.05** at all levels



Measured Posterior Safe Angle in Females – Right



Measured Posterior Safe Angle in Females – Left

For analysis of statistical significance, the posterior safe angle measured from CT scan for placing anterior screw instrumentation on the right side in males was compared with the right side in females.

Measured Posterior Safe Angle on Right side					
Level	Male		Female		p-value
	Mean (°)	SD	Mean (°)	SD	
T1	31.80	4.13	30.62	4.20	0.160
T2	27.90	3.96	26.60	3.92	0.102
T3	23.40	3.26	22.23	3.21	0.071
T4	22.01	3.12	20.86	3.24	0.074
T5	21.45	3.07	20.35	3.12	0.079
T6	15.70	2.01	15.01	2.18	0.103
T7	14.60	1.99	14.11	1.72	0.191
T8	10.60	1.70	10.13	1.72	0.173
T9	6.80	1.49	6.29	1.37	0.078
T10	4.91	1.54	4.23	1.91	0.053
T11	-0.50	1.81	-1.00	1.63	0.150
T12	-4.71	1.59	-4.60	1.86	0.751

On comparison, there is **no** significant statistical difference with p-value **>0.05** at all levels

For analysis of statistical significance, the posterior safe angle measured from CT scan for placing anterior screw instrumentation on the left side in males was compared with the left side in females.

Measured Posterior Safe Angle on Left side					
Level	Male		Female		p-value
	Mean (°)	SD	Mean (°)	SD	
T1	31.63	4.01	31.51	4.16	0.884
T2	27.42	3.81	27.10	4.03	0.684
T3	23.28	3.38	23.40	3.26	0.857
T4	21.90	3.02	21.30	3.17	0.335
T5	21.60	3.10	20.51	3.38	0.096
T6	14.90	2.14	14.28	2.30	0.166
T7	14.22	1.61	13.95	1.63	0.405
T8	10.01	1.31	9.60	1.37	0.129
T9	6.25	1.50	6.76	1.50	0.092
T10	4.50	1.61	4.38	2.01	0.742
T11	-1.08	1.30	-0.90	1.43	0.512
T12	-5.10	1.86	-4.95	1.65	0.671

On comparison, there is **no** significant statistical difference with p-value **>0.05** at all levels

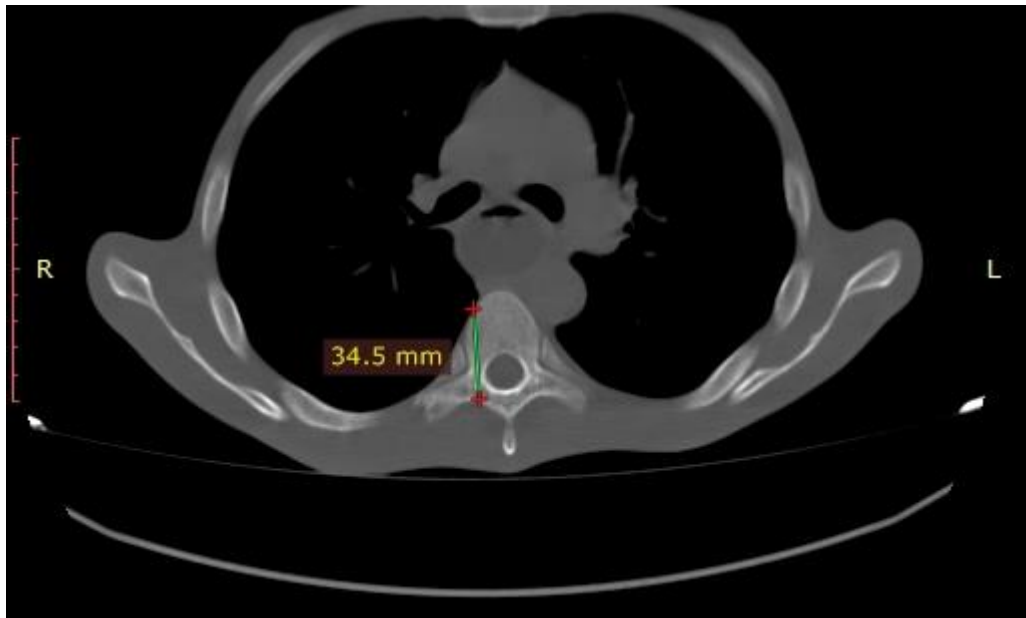
Pedicular Chord Length:

The Pedicular Chord Length was measured from CT scan for placing posterior screw instrumentation on the right side and left side in males and in females. The Pedicular Chord Length gradually increased from T1 to T9, then started to decrease from T10 for both right and left sides, males and females.

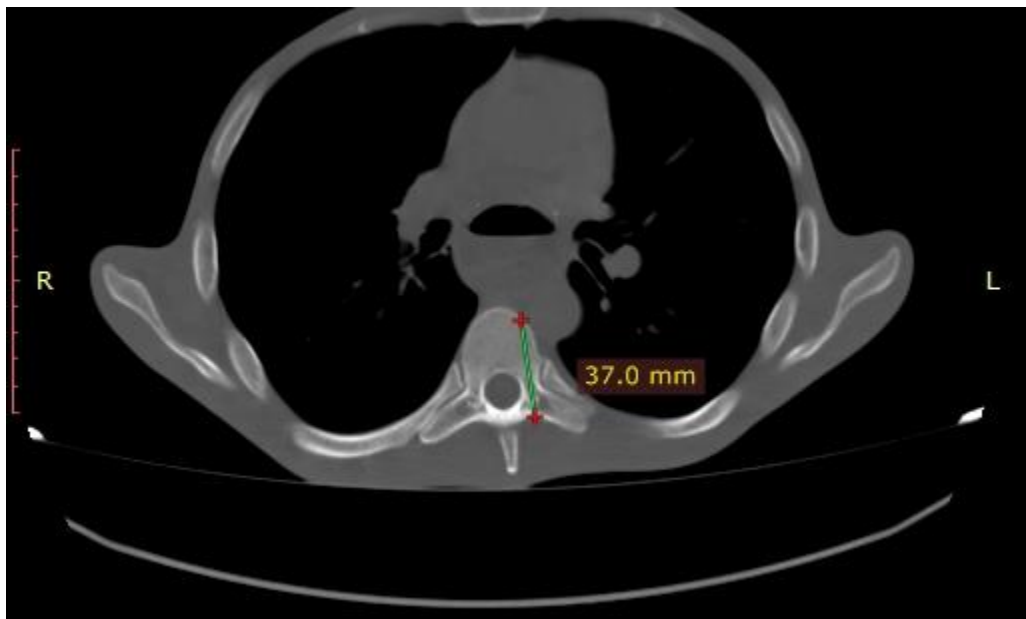
	Level	Right		Left	
		Mean (mm)	SD	Mean (mm)	SD
Males	T1	29.91	3.12	28.98	2.86
	T9	41.52	3.22	40.53	3.31
	T10	40.83	3.30	40.28	3.21

	Level	Right		Left	
		Mean (mm)	SD	Mean (mm)	SD
Females	T1	27.13	2.67	26.51	2.52
	T9	37.19	3.31	37.21	3.29
	T10	36.24	3.26	36.15	3.18

Pedicular Chord Length



Right Side

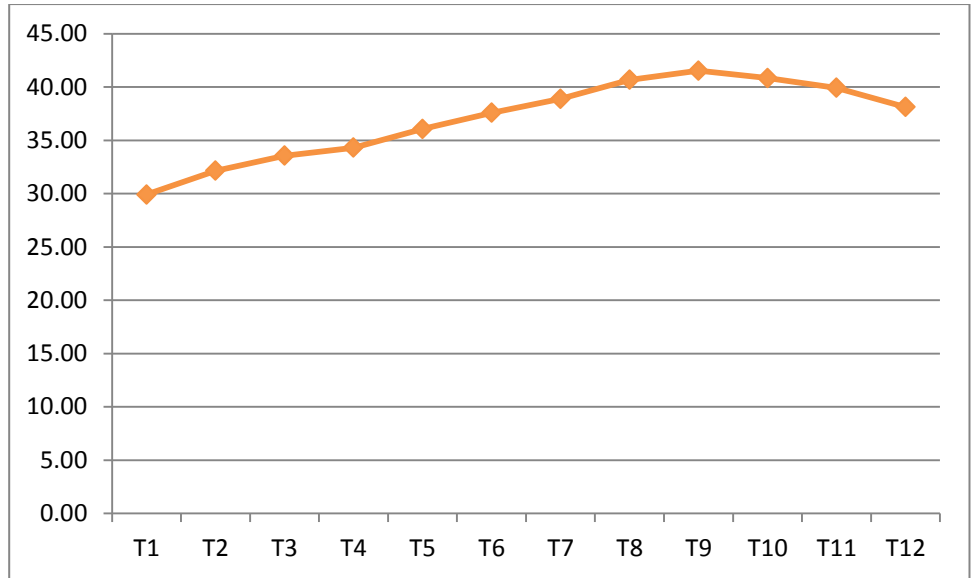


Left Side

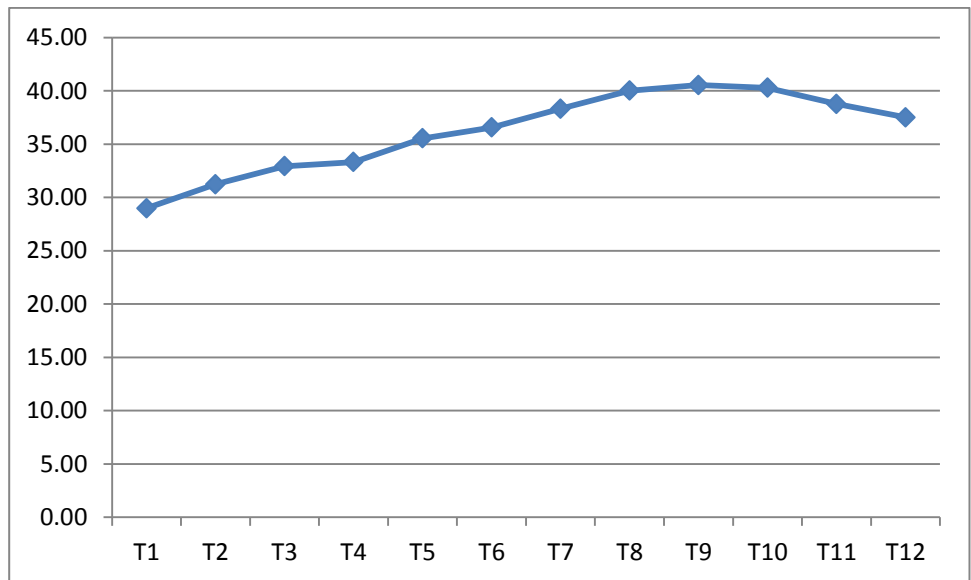
For analysis of statistical significance, the Pedicular Chord Length measured from CT scan for placing posterior screw instrumentation on the right side in males was compared with the left side in males.

Measured Pedicular Chord length in Males					
Level	Right		Left		p-value
	Mean (mm)	SD	Mean (mm)	SD	
T1	29.91	3.12	28.98	2.86	0.123
T2	32.14	3.36	31.23	3.12	0.164
T3	33.56	3.61	32.93	3.42	0.373
T4	34.31	3.53	33.32	3.29	0.150
T5	36.06	3.17	35.53	3.18	0.406
T6	37.58	3.21	36.56	3.22	0.116
T7	38.89	3.06	38.31	3.12	0.350
T8	40.67	3.18	40.01	3.01	0.289
T9	41.52	3.22	40.53	3.31	0.133
T10	40.83	3.30	40.28	3.21	0.400
T11	39.92	3.23	38.77	3.03	0.069
T12	38.11	3.29	37.50	3.19	0.407

On comparison, there is **no** significant statistical difference with p-value **> 0.05** at all levels



Measured Pedicular Chord length in Males – Right

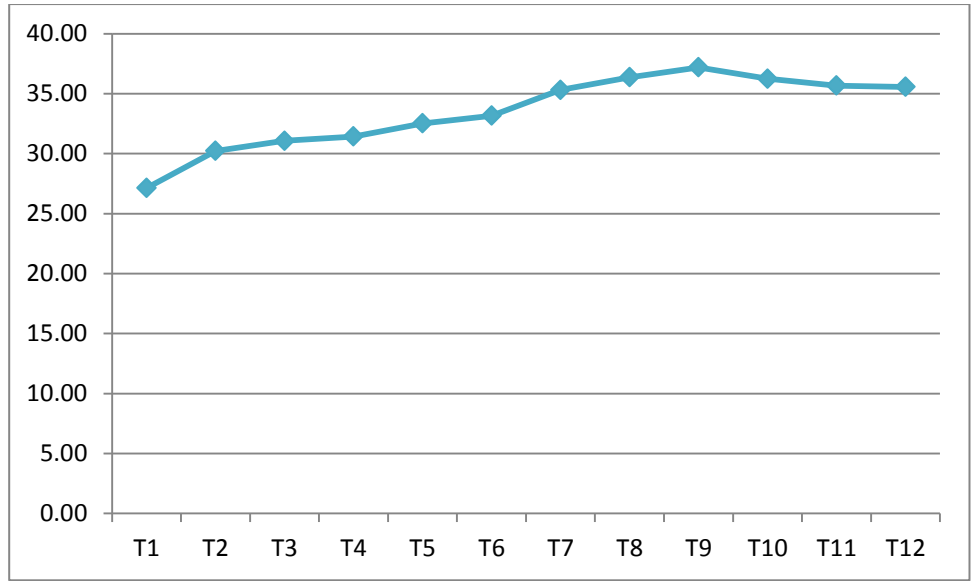


Measured Pedicular Chord length in Males – Left

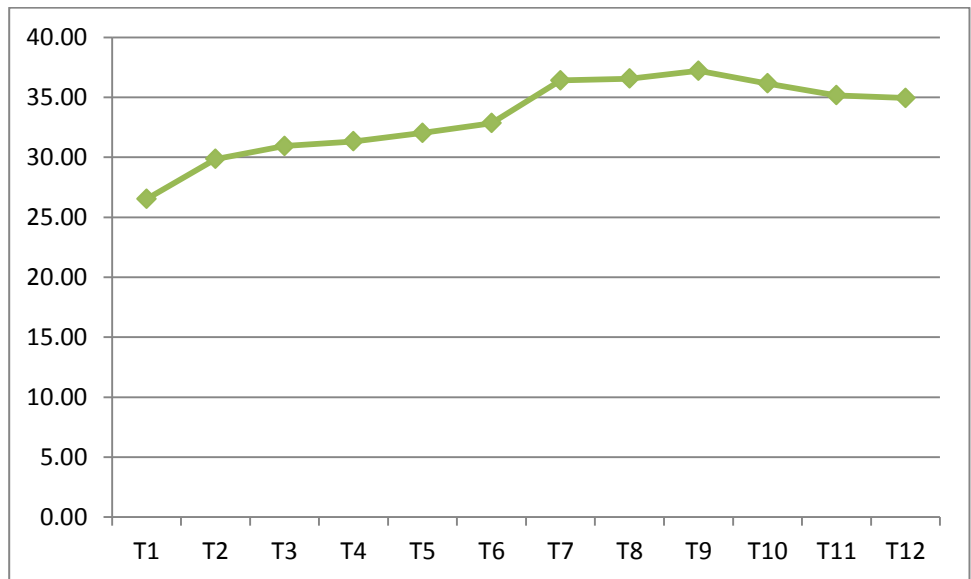
For analysis of statistical significance, the Pedicular Chord Length measured from CT scan for placing posterior screw instrumentation on the right side in females was compared with the left side in females.

Measured Pedicular Chord length in Females					
Level	Right		Left		p-value
	Mean (mm)	SD	Mean (mm)	SD	
T1	27.13	2.67	26.51	2.52	0.235
T2	30.23	3.10	29.85	3.07	0.539
T3	31.07	3.09	30.93	3.23	0.825
T4	31.42	3.35	31.32	3.05	0.876
T5	32.52	3.08	32.03	3.10	0.433
T6	33.16	3.52	32.84	3.44	0.647
T7	35.31	3.03	36.40	3.18	0.082
T8	36.36	3.41	36.55	3.32	0.778
T9	37.19	3.31	37.21	3.29	0.976
T10	36.24	3.26	36.15	3.18	0.889
T11	35.67	2.93	35.16	3.02	0.394
T12	35.57	3.16	34.93	3.24	0.320

On comparison, there is **no** significant statistical difference with p-value > **0.05** at all levels



Measured Pedicular Chord length in Females – Right



Measured Pedicular Chord length in Females – Left

For analysis of statistical significance, the Pedicular Chord Length measured from CT scan for placing posterior screw instrumentation on the right side in males was compared with the right side in females.

Measured Pedicular Chord length on Right side					
Level	Male		Female		p-value
	Mean (mm)	SD	Mean (mm)	SD	
T1	29.91	3.12	27.13	2.67	<0.001
T2	32.14	3.36	30.23	3.10	0.004
T3	33.56	3.61	31.07	3.09	<0.001
T4	34.31	3.53	31.42	3.35	<0.001
T5	36.06	3.17	32.52	3.08	<0.001
T6	37.58	3.21	33.16	3.52	<0.001
T7	38.89	3.06	35.31	3.03	<0.001
T8	40.67	3.18	36.36	3.41	<0.001
T9	41.52	3.22	37.19	3.31	<0.001
T10	40.83	3.30	36.24	3.26	<0.001
T11	39.92	3.23	35.67	2.93	<0.001
T12	38.11	3.29	35.57	3.16	<0.001

On comparison, there is **significant** statistical difference with p-value **<0.05** at all levels

For analysis of statistical significance, the Pedicular Chord Length measured from CT scan for placing anterior screw instrumentation on the left side in males was compared with the left side in females.

Measured Pedicular Chord length on Left side					
Level	Male		Female		p-value
	Mean (mm)	SD	Mean (mm)	SD	
T1	28.98	2.86	26.51	2.52	<0.001
T2	31.23	3.12	29.85	3.07	0.023
T3	32.93	3.42	30.93	3.23	0.003
T4	33.32	3.29	31.32	3.05	0.002
T5	35.53	3.18	32.03	3.10	<0.001
T6	36.56	3.22	32.84	3.44	<0.001
T7	38.31	3.12	36.40	3.18	0.003
T8	40.01	3.01	36.55	3.32	<0.001
T9	40.53	3.31	37.21	3.29	<0.001
T10	40.28	3.21	36.15	3.18	<0.001
T11	38.77	3.03	35.16	3.02	<0.001
T12	37.50	3.19	34.93	3.24	<0.001

On comparison, there is **significant** statistical difference with p-value **<0.05** at all levels

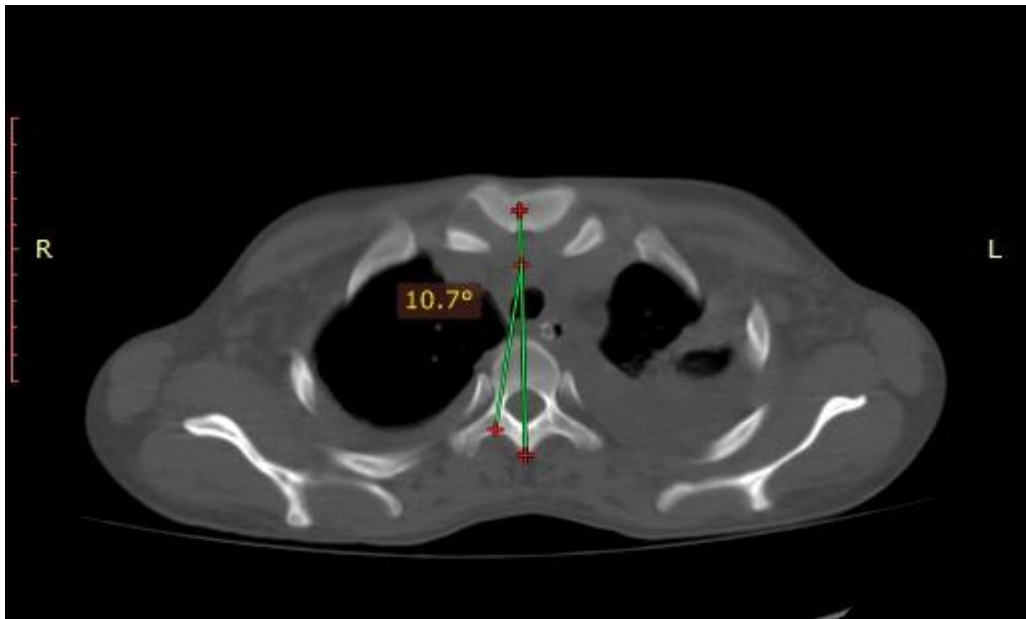
Pedicular Angle:

The Pedicular Angle was measured from CT scan for placing posterior screw instrumentation on the right side and left side in males and in females. The Pedicular Angle gradually decreased from T1 to T12 for both right and left sides, males and females.

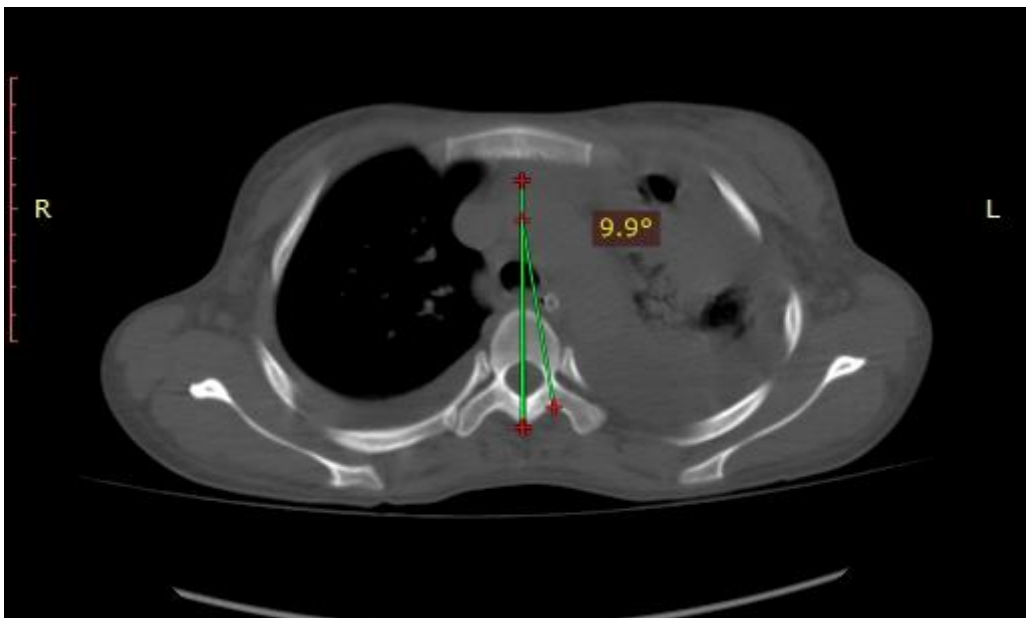
Males	Level	Right		Left	
		Mean (°)	SD	Mean (°)	SD
	T1	32.24	3.59	31.45	3.52
	T12	4.35	1.54	4.57	1.32

Females	Level	Right		Left	
		Mean (°)	SD	Mean (°)	SD
	T1	31.89	3.51	31.47	3.46
	T12	4.07	1.29	4.56	1.30

Pedicular Angle



Right Side

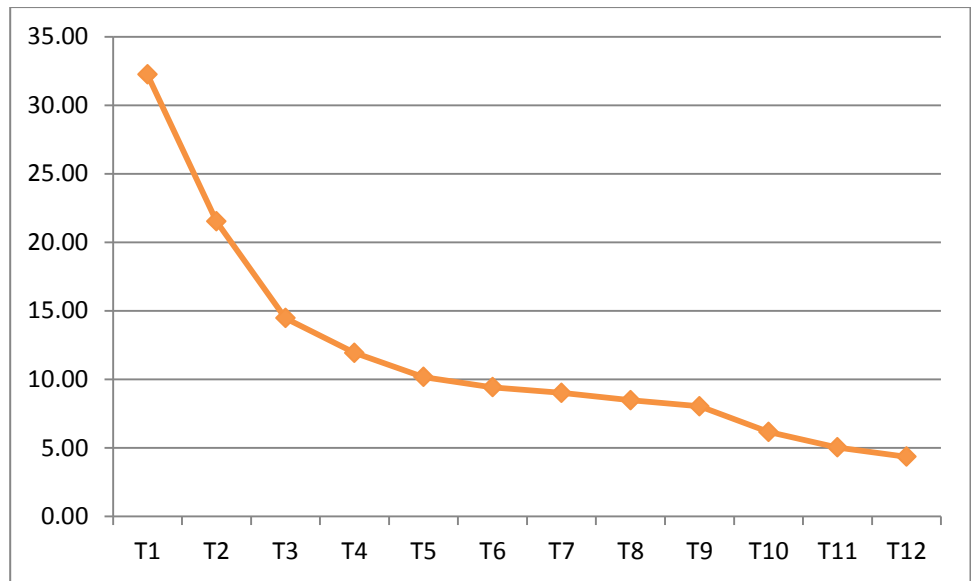


Left Side

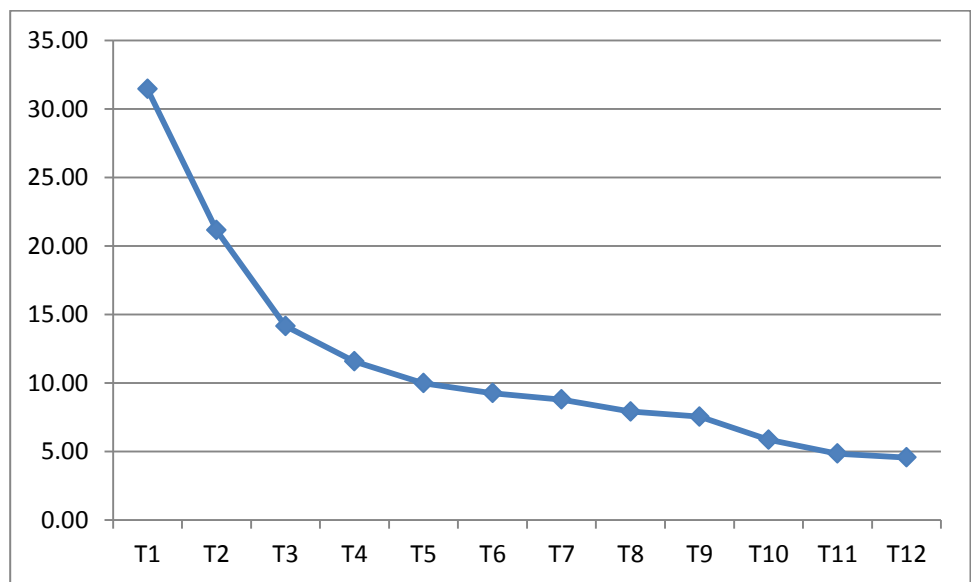
For analysis of statistical significance, the Pedicular Angle measured from CT scan for placing posterior screw instrumentation on the right side in males was compared with the left side in males.

Measured Pedicular Angle in Males					
Level	Right		Left		p-value
	Mean (°)	SD	Mean (°)	SD	
T1	32.24	3.59	31.45	3.52	0.269
T2	21.52	3.05	21.15	3.11	0.549
T3	14.47	2.96	14.15	2.84	0.584
T4	11.93	2.46	11.57	2.35	0.456
T5	10.17	2.31	9.98	2.17	0.673
T6	9.42	2.12	9.26	2.06	0.703
T7	9.01	2.07	8.79	2.13	0.602
T8	8.48	2.13	7.92	2.01	0.179
T9	8.03	2.01	7.54	2.02	0.227
T10	6.17	1.85	5.86	1.72	0.388
T11	5.03	1.64	4.85	1.43	0.560
T12	4.35	1.54	4.57	1.32	0.445

On comparison, there is **no** significant statistical difference with p-value > **0.05** at all levels



Measured Pedicular Angle in Males – Right

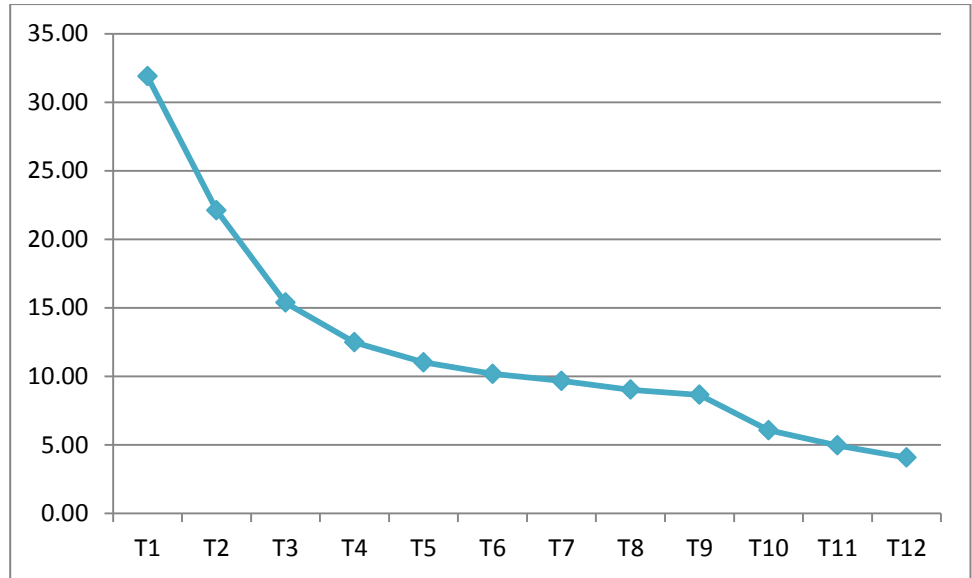


Measured Pedicular Angle in Males – Left

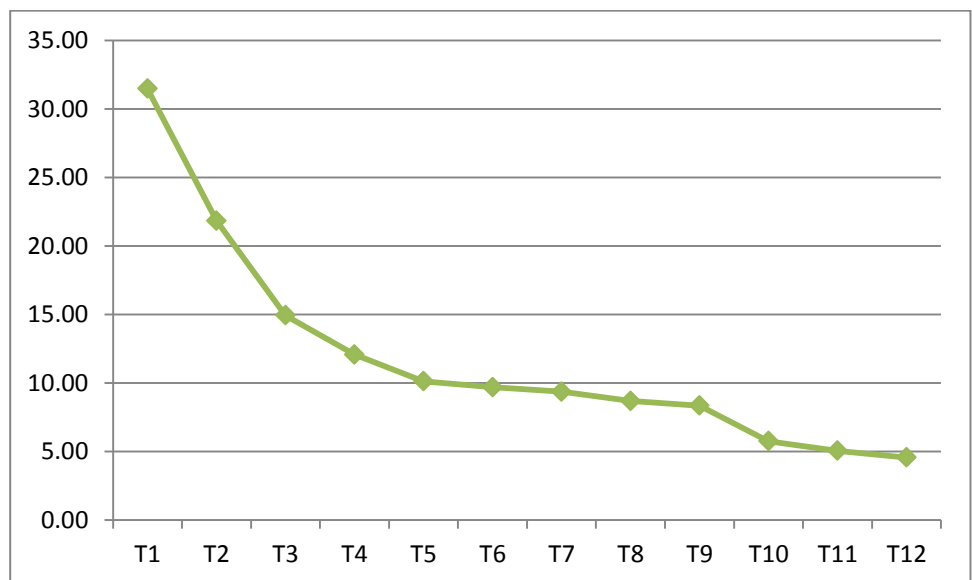
For analysis of statistical significance, the Pedicular Angle measured from CT scan for placing posterior screw instrumentation on the right side in females was compared with the left side in females.

Measured Pedicular Angle in Females					
Level	Right		Left		p-value
	Mean (°)	SD	Mean (°)	SD	
T1	31.89	3.51	31.47	3.46	0.548
T2	22.11	3.12	21.83	3.14	0.656
T3	15.38	2.85	14.93	2.79	0.427
T4	12.48	2.39	12.07	2.41	0.395
T5	11.02	2.49	10.12	2.51	0.075
T6	10.18	2.13	9.69	2.07	0.246
T7	9.67	2.12	9.37	2.08	0.477
T8	9.03	2.17	8.69	2.09	0.427
T9	8.65	2.12	8.35	2.17	0.486
T10	6.07	1.91	5.76	1.85	0.412
T11	4.96	1.53	5.06	1.54	0.745
T12	4.07	1.29	4.56	1.30	0.061

On comparison, there is **no** significant statistical difference with p-value > **0.05** at all levels



Measured Pedicular Angle in Females – Right



Measured Pedicular Angle in Females – Left

For analysis of statistical significance, the Pedicular Angle measured from CT scan for placing posterior screw instrumentation on the right side in males was compared with the right side in females.

Measured Pedicular Angle on Right side					
Level	Male		Female		p-value
	Mean (°)	SD	Mean (°)	SD	
T1	32.24	3.59	31.89	3.51	0.623
T2	21.52	3.05	22.11	3.12	0.341
T3	14.47	2.96	15.38	2.85	0.121
T4	11.93	2.46	12.48	2.39	0.260
T5	10.17	2.31	11.02	2.49	0.080
T6	9.42	2.12	10.18	2.13	0.077
T7	9.01	2.07	9.67	2.12	0.188
T8	8.48	2.13	9.03	2.17	0.204
T9	8.03	2.01	8.65	2.12	0.137
T10	6.17	1.85	6.07	1.91	0.791
T11	5.03	1.64	4.96	1.53	0.826
T12	4.35	1.54	4.07	1.29	0.327

On comparison, there is **no** significant statistical difference with p-value > **0.05** at all levels

For analysis of statistical significance, the Pedicular Angle measured from CT scan for placing posterior screw instrumentation on the left side in males was compared with the left side in females.

Measured Pedicular Angle on Left side					
Level	Male		Female		p-value
	Mean (°)	SD	Mean (°)	SD	
T1	31.45	3.52	31.47	3.46	0.977
T2	21.15	3.11	21.83	3.14	0.279
T3	14.15	2.84	14.93	2.79	0.169
T4	11.57	2.35	12.07	2.41	0.296
T5	9.98	2.17	10.12	2.51	0.766
T6	9.26	2.06	9.69	2.07	0.300
T7	8.79	2.13	9.37	2.08	0.171
T8	7.92	2.01	8.69	2.09	0.063
T9	7.54	2.02	8.35	2.17	0.056
T10	5.86	1.72	5.76	1.85	0.780
T11	4.85	1.43	5.06	1.54	0.482
T12	4.57	1.32	4.56	1.30	0.970

On comparison, there is **no** significant statistical difference with p-value > **0.05** at all levels

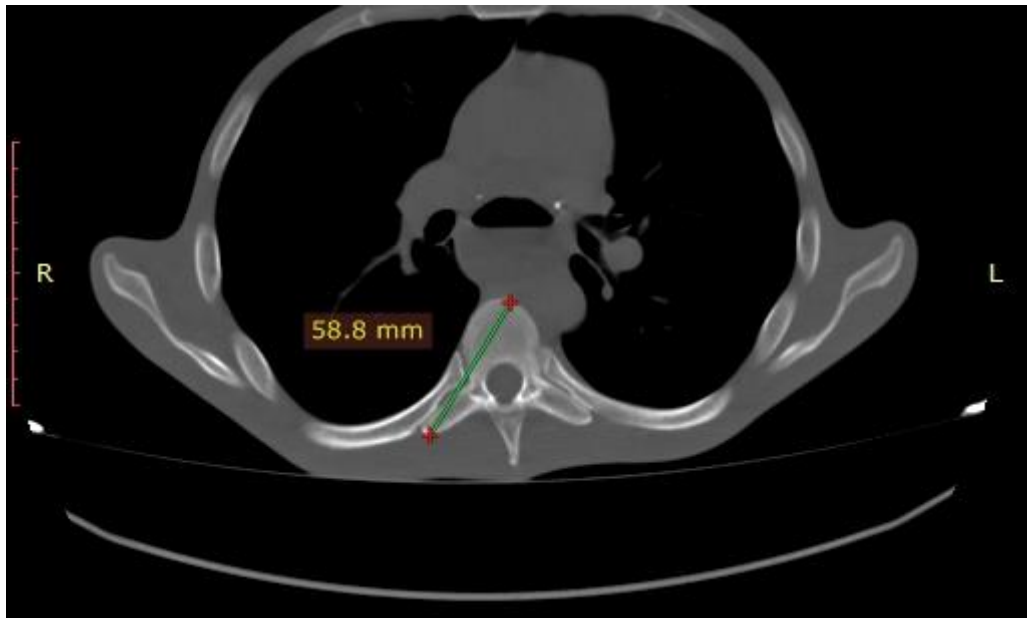
ExtraPedicular Chord Length:

The ExtraPedicular Chord Length was measured from CT scan for placing posterior screw instrumentation on the right side and left side in males and in females. TheExtra Pedicular Chord Length gradually increased from T1 to T8, then started to decrease from T9 for both right and left sides, males and females.

	Level	Right		Left	
		Mean (mm)	SD	Mean (mm)	SD
Males	T1	39.23	3.24	38.43	3.21
	T8	53.34	4.38	53.09	4.22
	T9	52.81	4.11	51.56	4.23

	Level	Right		Left	
		Mean (mm)	SD	Mean (mm)	SD
Females	T1	37.43	3.18	37.10	3.20
	T8	49.29	4.21	49.04	4.20
	T9	48.37	4.34	47.89	4.26

Extrapedicular Chord Length



Right Side

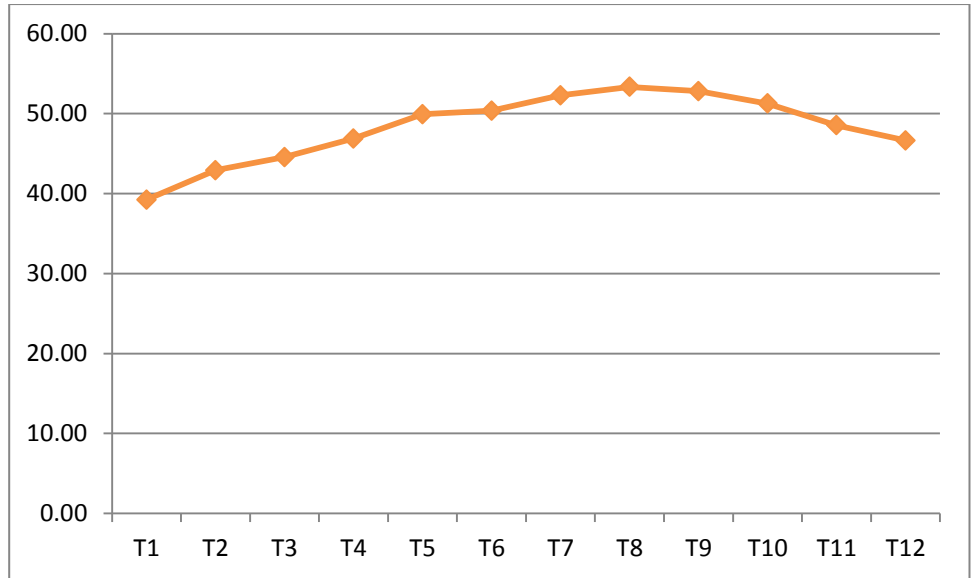


Left Side

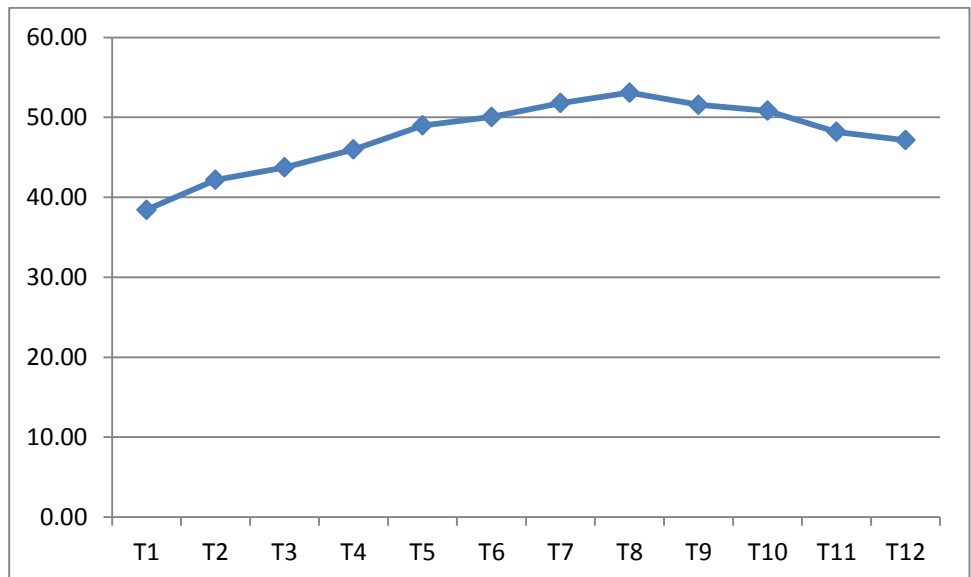
For analysis of statistical significance, the ExtraPedicular Chord Length measured from CT scan for placing posterior screw instrumentation on the right side in males was compared with the left side in males

Measured ExtraPedicular Chord length in Males					
Level	Right		Left		p-value
	Mean (mm)	SD	Mean (mm)	SD	
T1	39.23	3.24	38.43	3.21	0.218
T2	42.91	3.42	42.18	3.37	0.285
T3	44.55	3.73	43.74	3.64	0.274
T4	46.88	4.01	45.98	3.87	0.256
T5	49.92	4.04	48.98	3.81	0.234
T6	50.37	4.42	50.04	4.12	0.700
T7	52.29	4.15	51.79	4.06	0.544
T8	53.34	4.38	53.09	4.22	0.722
T9	52.81	4.11	51.56	4.23	0.137
T10	51.26	4.35	50.83	4.23	0.617
T11	48.55	3.95	48.18	3.72	0.631
T12	46.63	3.74	47.13	3.69	0.503

On comparison, there is **no** significant statistical difference with p-value > **0.05** at all levels



Measured ExtraPedicular Chord length in Males – Right

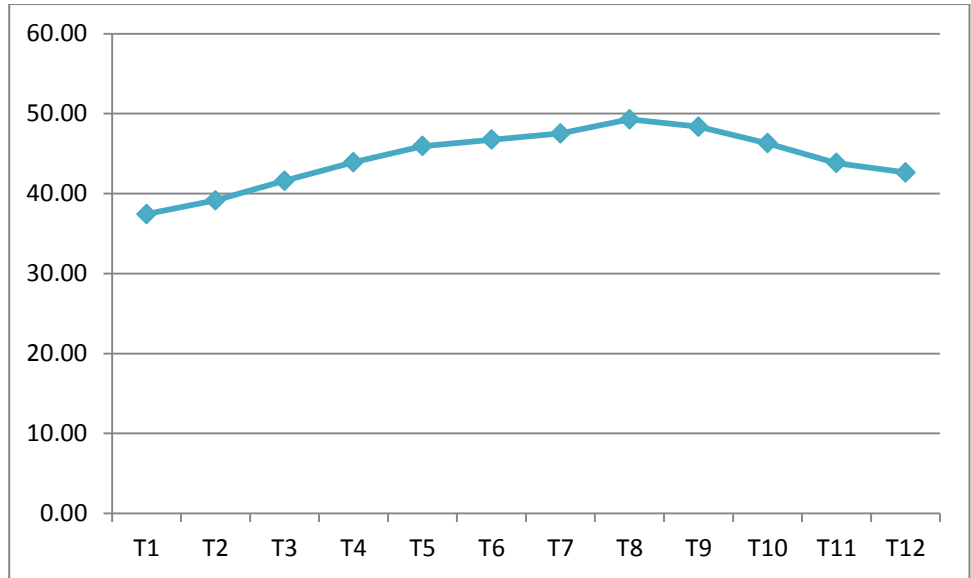


Measured ExtraPedicular Chord length in Males – Left

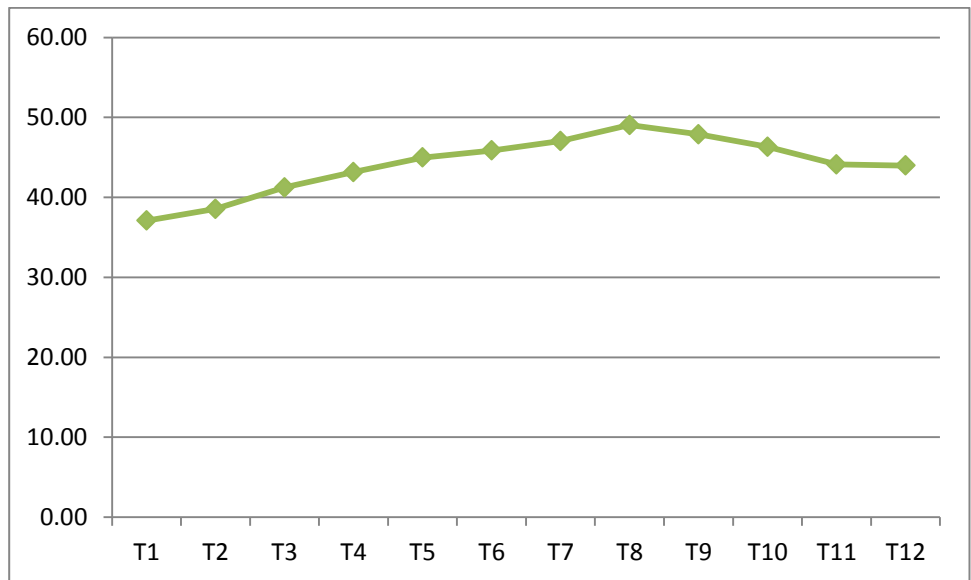
For analysis of statistical significance, the ExtraPedicular Chord Length measured from CT scan for placing posterior screw instrumentation on the right side in females was compared with the left side in females

Measured ExtraPedicular Chord length in Females					
Level	Right		Left		p-value
	Mean (mm)	SD	Mean (mm)	SD	
T1	37.43	3.18	37.10	3.20	0.512
T2	39.15	3.45	38.56	3.35	0.388
T3	41.60	3.62	41.23	3.58	0.608
T4	43.91	3.64	43.16	3.46	0.294
T5	45.93	3.76	44.97	3.63	0.197
T6	46.74	3.94	45.86	3.98	0.269
T7	47.52	4.13	47.03	4.11	0.553
T8	49.29	4.21	49.04	4.20	0.767
T9	48.37	4.34	47.89	4.26	0.578
T10	46.29	3.91	46.31	4.02	0.980
T11	43.81	3.69	44.12	3.79	0.679
T12	42.64	3.50	43.97	3.55	0.062

On comparison, there is **no** significant statistical difference with p-value > **0.05** at all levels



Measured ExtraPedicular Chord length in Females – Right



Measured ExtraPedicular Chord length in Females – Left

For analysis of statistical significance, the ExtraPedicular Chord Length measured from CT scan for placing posterior screw instrumentation on the right side in males was compared with the right side in females

Measured ExtraPedicular Chord length on Right side					
Level	Male		Female		p-value
	Mean (mm)	SD	Mean (mm)	SD	
T1	39.23	3.24	37.43	3.18	0.006
T2	42.91	3.42	39.15	3.45	<0.001
T3	44.55	3.73	41.60	3.62	<0.001
T4	46.88	4.01	43.91	3.64	<0.001
T5	49.92	4.04	45.93	3.76	<0.001
T6	50.37	4.42	46.74	3.94	<0.001
T7	52.29	4.15	47.52	4.13	<0.001
T8	53.34	4.38	49.29	4.21	<0.001
T9	52.81	4.11	48.37	4.34	<0.001
T10	51.26	4.35	46.29	3.91	<0.001
T11	48.55	3.95	43.81	3.69	<0.001
T12	46.63	3.74	42.64	3.50	<0.001

On comparison, there is **significant** statistical difference with p-value **<0.05** at all levels

For analysis of statistical significance, the ExtraPedicular Chord Length measured from CT scan for placing posterior screw instrumentation on the left side in males was compared with the left side in females

Measured ExtraPedicular Chord length on Left side					
Level	Male		Female		p-value
	Mean (mm)	SD	Mean (mm)	SD	
T1	38.43	3.21	37.10	3.20	0.029
T2	42.18	3.37	38.56	3.35	<0.001
T3	43.74	3.64	41.23	3.58	0.001
T4	45.98	3.87	43.16	3.46	<0.001
T5	48.98	3.81	44.97	3.63	<0.001
T6	50.04	4.12	45.86	3.98	<0.001
T7	51.79	4.06	47.03	4.11	<0.001
T8	53.09	4.22	49.04	4.20	<0.001
T9	51.56	4.23	47.89	4.26	<0.001
T10	50.83	4.23	46.31	4.02	<0.001
T11	48.18	3.72	44.12	3.79	<0.001
T12	47.13	3.69	43.97	3.55	<0.001

On comparison, there is **significant** statistical difference with p-value **<0.05** at all levels

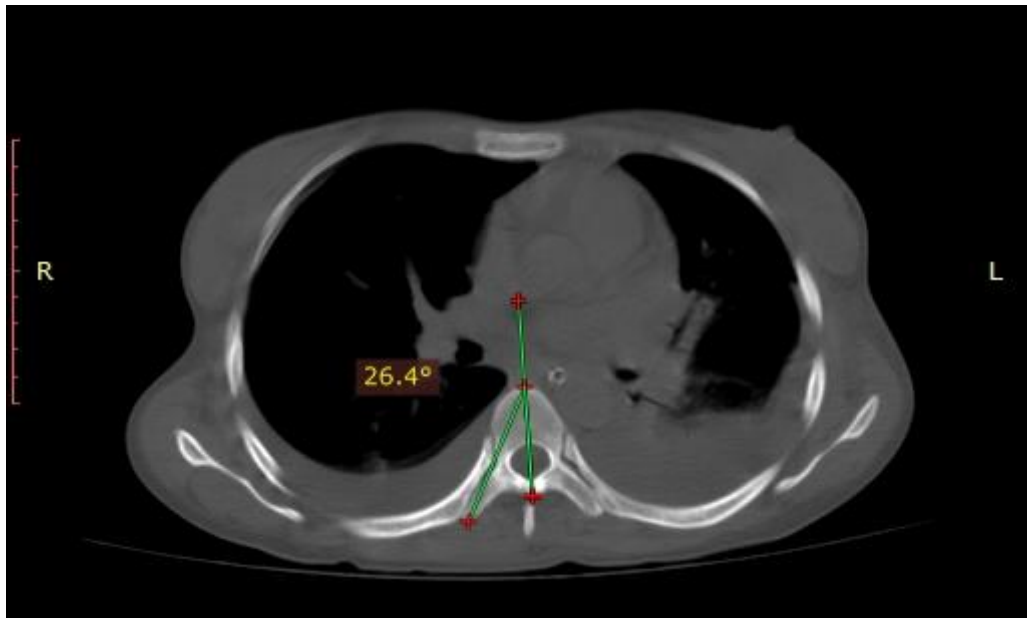
ExtraPedicular Angle:

The ExtraPedicular Angle was measured from CT scan for placing posterior screw instrumentation on the right side and left side in males and in females. The ExtraPedicular Angle gradually decreased from T1 to T12 for both right and left sides, males and females.

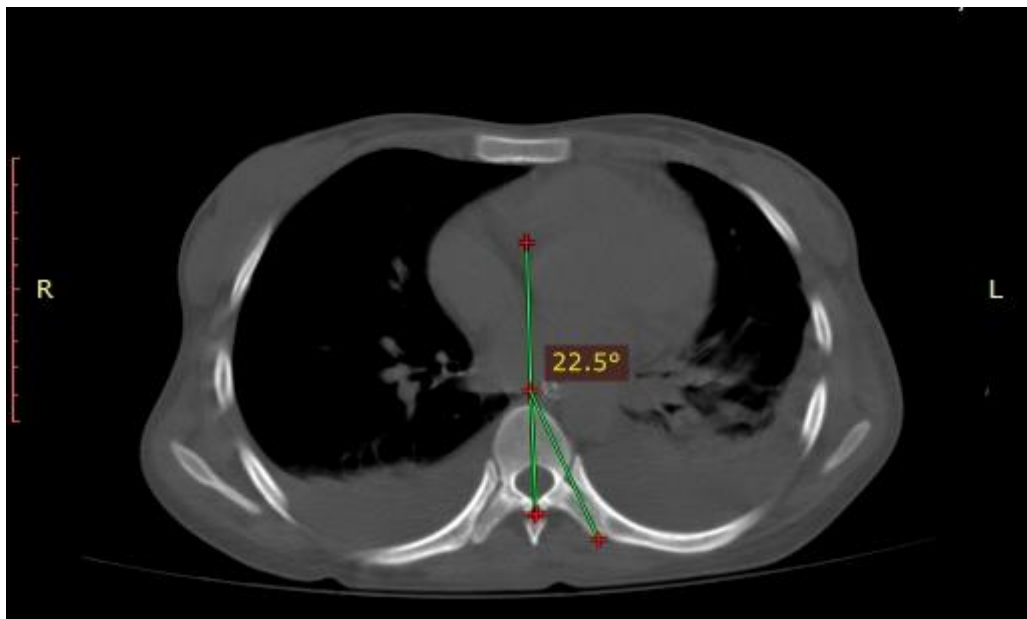
Males	Level	Right		Left	
		Mean (°)	SD	Mean (°)	SD
	T1	47.19	5.01	46.23	5.13
	T12	18.63	3.03	17.48	3.23

Females	Level	Right		Left	
		Mean (°)	SD	Mean (°)	SD
	T1	45.73	4.98	45.23	5.02
	T12	19.48	3.15	18.39	3.14

Extrapedicular Angle



Right Side

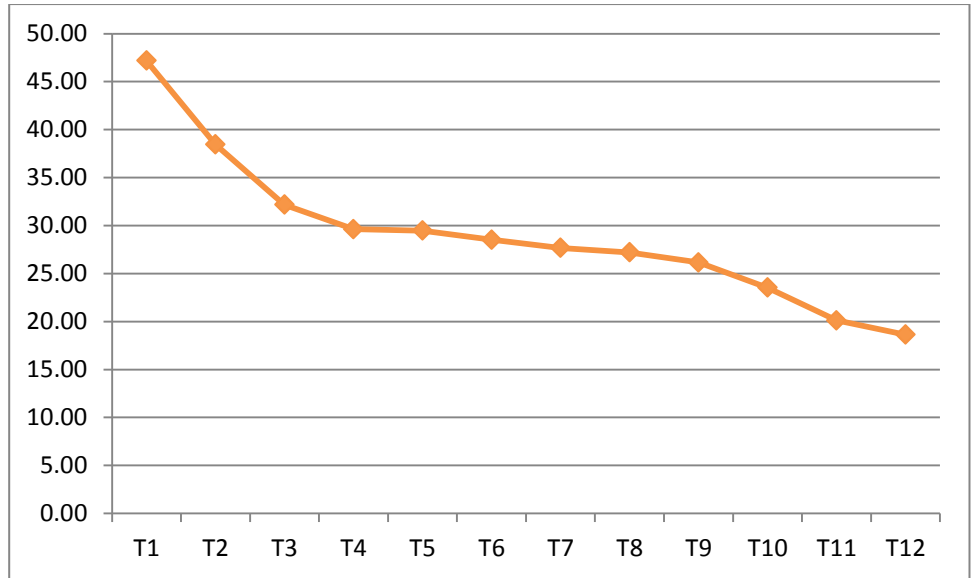


Left Side

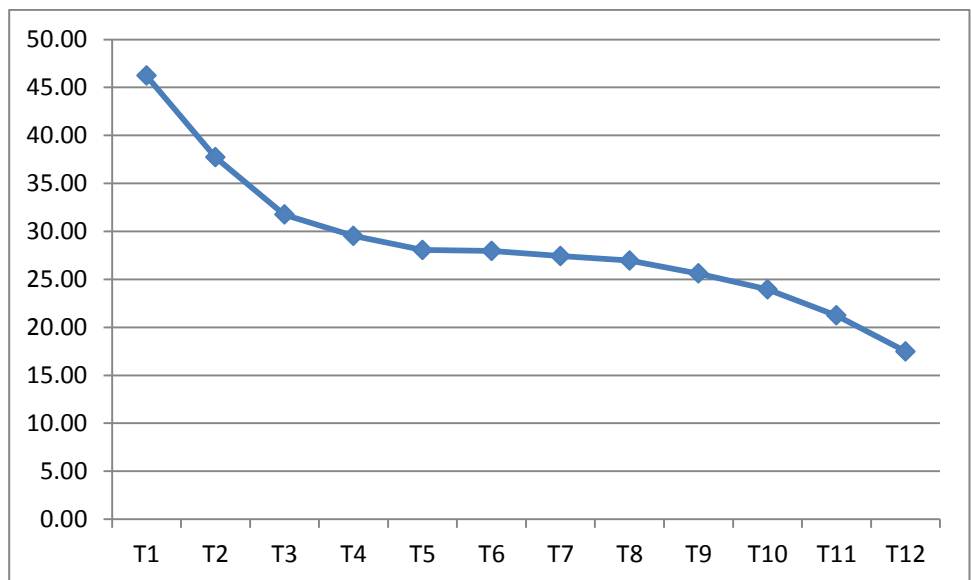
For analysis of statistical significance, the ExtraPedicular Angle measured from CT scan for placing posterior screw instrumentation on the right side in males was compared with the left side in males

Measured ExtraPedicular Angle in Males					
Level	Right		Left		p-value
	Mean (°)	SD	Mean (°)	SD	
T1	47.19	5.01	46.23	5.13	0.346
T2	38.45	4.51	37.72	4.46	0.418
T3	32.18	4.21	31.75	4.25	0.612
T4	29.63	4.13	29.52	4.02	0.893
T5	29.47	4.01	28.06	4.13	0.086
T6	28.52	3.99	27.96	3.89	0.479
T7	27.68	3.86	27.43	3.94	0.749
T8	27.21	3.91	26.96	3.86	0.748
T9	26.15	3.47	25.61	3.56	0.444
T10	23.53	3.26	23.96	3.48	0.525
T11	20.11	3.12	21.23	3.41	0.090
T12	18.63	3.03	17.48	3.23	0.069

On comparison, there is **no** significant statistical difference with p-value **>0.05** at all levels



Measured ExtraPedicular Angle in Males – Right

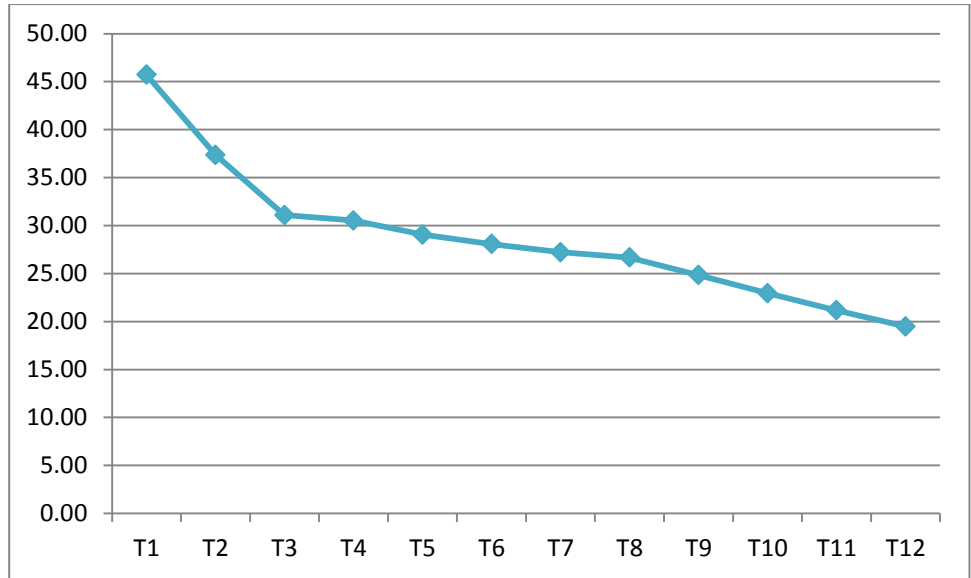


Measured ExtraPedicular Angle in Males - Left

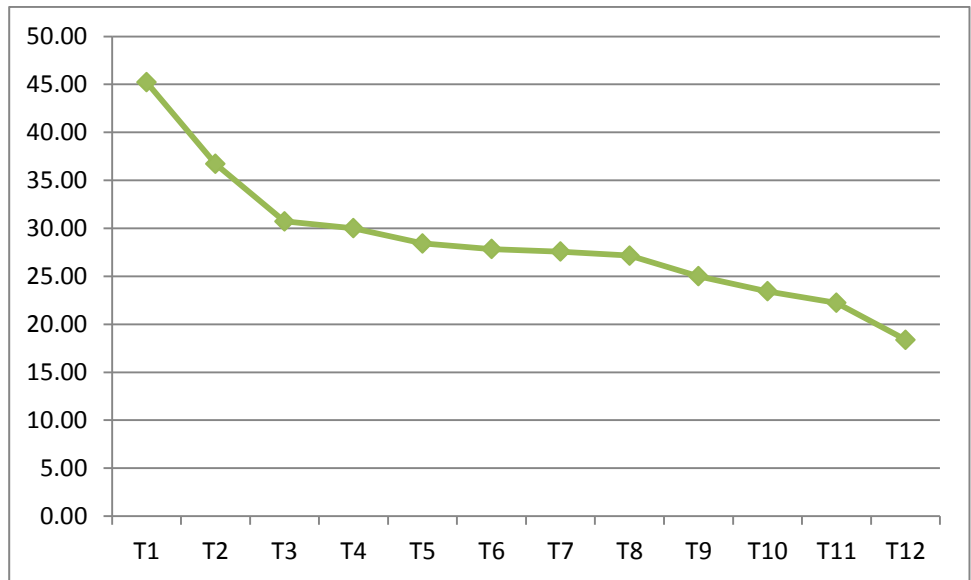
For analysis of statistical significance, the ExtraPedicular Angle measured from CT scan for placing posterior screw instrumentation on the right side in females was compared with the left side in females

Measured ExtraPedicular Angle in Females					
Level	Right		Left		p-value
	Mean (°)	SD	Mean (°)	SD	
T1	45.73	4.98	45.23	5.02	0.618
T2	37.36	4.56	36.72	4.45	0.479
T3	31.09	4.16	30.73	4.19	0.667
T4	30.52	4.05	30.01	4.18	0.537
T5	29.06	4.04	28.43	4.25	0.449
T6	28.07	3.93	27.84	3.91	0.770
T7	27.23	3.74	27.57	3.86	0.656
T8	26.68	3.83	27.16	4.08	0.546
T9	24.83	3.76	25.01	3.61	0.808
T10	22.96	3.44	23.43	3.47	0.498
T11	21.17	3.24	22.23	3.49	0.119
T12	19.48	3.15	18.39	3.14	0.086

On comparison, there is **no** significant statistical difference with p-value **>0.05** at all levels



Measured ExtraPedicular Angle in Females- Right



Measured ExtraPedicular Angle in Females- Left

For analysis of statistical significance, the ExtraPedicular Angle measured from CT scan for placing posterior screw instrumentation on the right side in males was compared with the right side in females

Measured ExtraPedicular Angle on Right side					
Level	Male		Female		p-value
	Mean (°)	SD	Mean (°)	SD	
T1	47.19	5.01	45.73	4.98	0.147
T2	38.45	4.51	37.36	4.56	0.232
T3	32.18	4.21	31.09	4.16	0.196
T4	29.63	4.13	30.52	4.05	0.279
T5	29.47	4.01	29.06	4.04	0.612
T6	28.52	3.99	28.07	3.93	0.571
T7	27.68	3.86	27.23	3.74	0.555
T8	27.21	3.91	26.68	3.83	0.495
T9	26.15	3.47	24.83	3.76	0.071
T10	23.53	3.26	22.96	3.44	0.397
T11	20.11	3.12	21.17	3.24	0.099
T12	18.63	3.03	19.48	3.15	0.172

On comparison, there is **no** significant statistical difference with p-value **>0.05** at all levels

For analysis of statistical significance, the ExtraPedicular Angle measured from CT scan for placing posterior screw instrumentation on the left side in males was compared with the left side in females

Measured ExtraPedicular Angle on Left side					
Level	Male		Female		p-value
	Mean (°)	SD	Mean (°)	SD	
T1	46.23	5.13	45.23	5.02	0.327
T2	37.72	4.46	36.72	4.45	0.264
T3	31.75	4.25	30.73	4.19	0.230
T4	29.52	4.02	30.01	4.18	0.552
T5	28.06	4.13	28.43	4.25	0.660
T6	27.96	3.89	27.84	3.91	0.878
T7	27.43	3.94	27.57	3.86	0.858
T8	26.96	3.86	27.16	4.08	0.802
T9	25.61	3.56	25.01	3.61	0.405
T10	23.96	3.48	23.43	3.47	0.448
T11	21.23	3.41	22.23	3.49	0.150
T12	17.48	3.23	18.39	3.14	0.156

On comparison, there is **no** significant statistical difference with p-value **>0.05** at all levels

DISCUSSION

After computer software guided measurements of thoracic spines in 100 patients (50 males and 50 females) who underwent CT thorax / CT thoracic spine for suspected lesions in thorax / thoracic spine, the values are analysed and compared with previous studies conducted nationally and internationally.

Transverse diameter:

Present study showed there is gradual increase in transverse diameter from T1 to T12 due increase in size of vertebral body and there is statistical significant difference between males and females. This suggests that large length of screw can inserted into vertebral body ventrolaterally at lower thoracic level and larger screw for males. The upper level of thoracic spine that can be approached through thoracotomy is T3 or T4. There is no significant difference between the sides of screw insertion. The side of thoracotomy depends on surgeons preference because both sides have important vascular structures and internal organs.

This study data is compared with X. H. Li et al¹² which shows that transverse diameter increases from T4 to T12 and no statistical significance between right and left except at T8 level, but not mentioned male and female difference

level	Transverse diameter X. H. Li et al ¹²				
	Left		Right		p-value
	Mean	SD	Mean	SD	
T4	24.88	2.64	23.43	2.67	0.231
T5	26.35	2.67	27.15	2.54	0.246
T6	28.18	2.54	28.32	2.50	0.723
T7	29.90	2.39	29.76	2.34	0.778
T8	31.72	2.57	30.67	2.91	0.002
T9	32.10	3.06	32.51	3.10	0.503
T10	34.37	2.27	34.82	3.07	0.358
T11	36.71	2.30	37.59	3.24	0.059
T12	38.70	3.16	39.03	3.63	0.604

Posterior Safe Angle:

X. H. Li et al¹² on their study concluded those posterior safe angles gradually decrease from T4 to T12. At lower levels T11 and T12 the angle become negative on measurement suggesting that vertebral canal is placed anterior to the line joining tips of corresponding ribs. The clinical implication of this finding during anterior screw instrumentation at ventrolateral aspect vertebral body is screw direction which should be directed anteriorly in T11 and T12 to avoid screw entering into spinal canal.

The significant statistical difference between sides is seen at T5, T7 and T8 level, but in present study there is no significant statistical difference, but not mentioned male and female difference

level	Posterior safe angle X. H. Li et al ¹²				
	Left		Right		p-value
	Mean	SD	Mean	SD	
T4	22.06	5.74	20.42	4.04	0.192
T5	21.45	6.18	18.71	4.78	0.022
T6	15.64	4.65	14.85	5.14	0.364
T7	14.52	3.98	10.91	3.50	0.000
T8	10.50	3.73	8.49	2.87	0.016
T9	7.78	3.52	6.69	3.52	0.134
T10	5.24	5.06	3.90	3.74	0.160
T11	-0.94	5.96	-2.14	5.40	0.256
T12	-8.70	4.15	-9.57	4.21	0.410

K. Papadimitriou et al¹¹. showed in their study, there was gradual decrease in distance between rib heads and spinal canal. At T11 and T12 the value became negative. This implies that posterior safe angle also become negative on measurement

Pedicular chord length:

Zindrick et al²¹ first described pedicle morphometric analysis using CT scan

Pedicular chord length is maximum safe length of screw that can be inserted during pedicle screw fixation without injuring structures at anterior aspect of vertebral body. In this study there gradual increase in length from T1 to T9 then from T10 started to decrease and there is no significant statistical difference between right and left side, but significant statistical difference between male and females

R. M. Kretzer et al¹⁸ did study on US trauma population, which showed pedicular chord length gradually increased from T1 to T9 and from T10 started to decrease. There was statistical significant difference between male and female in Pedicular chord length.

Pedicle screw insertion R. M. Kretzer et al ²²				
level	PCL		PA	
	Mean	SD	Mean	SD
T1	33.9	3.3	32.8	3.8
T2	35.3	3.5	20.5	4.4
T3	36.6	3.8	13.5	4.0
T4	38.4	3.8	11.0	3.8
T5	39.6	3.8	9.9	4.0
T6	40.6	4.0	8.7	3.8
T7	42.0	4.2	8.3	4.2
T8	43.4	4.0	8.9	3.9
T9	44.9	4.4	9.8	3.5
T10	44.4	4.4	8.3	3.8
T11	43.9	4.3	5.9	3.6
T12	44.5	4.8	3.8	3.4

Liau et al¹³ showed pedicular chord length gradually increased from T1 to T8 and from T9 started to decrease. There was statistical significant difference between male and female in Pedicular chord length at all levels.

Pedicular chord length Liau et al ¹³					
level	Male		Female		p-value
	Mean	SD	Mean	SD	
T1	34.76	3.15	32.30	2.74	<0.001
T2	36.65	2.75	33.41	3.09	<0.001
T3	36.98	2.84	34.65	3.26	<0.001
T4	37.44	3.49	35.84	3.19	<0.001
T5	38.41	3.05	36.28	2.68	<0.001
T6	39.21	3.34	36.89	3.04	<0.001
T7	39.75	3.65	37.16	2.86	<0.001
T8	40.02	3.23	37.37	2.85	<0.001
T9	39.93	3.24	37.18	2.79	<0.001
T10	39.09	3.20	36.40	2.99	<0.001
T11	37.85	3.46	34.84	4.01	<0.001
T12	37.55	3.22	34.93	4.69	<0.001

JH Kim, et al⁹ showed pedicular chord length gradually increased from T1 to T9 and from T10 started to decrease for males and gradually increased from T1 to T10 and from T11 started to decrease. There was statistical significant difference between male and female in Pedicular chord length except at T3, T4, T7, and T12.

Pedicular chord length JH Kim, et al ⁹					
level	Male		Female		p-value
	Mean	SD	Mean	SD	
T1	34.60	2.91	31.70	4.33	0.0255
T2	36.10	2.99	32.20	4.24	0.0018
T3	36.00	4.21	33.70	2.90	>0.05
T4	37.10	4.64	36.20	1.99	>0.05
T5	41.80	4.33	38.10	3.12	0.0044
T6	43.70	4.29	40.60	3.64	0.0157
T7	44.60	11.10	42.10	4.00	>0.05
T8	46.40	4.88	42.40	4.51	0.0091
T9	48.20	5.18	43.60	4.01	0.0005
T10	46.20	4.30	44.20	2.41	0.0356
T11	44.40	4.25	41.40	3.98	0.0122
T12	40.70	5.41	38.40	2.40	>0.05

But Pai, et al¹⁷ in his study showed gradual increase of chord length from T1 to T12

Pai, et al ¹⁷ Radiological analysis		
Pedicle screw insertion		
Level	PCL mean	PA mean
T1	28.8	22.7
T2	31.4	15.9
T3	32.6	12.9
T4	33.6	10.8
T5	34.8	10.2
T6	36.5	9.5
T7	38.2	8.7
T8	38.6	8.6
T9	39.5	8.6
T10	40.5	8.3
T11	40.5	8.0
T12	41.9	7.6

Pedicular Angle:

R. M. Kretzer et al¹⁸, Liau et al¹³, JH Kim et al⁹, Pai et al¹⁷ showed there was gradual decrease of angle from T1 to T12 except at T9 level for R. M. Kretzer et al.

Pedicular Angle , Liau et al ¹³					
level	Male		Female		p-value
	Mean	SD	Mean	SD	
T1	27.75	4.00	28.09	4.16	>0.05
T2	17.85	4.61	18.16	4.87	>0.05
T3	11.23	4.26	10.71	4.02	>0.05
T4	8.14	2.92	7.80	3.26	>0.05
T5	6.90	2.99	6.07	2.77	>0.05
T6	5.58	2.38	5.28	2.76	>0.05
T7	4.32	2.38	4.39	2.49	>0.05
T8	3.51	2.03	3.76	2.25	>0.05
T9	2.64	2.42	2.88	2.46	>0.05
T10	1.26	1.81	1.27	2.07	>0.05
T11	-0.24	1.84	0.01	2.36	>0.05
T12	-0.58	2.77	-0.40	2.22	>0.05

For Liau et al¹³ no significant statistical difference between male and females, but for R. M. Kretzer et al¹⁸ and JH Kim et al⁹ at many level there was significant statistical difference between male and females.

Pedicular Angle JH Kim et al ⁹					
level	Male		Female		p-value
	Mean	SD	Mean	SD	
T1	33.20	5.32	29.60	5.80	0.0439
T2	22.60	5.48	20.00	5.61	0.0097
T3	15.40	6.31	14.50	4.60	>0.05
T4	11.80	4.96	13.40	9.27	>0.05
T5	9.90	3.64	10.10	2.62	0.008
T6	8.60	3.71	9.10	3.12	0.0111
T7	7.80	3.29	8.20	2.39	0.0358
T8	7.20	3.00	7.20	2.34	0.0182
T9	7.40	3.12	7.40	3.04	>0.05
T10	8.00	3.37	7.20	3.01	>0.05
T11	7.60	2.61	6.80	2.51	0.0256
T12	6.50	2.40	6.40	1.86	>0.05

In Present study there is no significant statistical difference between right and left side, male and females and also gradual decrease of angle from T1 to T12

Extrapedicular Chord Length:

ExtraPedicular chord length JH Kim et al ⁹					
level	Male		Female		p-value
	Mean	SD	Mean	SD	
T1	48.10	3.26	45.30	2.82	0.0041
T2	51.70	3.53	47.90	3.59	0.0005
T3	53.40	3.82	50.50	3.54	0.0103
T4	56.60	4.10	52.70	3.73	0.0008
T5	58.70	4.12	54.70	3.39	0.0003
T6	60.20	4.55	56.60	3.43	0.0018
T7	62.10	4.17	57.40	3.19	<.0001
T8	61.90	4.51	57.60	3.21	<.0001
T9	61.90	4.04	57.30	3.58	<.0001
T10	61.30	4.40	56.00	3.64	<.0001
T11	58.50	4.48	53.00	3.86	<.0001
T12	56.60	4.56	52.50	4.36	0.0018

Dvorak M et al⁴ first described extrapedicular approach for Posterior thoracic screw instrumentation. JH Kim et al⁹ extrapedicular chord length gradually increased from T1 to T9 and from T10 started to decrease for males and increased from T1 to T8 and from T9 started to decrease for females. There

was statistical significant difference between male and female in ExtraPedicular chord length. This study has no significant statistical difference between right and left side, but significant statistical difference male and females and also gradual increase of extrapedicular chord length from T1 to T8 and decrease from T9 bilaterally

Extrapedicular Angle:

ExtraPedicular Angle JH Kim et al ⁹					
level	Male		Female		p-value
	Mean	SD	Mean	SD	
T1	46.80	7.02	45.40	4.50	>0.05
T2	38.10	7.50	37.10	6.58	>0.05
T3	31.70	6.76	32.50	4.69	>0.05
T4	29.00	4.76	29.90	5.08	>0.05
T5	29.20	4.44	29.10	4.57	>0.05
T6	28.20	4.01	27.40	4.99	>0.05
T7	27.40	3.89	26.00	4.36	>0.05
T8	27.10	4.03	25.20	4.75	>0.05
T9	26.10	3.50	24.30	3.78	>0.05
T10	24.60	4.48	23.20	3.47	>0.05
T11	22.30	3.47	22.00	3.31	>0.05
T12	20.90	3.14	19.90	3.32	>0.05

JH Kim et al⁹ extrapedicular angle gradually decreased from T1 to T12 for males and females. There was no statistical significant difference between male and female. This study has no significant statistical difference between right and left side, male and females and gradual decrease of extrapedicular angle from T1 to T12 bilaterally.

Drawbacks of this study:

- This study only included adult population, so measurements regarding length and angle are not useful for paediatric population
- The measurements are taken for virtual image that is constructed by computer by using matrix. So stimulation is not tested using values from this study. Pai et al¹⁷ Showed difference between measurements taken from radiological and from cadaveric specimens.
- CT Thorax / CT Thoracic spine is taken in lying supine position. But the anterior screw instrumentation is done in lateral position and the posterior instrumentation is done in prone position. There is difference in thoracic kyphosis and relationship of surrounding structures with vertebra due to gravity.
- Intraoperative imaging is useful during instrumentation

CONCLUSION

- ❖ This analysis of thoracic spine provides length and transverse angle for safe anterior and posterior screw instrumentation for thoracic spine which are evaluated using Computer software DICOM Viewer.
- ❖ These measurements show no significant statistical difference between sides for length and angle, no significant statistical difference between males and females for angle and significant statistical difference between males and females for length. Angles decrease from T1 to T12. Lengths increase from above downwards, but in posterior instrumentation there is a decrease in measurements in lower levels.
- ❖ This is virtual measurement of thoracic spine in transverse plane. This is useful in intraoperative guidance, while using C-arm AP and Lateral views are possible.
- ❖ Pre-operative CT Thoracic spine scan has become important investigation for pre-operative evaluation in patients planned for thoracic screw instrumentation¹³

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STUDY PROFORMA

COMPUTED TOMOGRAPHIC ANALYSIS OF THORACIC SPINE FOR EVALUATION OF SAFE LENGTH AND SAFE TRAJECTORY FOR ANTERIOR AND POSTERIOR SCREW INSTRUMENTATION

Name:

Age/Sex:

IP No. /OP No:

Chief complaint:

Anterior Instrumentation

Transverse dimension(mm):

Level	Rt side	Lt side
T1		
T2		
T3		
T4		
T5		
T6		
T7		
T8		
T9		
T10		
T11		
T12		

Vertebral angle($^{\circ}$):

Level	Rt side	Lt side
T1		
T2		
T3		
T4		
T5		
T6		
T7		
T8		
T9		
T10		
T11		
T12		

Posterior Instrumentation

Transpedicular approach

Pedicular Chord Length(mm):

Level	Rt side	Lt side
T1		
T2		
T3		
T4		
T5		
T6		
T7		
T8		
T9		
T10		
T11		
T12		

Pedicular Angle($^{\circ}$):

Level	Rt side	Lt side
T1		
T2		
T3		
T4		
T5		
T6		
T7		
T8		
T9		
T10		
T11		
T12		

Extrapedicular approach

Extrapedicular Cord Length:

Level	Rt side	Lt side
T1		
T2		
T3		
T4		
T5		
T6		
T7		
T8		
T9		
T10		
T11		
T12		

Extrapedicular Angle($^{\circ}$):

Level	Rt side	Lt side
T1		
T2		
T3		
T4		
T5		
T6		
T7		
T8		
T9		
T10		
T11		
T12		

Master Chart

12.0	GOMATHI	66.0	452 RT 59193	23.9	26.4	28.4	28.0	29.9	29.7	32.7	33.2	33.2	33.2	33.2	33.2	33.0	32.5		24.2	25.3	27.4	27.5	28.6	29.7	34.6	34.2	35.3	33.4	30.7	31.5
13.0	JAYA	29.0	332 RT 58943	23.7	26.1	28.3	27.9	29.8	29.4	32.5	33.2	33.2	33.2	33.2	33.2	32.7	32.0		24.0	25.2	27.2	27.5	28.4	29.6	33.8	34.2	35.3	33.4	30.3	31.5
14.0	JEROLD	48.0	376 RT 59048	29.2	33.9	33.2	33.5	36.5	36.1	38.0	39.1	40.3	38.8	37.8	38.5				28.3	33.1	32.8	34.2	34.0	36.0	39.0	39.5	39.9	41.5	36.5	37.8
15.0	JEYACHITRA	36.0	379 RT 57447	27.4	32.1	31.5	31.2	34.2	33.2	36.1	36.2	37.4	37.0	36.1	36.2				27.0	30.1	31.1	31.8	31.9	34.0	37.6	37.6	38.5	37.9	34.7	35.5
16.0	JOTHIAMMAL	55.0	342 RT 58955	29.0	33.5	33.1	32.9	35.8	35.6	37.1	39.0	40.2	38.5	37.3	38.2				28.2	32.7	32.4	33.8	33.7	35.4	38.6	39.2	39.5	40.4	36.1	37.4
17.0	KALIB BEEVI	50.0	293 RT 58908	27.4	32.1	32.0	31.2	34.2	33.2	36.3	36.3	37.7	37.2	36.1	36.3				27.0	30.1	31.1	31.9	32.0	34.1	37.7	37.8	38.7	38.0	34.8	36.1
18.0	KARPAAGAM	28.8	333 RT 7021	28.8	33.3	33.0	32.5	35.7	35.2	37.1	38.3	40.0	38.5	37.0	37.9				28.1	32.1	32.2	33.8	33.5	35.2	38.5	39.2	39.5	39.5	36.1	37.2
19.0	KARUNGAMMAL	60.0	514 RT 6944	27.8	32.2	32.2	31.3	34.2	33.7	36.5	36.5	37.9	37.4	36.1	36.4				27.1	30.6	31.2	32.3	32.2	34.2	37.7	37.9	38.7	38.4	34.9	36.2
20.0	KASIKANNI	28.5	337 RT 58948	28.5	33.1	33.0	32.4	35.6	35.1	37.0	38.3	39.0	38.2	36.6	37.7				27.9	32.0	31.7	33.5	33.1	35.2	38.4	38.8	39.2	39.3	36.1	37.0
21.0	KRISHNAMMAL	66.0	915 RT 6030	25.0	27.7	28.5	28.3	30.6	30.3	33.4	34.0	34.4	34.3	34.2	33.8				24.9	26.4	28.6	28.8	29.4	30.6	35.3	34.4	35.8	33.8	31.8	32.6
22.0	KUPPAMMAL	73.0	916 RT 6024	25.1	28.0	28.6	28.4	30.6	30.4	33.4	34.3	34.5	34.5	34.2	34.1				25.1	26.9	28.9	28.8	29.5	31.2	35.3	34.7	35.8	33.9	31.9	32.6
23.0	LAKSHMI	44.0	927 RT 6038	27.8	32.2	32.4	31.3	34.3	33.9	36.6	36.5	37.9	37.4	36.2	36.5				27.3	30.7	31.3	32.6	32.3	34.8	37.8	38.0	38.9	38.5	35.1	36.3
24.0	MAHESWARI	32.0	386 RT 57455	30.7	36.5	37.2	37.4	38.7	39.8	42.1	41.5	42.7	42.6	41.3	42.3				31.4	36.3	35.8	38.8	40.6	39.9	43.9	40.6	45.5	43.4	39.9	40.5
25.0	MALAIARASI	54.0	516 RT 6955	26.8	31.7	30.5	30.8	33.0	33.0	35.8	35.9	37.1	36.8	36.0	35.9				26.6	29.7	30.9	31.2	31.4	33.6	37.4	37.2	37.8	37.2	34.3	34.8
26.0	MUNIYAMMAL	50.0	918 RT 6012	30.7	36.2	36.1	36.6	38.5	39.4	41.2	40.8	42.6	40.7	41.0	42.2				31.1	35.9	35.3	37.0	35.9	39.7	43.0	40.6	44.9	43.0	39.1	40.4
27.0	MUTHU LAKSHMI	40.0	487 RT 56282	26.6	31.7	30.5	30.6	32.9	32.7	35.7	35.8	36.7	36.8	35.9	35.7				26.5	29.3	30.5	31.2	31.3	33.6	36.9	37.1	37.6	37.2	34.2	34.7
28.0	PANDIAMMAL	50.0	262 RT 58835	23.0	24.9	26.3	26.1	28.5	27.6	31.6	31.2	32.3	29.2	30.8	30.3				22.6	24.2	25.7	27.0	26.6	28.6	31.7	32.4	33.9	32.0	28.4	29.1
29.0	PAPPU	38.0	302 RT 6552	25.2	28.8	28.8	28.6	30.8	30.5	33.5	34.4	34.9	34.6	34.4	34.2				25.2	27.0	28.9	28.8	29.6	31.4	35.5	35.2	35.9	34.1	31.9	32.8
30.0	PONNU MANI	46.0	483 RT 6888	28.1	32.5	32.4	31.7	34.3	33.9	36.6	37.2	37.9	37.5	36.2	36.7				27.4	30.8	31.5	32.6	32.6	34.9	37.8	38.3	39.0	38.6	35.2	36.4
31.0	POTHUM PONNU	29.0	546 RT 59373	33.6	37.7	37.7	37.5	38.9	39.9	43.5	42.8	44.4	42.6	42.6	44.0				32.6	38.6	36.4	39.1	42.5	40.6	47.5	40.8	45.7	43.8	42.6	40.8
32.0	POTHUMANI	35.0	331 RT 58942	30.3	35.7	35.6	35.4	37.0	38.6	39.7	40.6	42.6	40.5	39.7	39.7				29.8	35.6	33.8	36.4	35.6	37.2	41.2	39.7	42.3	42.4	38.3	39.4
33.0	PREMALATHA	45.0	930 RT 604	26.4	31.5	30.1	30.3	32.0	32.7	35.5	35.7	36.2	36.5	35.7	35.0				26.3	28.8	30.4	30.8	30.8	33.5	36.8	36.6	37.4	36.7	33.5	34.2
34.0	PRIYA	26.0	266 RT 58847	30.7	35.8	35.9	36.6	37.8	39.0	40.7	40.6	42.6	40.5	40.4	40.3				31.1	35.9	34.1	36.4	35.8	37.9	41.6	40.1	44.5	42.7	38.7	40.1
35.0	RAJESHWARI	45.0	436 RT 6807	26.5	31.6	30.5	30.3	32.6	32.7	35.7	35.8	36.7	36.7	35.8	35.3				26.4	29.0	30.5	31.1	30.9	33.5	36.9	36.8	37.5	37.1	33.7	34.4
36.0	RAMAKKAL	40.0	431 RT 6813	23.1	24.9	26.3	26.4	28.7	28.2	31.7	31.3	32.3	29.5	31.9	31.3				22.7	25.0	25.8	27.1	27.7	29.2	32.2	32.4	34.1	32.3	29.2	30.2
37.0	RAMYA	19.0	514 RT 6967	25.2	29.0	28.9	29.1	30.9	30.9	33.7	34.6	34.7	34.8	34.4	34.6				25.2	27.1	29.1	29.0	29.6	31.5	35.5	35.4	36.0	34.4	32.0	32.9
38.0	SAKILA	29.0	524 RT 6968	28.1	32.5	32.7	32.2	34.8	34.5	36.7	37.2	37.9	37.6	36.3	37.1				27.6	31.3	31.6	32.8	32.7	35.0	38.0	38.5	39.1	38.9	35.3	36.8
39.0	SAROJA	60.0	320 RT 58930	29.9	35.1	35.3	34.7	36.9	37.3	39.3	40.2	42.3	39.9	38.9	39.7				29.5	35.5	33.3	36.2	35.0	37.0	40.9	39.7	41.9	41.9	37.5	39.0
40.0	SIVAGAMI SUNDARI	47.0	427 RT 6793	26.2	31.4	30.1	30.2	31.8	32.4	35.3	35.7	36.0	36.5	35.7	35.0				25.9	28.7	30.3	30.5	30.6	33.4	36.6	36.6	37.2	36.2	33.2	34.1
41.0	SUNDARA JOTHY	45.0	467 RT 6838	25.5	29.3	29.0	29.2	31.0	31.0	33.7	34.7	34.7	35.0	34.8	34.8				25.2	27.3	29.1	29.2	29.9	32.0	35.6	35.8	36.2	34.8	32.1	33.0
42.0	THAULAH	28.2	32.7	32.8	32.2	35.4	34.5	37.0	37.2	38.1	37.7	38.1	37.7	36.3	37.2				27.7	31.7	31.7	32.9	32.8	35.0	38.1	38.5	39.1	39.0	36.0	36.8
43.0	THENAMMAL	70.0	469 RT 6914	29.7	34.2	34.1	34.4	36.6	36.3	38.7	39.8	40.9	39.4	38.3	38.5				28.8	33.5	33.1	34.6	34.2	36.9	40.5	39.6	40.6	41.6	36.7	38.4
44.0	UMADEVU	21.0	340 RT 11770	29.5	34.0	34.0	33.5	36.5	36.2	38.0	39.3	40.6	38.8	38.2	38.5				28.3	33.3	33.0	34.5	34.1	36.8	39.4	39.5	40.5	41.6	36.5	38.1
45.0	UTHRA	22.0	612 RT 10662	29.8	34.4	34.6	34.5	36.9	36.9	39.0	40.0	42.1	39.6	38.7	38.6				28.9	33.9	33.1	35.5	34.8	36.9	40.8	39.6	40.9	41.8	37.3	38.5
46.0	VAIRAM	62.0	218 RT 32990	26.2	31.3	30.0	30.0	31.8	32.3	35.1	35.5	35.9	35.8	35.6	35.0				25.5	28.6	30.1	30.3	30.5	32.7	36.3	36.5	37.1	36.0	33.1	34.0
47.0	VALLI	40.0	366 RT 58989	25.6	29.5	29.1	29.6	31.2	31.2	34.0	34.8	35.0	35.4	35.1	34.8				25.2	27.5	29.1	29.2	29.9	32.1	35.7	35.9	36.3	35.1	32.3	33.3
48.0	VASANTHA	25.0	434 RT 6822	28.4	32.9	32.9	32.4	35.5	34.6	37.0	37.5	38.4	38.0	36.5	37.3				27.8	32.0	31.7	33.1	33.1	35.1	38.3	38.7	39.2	39.2	36.1	36.9
49.0	VEERAMMAL	58.0	300 RT 6557	23.2	25.4	27.5	27.6	29.1	28.8	32.1	31.7	32.6	30.2	32.0	31.6				23.5	25.0	26.3	27.3	28.1	29.2	33.1	32.5	35.0	32.6	29.3	30.4
50.0	VIJAYA	40.0	413 RT 6753	25.7	30.1	29.1	29.8	31.3	31.4	34.7	35.0	35.1	35.4	35.2	34.9				25.2	28.0	29.6	30.0	30.0	32.4	36.0	36.2	36.5	35.5	32.5	33.5

PEDICULAR ANGLE

MALE

SL NO	NAME	AGE	CT NO	RIGHT					LEFT																					
				T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12															
1.0	AALADIYAN	42.0	387 RT 59072	31.6	21.6	12.9	11.7	9.9	9.1	8.6	8.4	8.2	6.0	5.1	4.1				29.8	21.4	13.6	11.0	9.5	9.3	8.3	7.5	6.9	5.1	4.4	4.9
2.0	ADAIKALA RAJ	40.0	541 RT 6986	34.4	24.0	16.3	13.9	12.0	11.4	10.6	10.4	10.1	7.1	6.9	5.0				32.9	23.9	16.3	13.4	11.6	10.8	10.9	9.5	8.8	6.8	6.0	5.7
3.0	ARUMUGAM	49.0	306 RT 58912	39.1	26.2	19.1	18.6	14.6	13.3	12.8	11.8	11.4	8.6	8.3	6.0				38.4	26.5	20.8	16.7	13.8	14.3	13.5	12.3	12.9	7.6	8.1	6.9
4.0	AYYAR	41.0	420 RT 59126	40.1	28.0	19.3	19.7	16.5	14.8	13.9	12.4	11.5	9.8	8.5	7.1				39.2	26.8	22.1	17.9	14.2	15.3	14.7	12.4	13.2	8.4	8.3	7.0

SL NO	NAME	AGE	CT NO	RIGHT												LEFT											
				T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12
1.0	AMIRTHAM	45.0	539 RT 7005	32.3	23.4	15.5	12.8	11.6	10.5	9.7	9.2	9.5	5.8	5.3	4.8	33.0	22.0	16.0	12.5	10.1	10.1	9.8	9.1	9.3	6.3	5.1	4.6
2.0	ANAGALAESWARI	45.0	384 RT 59041	29.3	20.1	12.7	10.8	8.7	8.0	7.9	7.0	6.9	4.1	3.8	3.5	29.3	18.9	12.5	9.6	8.2	7.9	7.8	7.2	6.7	4.8	3.7	3.5
3.0	ANDICHI	60.0	491 RT 6897	23.0	16.4	8.9	8.0	5.2	6.0	5.8	5.1	5.3	1.8	2.7	2.4	26.3	16.3	9.9	7.9	4.8	5.5	4.8	5.1	3.0	3.0	2.6	2.3
4.0	ANGAMMAL	65.0	413 RT 6788	25.3	18.7	11.7	9.5	8.1	6.9	6.7	5.9	6.1	3.7	3.2	3.1	27.8	18.5	11.5	8.9	7.4	7.1	6.4	6.1	5.3	4.0	3.4	2.9
5.0	APARNA	21.0	428 RT 6815	29.8	21.0	14.5	11.8	9.9	9.1	8.3	8.1	5.0	4.7	3.9	3.1	31.1	20.2	14.0	11.3	9.1	8.8	8.4	7.8	8.3	5.2	4.5	4.3
6.0	ARYAMMAL	80.0	386 RT 59043	22.7	16.4	8.8	7.4	5.1	4.5	4.8	4.8	1.4	1.1	2.3	25.2	15.9	9.7	6.4	4.3	4.3	4.7	4.5	4.7	2.5	2.8	2.4	1.8
7.0	AVITHA BANU	38.0	330 RT 58960	35.9	24.9	17.4	14.1	13.0	11.6	11.3	10.9	11.5	7.9	6.0	5.6	35.8	24.3	17.4	13.9	12.2	10.8	11.1	10.1	10.4	7.7	6.0	6.0
8.0	AZHAGU	53.0	528 RT 6957	32.0	23.3	15.4	12.7	11.1	10.4	9.7	9.1	9.2	5.7	5.3	4.6	33.0	21.8	15.9	12.4	10.0	10.1	9.5	9.0	9.1	6.2	4.9	4.6
9.0	CHINNA MANI	52.0	438 RT 6814	28.9	19.9	12.6	10.7	8.7	7.9	7.7	6.8	6.9	4.1	3.7	3.4	29.3	18.8	12.3	9.6	8.1	7.9	7.8	7.1	6.6	4.6	3.6	3.5
10.0	CHINNAREKKAMMAL	28.0	544 RT 6984	27.3	19.5	12.6	10.3	8.5	7.6	7.5	6.7	6.6	3.9	3.7	3.4	28.4	18.6	12.2	9.1	7.9	7.6	7.7	6.8	6.2	4.6	3.6	3.3
11.0	DEVI AMBIKA	23.0	381 RT 6733	30.6	21.6	14.8	11.9	10.0	9.9	9.3	8.5	8.1	5.2	4.7	3.9	31.3	20.6	14.1	11.5	9.3	8.9	8.6	8.4	5.3	4.6	4.4	
12.0	GOMATHI	66.0	452 RT 59193	26.7	19.4	12.5	10.1	8.3	7.4	7.4	6.6	6.6	3.9	3.6	3.4	28.4	18.6	12.1	9.1	7.7	7.5	7.4	6.8	5.7	4.6	3.6	3.1
13.0	JAYA	29.0	332 RT 58943	25.6	19.3	12.3	9.9	8.2	7.2	6.7	6.5	6.2	3.8	3.4	3.2	27.9	18.5	11.6	8.9	7.5	7.3	7.0	6.3	5.6	4.5	3.6	3.0
14.0	JEROLD	48.0	376 RT 59048	36.0	25.4	17.5	14.4	13.1	12.0	11.5	10.9	11.5	8.0	6.0	5.6	35.8	25.0	17.8	14.0	12.4	11.0	11.2	10.3	10.6	7.8	6.1	6.1
15.0	JEVACHITRA	36.0	379 RT 57447	32.3	23.5	15.6	13.1	11.7	10.5	9.7	9.3	9.6	5.8	5.3	4.9	33.1	22.1	16.1	12.5	10.3	10.1	9.9	9.1	9.5	6.4	5.1	4.6
16.0	JOTHIAMMAL	55.0	342 RT 58955	35.4	24.9	17.3	14.1	12.7	11.6	11.2	10.9	11.3	7.8	5.9	5.6	35.5	24.2	17.4	13.7	11.8	10.8	11.0	10.0	10.3	7.5	6.0	5.8
17.0	KALIB BEEVI	50.0	293 RT 58908	33.2	23.6	15.6	13.1	11.7	10.6	9.8	9.4	9.7	6.1	5.3	5.0	33.5	22.3	16.4	12.6	10.3	10.2	9.9	9.3	9.5	6.4	5.1	4.7
18.0	KARPAAGAM	40.0	546 RT 7021	35.2	24.9	16.7	14.1	12.5	11.5	11.1	10.3	10.8	7.7	5.9	5.5	35.4	23.1	17.3	13.6	11.7	10.6	10.9	10.0	10.2	7.4	5.9	5.7
19.0	KARUNGAMMAL	60.0	514 RT 6944	33.3	23.6	15.7	13.1	11.7	10.6	10.0	9.9	10.0	6.3	5.4	5.0	33.8	22.3	16.4	13.1	10.4	10.2	10.1	9.3	9.6	6.4	5.2	4.8
20.0	KASIKANNI	55.0	337 RT 58948	35.2	24.7	16.7	13.9	12.4	11.4	10.4	10.2	10.6	7.3	5.8	5.5	34.8	22.7	17.3	13.4	11.7	10.6	10.8	9.9	10.0	7.3	5.7	5.5
21.0	KRISHNAMMAL	66.0	915 RT 6030	29.3	20.2	12.8	10.9	8.8	8.0	8.0	7.4	7.1	4.3	3.9	3.5	29.8	19.1	12.6	10.1	8.3	7.9	7.9	7.3	7.2	4.9	3.9	4.0
22.0	KUPPAMMAL	73.0	916 RT 6024	29.4	20.6	13.2	11.1	8.9	8.6	8.5	7.5	7.1	4.5	4.1	3.6	30.5	19.8	12.8	10.1	8.4	7.9	7.9	7.5	7.2	4.9	4.2	4.0
23.0	LAKSHMI	44.0	927 RT 6038	33.5	23.7	16.4	13.1	11.8	10.7	10.2	10.0	10.2	6.5	5.4	5.0	34.2	22.4	16.8	13.2	10.5	10.3	10.2	9.3	9.7	6.5	5.3	4.8
24.0	MAHESWARI	32.0	386 RT 57455	38.5	27.5	21.2	17.6	16.3	14.2	14.0	13.8	12.9	9.7	8.6	6.8	37.9	27.1	21.0	15.7	14.0	12.5	12.6	12.0	11.6	8.9	7.5	6.6
25.0	MALAIARASI	54.0	516 RT 6955	31.9	23.1	15.3	12.6	10.9	10.2	9.6	9.0	8.9	5.7	5.1	4.5	32.9	21.8	15.9	12.3	9.9	10.1	9.4	9.0	9.0	6.1	4.9	4.6
26.0	MUNIYAMMAL	50.0	918 RT 6012	38.4	26.4	20.5	16.5	15.4	14.0	13.2	12.8	12.9	8.9	7.8	6.6	37.2	27.1	20.4	15.7	13.7	12.1	12.5	12.0	11.4	8.6	6.8	6.4
27.0	MUTHU LAKSHMI	40.0	487 RT 56282	31.8	22.9	15.3	12.4	10.6	10.2	9.5	8.9	8.8	5.6	5.1	4.5	32.7	21.6	15.8	12.2	9.9	9.8	9.3	8.9	8.8	6.1	4.8	4.6
28.0	PANDIAMMAL	50.0	262 RT 58835	24.4	18.1	9.5	8.6	5.8	6.0	6.5	5.4	5.6	3.1	2.9	2.6	26.5	16.4	10.2	8.3	5.6	5.8	5.3	3.9	3.6	2.9	2.4	
29.0	PAPPU	38.0	302 RT 6552	29.5	20.7	13.8	11.1	9.0	8.7	8.5	7.9	7.2	4.5	4.2	3.6	30.7	19.8	13.0	10.4	8.6	8.0	8.3	7.6	7.5	5.0	4.2	4.1
30.0	PONNU MANI	46.0	483 RT 6888	34.5	23.8	16.6	13.1	11.9	10.7	10.3	10.1	10.4	6.8	5.6	5.1	34.4	22.4	16.9	13.3	10.8	10.3	10.2	9.4	9.7	6.5	5.3	4.9
31.0	POTHUM PONNU	29.0	546 RT 59373	40.5	27.8	23.6	18.9	17.5	14.6	14.9	14.0	13.7	9.9	9.2	7.8	39.3	28.1	21.1	17.5	14.2	14.7	15.3	12.1	12.7	8.9	8.0	6.6
32.0	POTHUMANI	35.0	331 RT 58942	38.0	25.9	18.2	15.3	14.5	12.8	12.2	12.4	12.1	8.3	6.9	5.9	37.1	26.0	19.4	14.9	13.2	11.7	11.6	11.4	11.1	8.5	6.4	6.3
33.0	PREMALATHA	45.0	930 RT 604	30.9	22.0	15.0	12.2	10.2	10.1	9.4	8.6	8.6	5.5	5.1	4.1	32.2	20.7	14.8	12.0	9.7	9.7	9.2	8.7	8.7	5.4	4.8	4.5
34.0	PRIYA	26.0	266 RT 58847	38.3	26.1	20.1	15.6	15.3	13.5	12.6	12.5	12.2	8.8	7.7	6.0	37.2	26.1	20.1	15.1	13.7	11.9	12.2	11.4	11.2	8.6	6.6	6.4
35.0	RAJESHWARI	45.0	436 RT 6807	31.0	22.7	15.2	12.4	10.4	10.1	9.5	8.6	8.7	5.6	5.1	4.3	32.4	21.6	15.7	12.2	9.7	9.8	9.2	8.8	8.8	5.5	4.8	4.6
36.0	RAMAKKAL	40.0	431 RT 6813	24.5	18.3	10.8	8.6	7.7	6.3	6.6	5.5	5.7	3.5	3.0	2.7	26.8	16.5	10.3	8.6	6.1	5.8	6.0	5.7	4.5	3.7	3.0	2.5
37.0	RAMYA	19.0	514 RT 6967	29.5	20.7	14.1	11.3	9.2	9.0	8.7	8.0	7.4	4.5	4.3	3.6	30.8	19.9	13.2	10.5	8.8	8.2	8.3	7.6	7.8	5.0	4.3	4.2
38.0	SAKILA	29.0	524 RT 6968	34.6	24.0	16.6	13.2	12.2	10.8	10.3	10.1	10.4	7.1	5.7	5.3	34.5	22.5	17.0	13.3	10.8	10.3	10.5	9.5	9.8	6.6	5.4	4.9
39.0	SAROJA	60.0	320 RT 58930	37.8	25.7	18.1	15.0	14.3	12.6	12.0	12.4	11.9	8.3	6.6	5.9	36.7	25.9	19.2	14.9	12.8	11.5	11.6	11.3	11.1	8.4	6.4	6.2
40.0	SIVAGAMI SUNDARI	47.0	427 RT 6793	30.8	21.7	14.9	11.9	10.1	10.0	9.3	8.5	8.5	5.3	5.0	4.1	32.0	20.6	14.5	12.0	9.5	9.6	9.0	8.6	8.5	5.4	4.6	4.5
41.0	SUNDARA JOTHY	45.0	467 RT 6838	29.7	20.7	14.2	11.3	9.2	9.0	8.7	8.2	7.4	4.7	4.5	3.6	30.8	20.1	13.4	11.0	8.9	8.2	8.3	7.7	7.9	5.1	4.3	4.2
42.0	THAULAH	40.0	77 RT 11037	34.7	24.5	16.7	13.2	12.2	10.9	10.3	10.1	10.4	7.1	5.7	5.3	34.6	22.5	17.0	13.3	10.9	10.4	10.8	9.7	10.8	7.1	5.6	5.1
43.0	THEANIMAL	70.0	469 RT 6914	36.9	25.6	17.7	14.6	13.6	12.4	11.7	11.7	11.8	8.0	6.4	5.8	36.2	25.3	18.5	14.5	12.7	11.1	11.3	10.7	10.8	8.1	6.1	6.1
44.0	UMADEVU	21.0	340 RT 11770	36.9	25.4	17.6	14.4	13.5	12.2	11.7	11.1	11.8	8.0	6.1	5.7	36.0	25.3	18.0	14.3	12.4	11.0	11.3	10.4	10.6	8.1	6.1	6.1
45.0	UTHRA	22.0	612 RT 10662	37.3	25.6	18.0	14.7	14.1	12.6	11.9	12.2	11.9	8.2	6.6	5.8	36.7	25.9	18.5	14.5	12.8	11.2	11.5	10.9	10.9	8.3	6.4	6.2

SL NO	NAME	AGE	CT NO	RIGHT	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	LEFT	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12
46.0	VAIRAM	62.0	218 RT 32990	30.7	21.6	14.9	11.9	10.1	10.0	9.3	8.5	8.5	8.5	8.5	8.5	8.5	31.8	20.6	14.3	11.8	11.8	9.5	9.2	8.9	8.6	8.4	5.4	4.6	4.4
47.0	VALLI	40.0	366 RT 58989	29.8	20.7	14.3	11.4	9.8	9.5	8.9	8.2	7.5	4.7	4.5	3.7	3.9	30.9	22.1	13.6	11.1	9.0	8.3	8.3	8.7	8.0	5.1	4.4	4.2	
48.0	VASANTHA	25.1	434 RT 6822	35.1	24.5	16.7	13.7	12.4	11.1	10.4	10.2	10.4	7.2	5.7	5.4	5.4	34.6	22.7	17.1	13.4	11.4	10.6	10.8	9.9	9.9	7.3	5.6	5.4	
49.0	VEERAMMAL	58.0	300 RT 6557	24.9	18.5	11.1	9.3	7.9	6.6	6.7	5.7	6.0	3.6	3.2	3.0	3.0	27.4	17.0	11.4	8.9	7.3	6.1	6.2	6.0	4.6	3.9	3.3	2.9	
50.0	VIJAYA	40.0	413 RT 6753	29.8	20.7	14.4	11.7	9.9	9.6	9.0	8.3	7.5	4.9	4.6	3.7	3.7	31.0	20.2	13.9	11.2	9.0	8.8	8.4	7.8	8.2	5.2	4.5	4.2	

EXTRAPEDICULAR CHORD LENGTH

MALE

SL NO	NAME	AGE	CT NO	RIGHT	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	LEFT	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12
1.0	AALADIYAN	42.0	387 RT 59072	38.8	42.7	43.9	46.8	49.6	50.5	52.3	53.1	52.6	50.4	48.5	46.1	46.1	37.5	41.7	42.1	45.2	47.4	50.4	50.8	51.1	50.4	51.1	47.5	46.3	
2.0	ADAIKALA RAJ	40.0	541 RT 6986	42.3	46.6	47.1	49.6	53.9	55.1	55.8	58.0	55.6	55.4	51.2	48.8	48.8	40.1	44.9	45.6	49.4	51.3	54.2	54.6	55.5	54.0	55.1	51.5	50.1	
3.0	ARUMUGAM	49.0	306 RT 58912	45.5	49.6	50.8	51.8	59.3	60.1	59.0	62.0	62.4	61.4	55.5	54.3	54.3	43.6	48.0	49.3	53.1	55.2	57.1	58.8	61.3	58.8	58.7	55.3	55.0	
4.0	AYYAR	41.0	420 RT 59126	46.0	49.9	52.2	52.4	61.8	60.4	63.1	63.5	63.2	61.4	57.1	55.9	55.9	44.4	49.7	49.3	54.0	55.2	57.9	59.2	63.9	59.0	59.1	58.1	55.3	
5.0	BALU	70.0	385 RT 59042	43.9	47.9	48.0	50.8	55.6	56.8	60.1	57.1	58.6	52.3	51.1	51.1	51.1	41.9	46.6	46.4	50.5	52.7	55.9	56.7	57.2	55.5	56.7	52.7	53.2	
6.0	DHARAMARAJ	50.0	339 RT 58950	40.4	45.2	44.7	48.0	52.2	52.0	53.9	55.5	54.6	53.3	50.1	48.1	48.1	38.5	43.4	43.6	47.6	49.4	51.6	52.2	53.7	52.0	52.7	49.9	48.1	
7.0	DHARMARAJ	52.0	380 RT 6732	37.0	39.5	41.6	43.1	46.8	46.1	48.5	50.8	50.0	48.0	46.1	43.6	43.6	35.3	39.3	40.0	42.9	45.9	47.2	48.6	47.8	48.5	49.5	45.4	44.2	
8.0	GANESAN	47.0	383 RT 6717	38.5	42.7	43.8	45.8	48.4	50.3	51.1	53.0	52.4	50.2	48.1	46.0	46.0	37.4	41.6	41.8	45.1	47.2	49.9	50.7	50.9	50.1	51.0	47.3	46.3	
9.0	IRULAPPAN	53.0	487 RT 4293	40.0	44.8	44.6	47.9	52.1	52.0	53.7	55.1	54.2	52.8	49.6	47.6	47.6	38.3	43.2	43.5	46.8	49.0	51.6	51.6	53.3	51.3	52.2	49.8	47.5	
10.0	KALASALINGAM	55.0	369 RT 59014	44.9	49.2	49.9	51.3	56.8	60.0	58.7	61.5	59.9	61.1	53.6	52.0	52.0	43.5	47.7	48.2	51.8	53.8	56.7	58.3	60.7	57.1	57.8	54.7	54.9	
11.0	KANDHASAMY	52.0	371 RT 58999	31.3	34.1	36.9	39.3	39.2	40.4	44.0	44.8	45.0	41.1	40.5	35.4	35.4	32.3	35.1	38.2	37.9	41.3	41.7	44.9	42.9	44.7	43.1	40.2	40.9	
12.0	KARMEGAM	60.0	920 RT 6031	44.3	48.2	48.7	50.8	55.9	56.9	57.4	60.1	58.7	60.0	52.3	51.2	51.2	42.1	47.0	46.9	50.5	53.2	56.1	57.6	58.8	56.0	57.2	52.8	53.3	
13.0	KARUPPAYEE	40.0	372 RT 56309	40.8	45.8	45.5	48.3	52.5	52.4	54.3	56.0	54.7	53.5	50.2	48.1	48.1	39.0	43.5	43.6	47.8	49.9	51.8	52.7	53.7	52.7	52.7	49.9	48.2	
14.0	KRISHNAN	40.0	921 RT 6035	37.1	39.9	41.7	43.1	47.0	46.7	48.9	51.1	50.1	48.2	46.5	43.8	43.8	35.6	39.8	40.2	43.5	45.9	47.8	48.8	48.2	48.6	49.5	45.9	44.2	
15.0	LOGANATHAN	28.0	292 RT 57217	38.8	42.9	43.9	46.9	49.7	50.7	52.4	53.3	52.8	50.5	48.5	46.1	46.1	37.5	41.7	42.2	45.5	47.6	50.5	50.8	51.1	50.6	51.2	48.1	46.4	
16.0	MAHENDRAN	45.0	435 RT 6816	42.4	47.5	47.2	49.6	54.2	55.5	55.9	59.0	55.6	55.8	51.3	49.1	49.1	40.5	45.5	45.7	49.5	51.5	54.3	55.1	55.8	54.3	55.2	51.7	50.1	
17.0	MAHESHWARAN S	50.0	515 RT 6884	43.2	47.6	47.3	49.7	54.3	56.1	56.0	59.3	55.7	57.1	51.5	49.5	49.5	40.5	45.7	45.8	49.6	51.7	54.3	55.2	56.0	54.4	55.3	51.8	50.8	
18.0	MALAIANDI	55.0	260 RT 58831	36.5	39.0	40.8	43.0	46.3	45.9	48.4	50.3	49.7	47.6	45.5	42.8	42.8	34.7	39.2	39.9	42.1	45.0	47.2	48.2	47.7	48.4	49.1	45.3	43.9	
19.0	MOOKAN	62.0	439 RT 6825	36.7	39.1	41.5	43.0	46.4	45.9	48.4	50.4	49.8	47.9	45.8	42.9	42.9	35.1	39.2	40.0	42.1	45.8	47.2	48.2	47.8	48.4	49.1	45.3	44.0	
20.0	MURUGESAN	60.0	546 RT 7004	43.5	47.6	47.3	50.7	54.3	56.4	56.6	59.6	55.7	57.2	51.9	49.6	49.6	40.6	45.7	46.1	49.6	51.9	54.4	55.4	56.2	54.5	56.4	52.6	51.3	
21.0	MURUGESAN	45.0	464 RT 6837	43.5	47.9	48.0	50.7	55.1	56.7	56.6	59.9	55.9	58.0	52.1	50.7	50.7	40.9	46.2	46.4	50.0	52.0	55.0	56.6	56.9	55.4	56.7	52.6	52.7	
22.0	MUTHU	47.0	488 RT 6870	38.4	42.6	43.7	45.6	48.1	50.0	50.5	52.7	51.7	50.0	48.0	45.7	45.7	37.3	41.5	41.8	44.9	47.1	49.7	50.6	50.8	50.1	51.0	47.0	46.0	
23.0	MUTHUSAMY	62.0	547 RT 6987	42.0	46.2	46.7	49.1	53.4	53.7	55.1	57.7	55.2	54.9	51.1	48.8	48.8	39.3	44.8	45.2	48.9	50.8	54.0	54.0	54.2	55.1	53.7	54.3	51.2	49.5
24.0	NATARAJAN	58.0	340 RT 58951	38.1	42.5	43.0	45.0	47.9	49.6	50.2	51.6	51.6	49.6	47.9	45.4	45.4	37.1	41.0	41.7	44.4	46.6	49.5	50.2	49.9	50.1	50.6	46.8	45.6	
25.0	PALANI SAMY	55.0	529 RT 6951	33.4	35.9	37.3	39.6	42.4	42.9	46.6	46.3	46.1	42.8	42.8	37.3	37.3	32.4	36.6	38.7	39.7	42.3	43.8	45.5	43.7	45.1	44.5	40.2	41.7	
26.0	PALANIANDI	70.0	531 RT 59379	42.0	46.2	46.3	49.1	53.0	53.4	54.6	57.5	55.2	54.4	51.1	48.6	48.6	39.2	44.2	45.0	48.2	50.6	53.9	53.8	55.1	53.4	54.2	50.9	49.3	
27.0	PANDI	45.0	452 RT 6840	41.6	46.2	46.2	48.8	52.8	53.0	54.5	57.1	54.9	54.4	50.9	48.6	48.6	39.1	43.9	44.3	48.2	50.1	53.5	53.6	54.7	53.0	53.8	50.8	48.8	
28.0	PANDIA RAJAN	76.0	539 RT 6982	37.6	41.9	42.7	44.0	47.7	48.8	50.1	51.5	51.5	49.4	47.1	45.2	45.2	36.3	40.9	41.6	44.1	46.3	48.6	49.5	49.1	50.0	50.2	46.7	45.4	
29.0	PICHAI	40.0	516 RT 6971	37.5	41.7	42.3	44.0	47.5	48.5	49.8	51.5	50.8	49.4	47.1	45.2	45.2	36.3	40.9	41.2	44.0	46.3	48.6	49.4	49.0	50.0	50.0	46.6	45.2	
30.0	PICHAI	55.0	513 RT 6954	41.1	46.0	45.9	48.8	52.7	52.8	54.5	56.2	54.7	54.0	50.6	48.4	48.4	39.0	43.8	43.9	48.2	50.1	53.2	53.1	54.5	52.9	53.2	50.6	48.6	
31.0	RAJENDRAN	55.0	468 RT 6834	40.8	46.0	45.7	48.7	52.6	52.5	54.4	56.1	54.7	53.9	50.5	48.3	48.3	39.0	43.8	43.7	47.8	50.1	53.0	52.8	54.0	52.8	53.1	50.1	48.4	
32.0	RAKKAPPAN	41.0	220 RT 56888	37.4	41.3	41.8	43.9	47.5	48.5	49.6	51.3	50.6	49.3	46.6	45.0	45.0	36.0	40.8	41.2	44.0	46.3	48.3	49.3	49.3	48.9	49.8	46.5	44.7	
33.0	RAMAYAN	62.0	470 RT 6866	38.4	42.6	43.3	45.1	47.9	50.0	50.3	52.2	51.7	49.8	47.9	45.6	45.6	37.2	41.2	41.7	44.7	46.9	49.6	50.5	50.4	50.1	50.9	46.9	45.8	
34.0	RAMUTHAVAR	60.0	434 RT 6811	37.3	40.8	41.8	43.5	47.5	47.5	49.4	51.3	50.3	49.2	46.5	44.7	44.7	35.9	39.9	40.5	43.9	46.2	48.0	49.3	48.4	49.5	49.8	46.2	44.4	
35.0	SALLEEM	58.0																											

39.0	SILUVAIPILLAI	55.0	268 RT 58850	40.0	44.2	44.1	47.4	51.4	53.2	53.9	53.1	50.8	49.3	47.3	37.8	42.7	43.1	46.0	48.3	51.4	51.3	52.8	51.2	51.7	48.4	47.4	
40.0	SOLAI	46.0	267 RT 58848	34.6	38.4	38.8	40.7	43.9	44.8	47.4	47.8	49.0	46.2	44.4	40.2	33.6	38.7	39.0	40.8	44.1	44.8	46.2	44.8	47.0	46.1	47.0	43.5
41.0	SOLAI	62.0	534 RT 56552	40.0	44.8	44.4	47.9	51.6	51.8	53.6	54.9	53.6	52.6	49.5	47.4	38.1	43.0	43.3	46.6	48.8	51.5	51.4	53.1	51.3	52.0	49.0	47.5
42.0	THANGARAJ	59.0	429 RT 6810	36.0	38.7	40.4	41.8	46.1	45.3	47.7	49.8	49.6	47.1	44.9	42.2	34.1	38.8	39.8	41.1	44.4	46.2	47.7	47.3	48.0	47.3	44.5	43.7
43.0	THANGAVEL	62.0	274 RT 58868	40.3	44.9	44.7	48.0	52.1	52.0	53.9	55.2	54.3	53.0	49.7	48.1	38.4	43.2	43.5	46.8	49.1	51.6	51.6	53.4	51.9	52.6	49.9	47.8
44.0	THAYUMANASAMY	62.0	531 RT 59389	36.5	38.8	40.7	42.6	46.2	45.6	48.3	49.8	49.7	47.2	45.3	42.5	34.4	39.1	39.8	41.8	44.5	47.0	47.7	47.3	48.3	48.9	45.2	43.8
45.0	THINESH	22.0	469 RT 6833	42.1	46.5	47.0	49.4	53.7	53.9	55.6	57.8	55.3	55.1	51.1	48.8	39.3	44.8	45.6	49.3	50.8	54.2	54.5	55.2	53.8	54.6	51.4	49.5
46.0	UJALDOSS	22.0	63 RT 10999	35.9	38.6	39.9	41.1	44.3	44.9	47.6	48.0	49.2	46.4	44.7	40.6	33.6	38.8	39.5	40.9	44.3	45.9	46.4	47.2	47.9	46.9	43.4	43.7
47.0	VEERARAJ	50.0	161 RT 11233	40.0	44.7	44.4	47.5	51.6	51.4	53.6	54.2	53.5	50.9	49.4	47.3	37.9	42.9	43.3	46.1	48.7	51.4	51.4	53.1	51.2	52.0	48.5	47.4
48.0	VENKATASAMY	60.0	704 RT 10753	34.1	38.2	38.1	40.4	43.8	44.3	47.2	47.4	47.1	46.1	44.3	40.0	32.7	37.3	38.8	40.3	44.1	44.3	46.1	44.5	46.2	45.6	42.5	43.1
49.0	VENKATESAN	40.0	409 RT 59097	39.2	43.3	44.1	47.1	50.9	51.1	53.1	53.6	53.0	50.7	48.8	46.7	37.8	42.4	42.5	45.9	48.3	51.1	51.1	52.4	51.1	51.5	48.2	46.9
50.0	VIRUMANDI	45.0	189 RT 11315	38.0	42.3	42.9	45.0	47.7	49.3	50.2	51.6	51.5	49.4	47.6	45.3	36.7	40.9	41.7	44.4	46.4	48.7	50.0	49.7	50.1	50.6	46.8	45.4

FEMALE

SL NO	NAME	AGE	CT NO	RIGHT												LEFT											
				T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12
1.0	AMIRTHAM	45.0	539 RT 7005	37.1	39.3	43.1	45.1	45.6	47.7	47.5	51.9	48.7	47.9	44.2	43.0	37.6	39.3	40.7	44.6	46.2	47.0	48.1	49.8	49.4	46.1	43.8	44.1
2.0	ANAGALAESWARI	45.0	384 RT 59041	33.2	36.1	39.1	41.1	42.0	43.3	44.9	47.2	44.7	43.7	40.0	38.7	34.1	36.3	37.3	40.9	43.0	42.0	43.9	46.9	45.6	43.3	41.0	40.2
3.0	ANDICHI	60.0	491 RT 6897	31.5	32.7	33.8	37.7	38.4	38.3	38.2	41.2	42.0	41.5	34.4	34.5	31.2	32.8	33.5	37.1	40.6	37.9	38.2	43.0	42.5	38.7	33.0	36.1
4.0	ANGAMMAL	65.0	413 RT 6788	32.5	34.7	37.2	40.3	40.8	41.2	41.4	44.0	42.9	42.6	39.2	36.5	32.6	35.1	36.3	39.6	42.4	39.8	41.2	44.4	43.9	41.8	38.4	38.6
5.0	APARNA	21.0	428 RT 6815	34.9	37.8	41.6	42.5	44.2	45.4	46.4	49.0	46.6	45.5	42.3	41.7	36.1	37.7	39.7	43.6	44.9	45.7	46.1	48.6	48.0	45.0	42.8	42.1
6.0	ARYAMMAL	80.0	386 RT 59043	31.3	32.0	32.2	37.2	37.0	38.2	37.4	41.2	40.7	40.3	33.0	33.5	31.1	31.3	32.7	36.1	38.2	37.1	37.9	40.7	41.2	38.6	32.9	35.9
7.0	AVITHA BANU	38.0	330 RT 58960	40.3	41.2	45.5	47.5	48.6	50.1	49.8	54.0	51.2	50.4	46.2	45.1	40.5	41.4	43.6	46.3	48.0	49.6	50.7	51.9	53.1	49.6	47.1	46.9
8.0	AZHAGU	52.0	528 RT 6957	37.1	39.0	42.8	44.7	45.4	47.5	47.3	51.4	48.5	47.3	44.1	43.0	37.5	39.3	40.6	44.4	46.1	46.9	48.1	49.8	49.4	46.0	43.4	43.6
9.0	CHINNA MANI	52.0	438 RT 6814	33.1	36.0	38.5	40.8	41.9	43.0	44.8	46.6	44.6	43.7	39.7	38.5	33.9	36.1	37.3	40.9	43.0	41.8	43.8	46.7	45.0	42.9	40.9	40.0
10.0	CHINNAREKAMMAL	28.0	544 RT 6984	33.0	35.9	38.2	40.6	41.4	42.9	44.5	45.6	43.6	43.4	39.5	38.4	33.3	35.6	36.7	40.8	42.5	41.5	43.7	46.4	44.7	42.5	40.5	39.9
11.0	DEVI AMBIKA	23.0	381 RT 6733	35.1	38.1	42.0	42.5	44.3	45.4	46.5	49.1	47.0	45.5	42.3	42.3	36.4	37.7	39.7	43.7	45.3	45.7	46.2	48.6	48.1	45.0	42.8	42.5
12.0	GOMATHI	66.0	452 RT 59193	33.0	35.6	38.0	40.6	41.0	42.7	43.5	44.8	44.3	42.8	39.4	37.4	33.2	35.1	36.5	40.8	42.5	41.4	43.4	45.3	44.5	42.4	39.8	39.2
13.0	JAYA	29.0	332 RT 58943	33.0	35.2	37.7	40.3	41.0	42.5	41.5	44.1	42.9	42.8	39.4	36.6	32.8	35.1	36.3	40.2	42.5	40.6	43.2	44.7	44.4	42.1	39.0	38.8
14.0	JEROLD	48.0	376 RT 59048	41.3	42.4	45.9	47.7	49.6	50.3	50.7	54.1	51.6	50.9	46.4	45.5	40.7	41.5	43.8	46.8	48.3	49.6	51.4	52.2	53.1	49.7	47.3	47.0
15.0	JEYACHITRA	36.0	379 RT 57447	37.4	39.3	43.2	45.1	45.6	47.9	47.5	51.9	49.2	48.4	44.3	43.4	37.7	39.5	41.1	44.9	46.2	47.0	48.9	50.1	49.8	46.4	44.2	44.2
16.0	JOTHIAMMAL	55.0	342 RT 58955	39.9	40.3	45.3	46.9	48.4	49.4	49.8	53.9	51.2	50.3	45.9	44.8	39.7	41.4	43.4	45.6	47.7	49.3	50.5	51.5	52.6	49.4	46.6	46.5
17.0	KALIB BEEVI	50.0	293 RT 58908	37.9	39.6	43.2	45.2	45.7	48.1	47.7	52.2	49.3	48.4	44.4	43.5	37.9	39.5	41.2	45.0	46.2	47.1	49.1	50.2	49.9	47.0	44.4	44.3
18.0	KARPAAGAM	40.0	546 RT 7021	39.8	40.3	45.2	46.9	48.1	49.3	49.5	53.6	50.8	50.2	45.8	44.8	39.6	41.0	43.2	45.5	47.6	48.8	50.4	51.2	52.3	49.0	46.0	45.5
19.0	KARUNGAMMAL	60.0	514 RT 6944	38.2	39.6	43.4	45.2	46.2	48.2	47.9	52.2	49.6	48.5	44.6	43.5	38.2	39.6	41.4	45.0	46.3	47.3	49.1	50.6	50.2	47.0	44.5	44.4
20.0	KASIKANNI	55.0	337 RT 58948	39.4	40.2	45.1	46.7	47.1	49.0	49.5	53.6	50.2	50.2	45.3	44.8	39.2	40.5	42.4	45.5	47.4	48.4	50.1	51.1	52.2	48.2	45.9	45.5
21.0	KRISHNAMMAL	66.0	915 RT 6030	33.2	36.2	39.4	41.1	42.2	43.9	45.1	47.4	44.8	44.2	40.6	38.8	35.0	36.4	38.3	41.1	43.4	42.4	43.9	47.1	46.1	43.3	41.1	40.9
22.0	KUPPAMMAL	73.0	916 RT 6024	33.6	36.4	39.7	41.1	42.2	44.2	45.4	47.5	44.9	44.8	40.7	39.7	35.1	36.4	38.8	41.2	43.6	43.0	44.0	47.3	46.1	43.7	41.4	41.2
23.0	LAKSHMI	44.0	927 RT 6038	38.4	39.6	44.0	45.4	46.2	48.7	48.4	52.3	49.7	48.6	44.8	44.1	38.2	39.6	41.6	45.1	46.3	47.4	49.4	50.6	50.3	47.1	44.6	44.5
24.0	MAHESWARI	32.0	386 RT 57455	45.2	43.8	50.0	52.8	52.8	55.9	54.4	60.2	59.1	54.8	49.0	48.1	43.4	46.0	47.7	50.6	54.8	53.5	56.5	57.5	55.7	51.8	49.5	50.7
25.0	MALAIARASI	54.0	516 RT 6955	36.6	39.0	40.8	42.8	44.3	45.1	47.2	47.3	51.4	48.4	44.0	43.0	37.4	39.2	40.7	44.4	46.1	46.9	48.0	49.8	49.3	46.0	43.4	43.2
26.0	MUNIYAMMAL	50.0	918 RT 6012	43.6	43.8	48.1	51.9	52.3	54.5	53.9	59.8	55.5	54.0	48.8	48.0	42.1	44.6	46.7	49.7	51.7	52.1	54.5	55.6	55.5	51.7	49.1	50.5
27.0	MUTHU LAKSHMI	40.0	487 RT 56282	36.5	38.8	42.3	43.7	45.0	46.7	47.3	51.2	48.2	47.0	44.0	42.8	37.1	39.2	40.3	44.2	46.1	46.7	47.8	49.8	49.3	45.9	43.3	43.1
28.0	PANDIAMMAL	50.0	262 RT 58835	31.5	33.5	36.0	38.1	39.2	38.5	38.7	41.5	42.1	41.9	37.4	35.9	31.9	33.4	34.3	37.6	41.4	38.0	38.7	43.5	42.9	39.7	35.1	37.3
29.0	PAPPU	38.0	302 RT 6552	34.1	36.7	39.7	41.1	42.7	44.7	45.6	47.7	45.1	44.9	41.2	39.7	35.4	36.4	39.1	41.3	43.9	43.6	44.4	47.6	46.1	43.7	41.7	41.3
30.0	PONNU MANI	46.0	483 RT 6888	38.4	39.7	44.0	45.4	46.3	48.7	48.9	52.3	49.7	48.8	44.9	44.2	38.2	39.8	41.9	45.2	46.6	47.8	49.4	50.6	51.1	47.2	44.8	44.6
31.0	POTHUM PONNU	29.0	546 RT 59373	45.5	45.4	50.5	54.8	53.1	57.7	57.0	61.7	62.6	58.4	49.9	50.0	44.2	47.0	52.9	52.0	55.7	54.1	57.4	57.5	59.2	52.4	52.2	52.5
32.0	POTHUMANI	35.0	331 RT 58942	42.8	43.5	47.0	49.7	51.3	53.1	52.7	56.3	53.6	52.0	48.2	47.0	41.7	43.3	44.9	49.2	48.9	50.8	53.7	54.2	54.8	51.2	48.1	48.4

33.0	PREMALATHA	45.0	930 RT 604	35.7	38.3	42.2	43.4	44.9	46.5	47.1	50.3	47.6	46.2	43.0	42.6	36.8	38.6	40.0	43.9	45.4	46.5	47.0	49.3	48.6	45.6	43.2	42.7
34.0	PRIYA	26.0	266 RT 58847	43.2	43.6	48.0	49.7	51.4	53.6	53.3	58.8	55.3	53.2	48.7	47.5	41.7	43.4	46.0	49.2	49.1	50.9	53.7	54.5	55.2	51.4	48.2	50.3
35.0	RAJESHWARI	45.0	436 RT 6807	36.0	38.5	42.3	43.5	45.0	46.5	47.2	50.7	47.7	46.3	43.1	42.8	36.9	38.4	40.2	44.1	45.9	46.5	47.1	49.6	49.3	45.7	43.3	42.9
36.0	RAMAKKAL	40.0	431 RT 6813	31.6	33.6	36.8	38.6	39.3	40.6	40.0	41.7	42.6	42.0	38.1	36.1	31.9	34.0	35.4	38.1	41.6	38.4	39.8	44.1	43.5	40.4	36.1	37.6
37.0	RAMYA	19.0	514 RT 6967	34.6	37.0	40.1	41.8	42.8	44.9	45.7	47.7	45.3	45.0	41.3	40.5	35.6	36.6	39.2	41.4	44.0	44.8	44.6	48.2	46.2	43.8	42.2	41.4
38.0	SAKILA	29.0	524 RT 6968	38.6	39.8	44.0	46.3	46.9	48.8	49.1	53.3	49.8	49.7	45.1	44.5	38.6	39.8	42.0	45.2	46.8	47.9	49.7	50.6	51.1	47.5	45.4	44.7
39.0	SAROJA	60.0	320 RT 58930	42.2	43.0	46.6	49.3	51.1	52.2	52.5	55.3	53.2	51.7	48.0	46.3	41.4	42.2	44.7	48.8	48.8	50.1	52.9	53.9	54.1	51.0	48.1	48.2
40.0	SIVAGAMI SUNDARI	47.0	427 RT 6793	35.5	38.2	42.1	43.1	44.9	45.9	46.9	50.0	47.3	46.0	42.8	42.4	36.7	38.2	39.8	43.7	45.4	46.4	46.9	49.3	48.3	45.5	43.0	42.7
41.0	SUNDARA JOTHY	45.0	467 RT 6838	34.7	37.5	40.3	41.9	43.5	44.9	45.8	48.2	46.4	45.2	41.3	40.5	35.8	37.3	39.3	43.9	44.1	45.0	44.6	48.4	47.3	44.0	42.3	41.7
42.0	THAULAH	40.0	77 RT 11037	38.8	39.8	44.2	46.6	46.9	48.9	49.2	53.6	49.8	49.7	45.2	44.5	38.8	39.9	42.0	45.2	46.9	48.2	49.7	51.0	51.4	47.8	45.7	44.7
43.0	THENAMMAL	70.0	469 RT 6914	41.8	42.5	46.2	48.6	50.5	51.1	52.1	54.4	51.8	51.1	46.8	45.6	41.0	41.8	44.1	47.2	48.4	49.7	52.0	52.5	53.3	50.4	47.5	47.3
44.0	UMADEVI	21.0	340 RT 11770	41.3	42.4	46.0	48.6	50.4	50.9	51.7	54.4	51.8	51.0	46.5	45.5	40.8	41.7	43.8	47.1	48.3	49.7	51.8	52.3	53.3	49.8	47.3	47.2
45.0	UTHRA	22.0	612 RT 10662	42.1	42.6	46.3	48.8	50.7	52.1	52.4	54.9	52.8	51.2	48.0	46.2	41.2	42.1	44.6	47.5	48.8	50.1	52.8	52.9	53.7	50.5	47.9	47.5
46.0	VAIRAM	62.0	218 RT 32990	35.5	38.1	42.1	42.7	44.4	45.5	46.7	49.8	47.1	45.6	42.8	42.4	36.7	37.7	39.8	43.7	45.4	45.8	46.2	49.1	48.1	45.4	42.8	42.6
47.0	VALLI	40.0	366 RT 58989	34.8	37.6	41.2	42.5	43.6	45.2	46.3	48.5	45.8	45.3	41.3	40.6	35.9	37.4	39.6	42.0	44.7	45.0	45.0	48.5	47.4	44.7	42.3	41.9
48.0	VASANTHA	25.0	434 RT 6822	39.1	40.0	44.9	46.6	47.0	49.0	49.2	53.6	49.8	49.9	45.2	44.6	39.2	40.0	42.1	45.5	47.1	48.3	49.7	51.0	51.8	48.0	45.8	45.1
49.0	VEERAMMAL	58.0	300 RT 6557	32.2	34.7	37.1	39.9	40.0	41.2	40.8	43.7	42.8	42.3	38.8	36.2	32.5	34.1	35.9	39.3	42.2	38.5	40.1	44.4	43.7	41.7	36.2	38.2
50.0	VIJAYA	40.0	413 RT 6753	34.8	37.8	41.3	42.5	44.0	45.4	46.4	48.6	45.8	45.4	42.2	40.6	36.0	37.5	39.6	42.2	44.7	45.3	45.4	48.6	47.8	44.9	42.8	41.9

EXTRAPEDICULAR ANGLE

MALE

SL.NO	NAME	AGE	CT NO	RIGHT											LEFT												
				T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12
1.0	AALADIYAN	42.0	387 RT 59072	46.2	38.2	31.0	28.4	29.3	28.2	26.0	27.6	27.6	24.0	19.8	17.6	46.4	36.5	32.7	29.2	28.7	28.2	25.9	25.5	24.9	24.4	21.7	16.5
2.0	ADAIKALA RAJ	40.0	541 RT 6986	51.0	41.8	34.7	33.3	33.0	30.7	28.9	30.5	30.5	26.4	21.9	21.3	50.2	41.7	35.6	32.5	31.9	30.9	29.4	30.5	28.4	27.3	24.5	19.3
3.0	ARUMUGAM	49.0	306 RT 58912	53.9	46.4	38.3	37.4	37.0	35.9	34.4	35.7	32.5	32.3	25.4	24.2	54.8	46.9	40.1	37.4	36.5	36.4	33.9	33.7	33.2	31.2	28.5	23.8
4.0	AYYAR	41.0	420 RT 59126	55.2	46.7	42.4	40.8	37.8	36.6	35.3	36.0	36.4	33.1	25.7	24.2	54.8	51.1	41.3	38.8	36.7	38.2	34.3	35.8	33.9	32.3	28.7	25.1
5.0	BALU	70.0	385 RT 59042	52.2	43.2	37.6	33.9	33.9	32.4	30.8	32.2	31.1	28.2	23.4	22.2	51.8	44.1	36.5	34.2	35.3	33.1	30.4	31.6	30.8	29.5	25.7	21.3
6.0	DHARAMAR	50.0	339 RT 58950	48.3	39.1	32.1	30.7	31.0	29.1	27.5	29.2	28.9	24.8	21.2	19.6	47.8	38.3	34.2	30.8	31.0	30.2	27.6	28.5	27.0	25.9	23.2	17.9
7.0	DHARAMARAJ	52.0	380 RT 6732	43.5	35.3	28.7	26.0	26.4	25.9	22.6	24.4	24.7	20.8	17.9	16.3	43.6	34.2	29.2	25.9	25.6	24.1	23.7	23.4	22.4	21.4	19.2	14.5
8.0	GANESAN	47.0	383 RT 6717	46.1	37.9	30.7	28.1	28.7	28.0	25.8	27.3	27.2	23.8	19.7	17.5	46.3	36.3	32.0	29.1	28.7	28.0	25.9	25.4	24.3	24.3	21.7	16.4
9.0	IRULAPPAN	53.0	487 RT 4293	48.0	39.0	32.0	30.2	30.4	28.6	27.4	28.5	28.7	24.6	20.9	19.2	47.6	37.9	33.6	30.0	29.8	29.8	27.1	27.4	26.5	25.3	22.8	17.8
10.0	KALASALINGAM	55.0	369 RT 59014	53.8	45.0	38.2	35.4	35.8	35.8	33.3	35.5	31.6	29.9	23.9	23.0	52.9	45.4	39.7	36.8	36.1	36.4	33.7	33.7	32.2	30.3	27.0	23.8
11.0	KANDHASAMY	52.0	371 RT 58999	37.8	30.9	23.8	20.5	19.9	19.2	19.8	18.5	17.4	15.4	14.0	12.2	34.1	29.4	26.0	20.9	19.2	21.3	20.6	20.2	17.5	17.2	13.8	11.5
12.0	KARMEGAM	60.0	920 RT 6031	53.5	43.7	38.1	34.3	34.4	32.9	31.5	34.1	31.2	28.6	23.7	22.6	52.0	44.3	36.8	34.9	35.4	33.2	31.2	31.8	31.0	29.7	25.7	21.6
13.0	KARUPPAYEE	40.0	372 RT 56309	48.8	39.3	32.5	30.8	31.5	29.5	27.6	29.3	29.1	24.8	21.3	19.9	48.2	38.4	34.6	31.1	31.0	30.4	27.8	28.5	27.0	26.0	23.2	18.0
14.0	KRISHNAN	40.0	921 RT 6035	44.3	35.6	29.0	26.1	26.6	26.4	22.7	24.5	24.9	20.8	18.1	16.4	43.6	34.6	29.4	26.5	25.9	24.2	23.9	23.5	22.5	21.8	19.3	14.7
15.0	LOGANATHAN	28.0	292 RT 57217	46.2	38.3	31.1	28.6	29.3	28.3	26.3	27.6	27.6	24.0	19.9	17.7	46.6	37.5	32.7	29.2	28.9	28.6	26.0	26.0	24.9	24.7	21.8	16.5
16.0	MAHENDRAN	45.0	435 RT 6816	51.2	42.0	34.8	33.6	33.0	30.9	29.0	30.5	30.9	26.4	22.3	21.3	50.8	42.1	35.8	33.0	33.4	30.9	29.5	30.6	29.0	27.4	24.5	19.7
17.0	MAHESHWARAN S	50.0	515 RT 6884	51.4	42.6	34.9	33.8	33.2	30.9	29.1	30.7	31.0	26.4	22.4	21.4	50.9	42.7	35.8	33.5	33.5	32.1	29.7	30.6	29.2	27.5	24.8	19.9
18.0	MAHAIAANDI	55.0	260 RT 58831	42.5	34.9	28.4	25.9	25.7	25.5	22.0	23.2	23.0	20.4	16.7	16.2	42.5	33.8	27.9	25.5	24.3	23.5	23.7	22.9	21.1	21.2	18.3	14.0
19.0	MOOKAN	62.0	439 RT 6825	42.9	34.9	28.6	25.9	25.8	25.6	22.6	23.7	24.4	20.7	17.5	16.2	43.1	33.8	28.2	25.9	25.3	23.5	23.7	23.3	21.5	21.2	18.4	14.1
20.0	MURUGESAN	60.0	546 RT 7004	51.5	42.9	35.9	33.8	33.7	31.0	29.8	31.3	31.0	27.2	23.3	21.6	51.1	43.1	35.9	33.5	33.9	32.7	30.0	31.1	29.3	27.9	25.0	20.0
21.0	MURUGESAN	45.0	464 RT 6837	51.5	43.0	37.5	33.8	33.7	31.9	30.2	31.3	31.0	27.7	23.4	21.9	51.2	43.5	36.2	34.2	34.7	32.8	30.3	31.2	29.8	28.2	25.6	20.1
22.0	MUTHU	47.0	488 RT 6870	46.0	37.3	30.5	28.0	28.6	27.5	25.7	27.2	27.0	23.7	19.7	17.3	46.2	36.3	32.0	29.0	28.2	27.1	25.7	24.8	24.1	23.1	21.4	16.3
23.0	MUTHUSAMY	62.0	547 RT 6987	50.1	40.8	34.3	31.5	32.1	30.1	28.4	29.9	30.0	25.6	21.7	21.1	49.2	41.1	35.3	32.0	32.1	31.6	30.8	29.1	29.7	28.1	23.9	18.9
24.0	NATARAJAN	58.0	340 RT 58951	45.6	36.7	30.4	27.7	28.5	27.4	25.4	26.7	26.5	23.6	19.3	17.0	45.9	35.8	31.9	28.9	27.7	26.5	25.3	24.5	23.8	22.9	21.2	16.0
25.0	PALANI SAMY	55.0	529 RT 6951	39.3	30.9	23.9	20.5	22.9	22.0	20.3	19.9	18.5	16.9	14.3	13.5	34.7	29.5	26.0	21.2	20.2	21.9	20.6	20.8	18.7	17.3	14.3	13.4

20.0	KASIKANNI	55.0	337 RT 58948	50.7	39.7	34.0	34.2	30.7	30.7	30.1	28.9	26.9	24.2	22.1	21.4				49.4	40.2	33.2	32.9	31.5	28.8	29.9	29.5	26.5	25.4	24.7	19.3
21.0	KRISHNAMMAL	66.0	915 RT 6030	42.1	33.5	28.4	27.4	25.4	26.4	24.9	23.5	21.2	21.1	19.0	16.8				43.0	33.5	28.8	27.9	26.0	22.1	24.2	23.3	20.0	19.2	15.5	
22.0	KUPPAMMAL	73.0	916 RT 6024	42.4	33.6	28.6	27.6	25.5	26.5	25.0	23.7	21.2	21.1	19.0	17.1				43.3	34.0	28.9	27.9	26.0	22.4	24.4	23.6	22.5	20.5	19.8	15.8
23.0	LAKSHMI	44.0	927 RT 6038	48.4	38.0	32.9	32.7	29.3	29.5	29.4	28.0	25.9	23.6	21.4	19.8				48.0	39.0	33.0	31.7	29.5	27.2	28.2	28.2	25.8	23.9	23.7	18.4
24.0	MAHESWARI	32.0	386 RT 57455	55.9	44.5	38.3	37.9	40.1	34.0	32.9	33.2	33.5	27.0	28.4	26.2				57.2	45.6	37.6	38.2	35.8	34.4	32.7	36.2	32.4	29.5	23.6	
25.0	MALAIARASI	54.0	516 RT 6955	46.0	36.5	32.0	31.6	28.5	28.4	28.0	27.1	24.8	23.1	20.3	19.2				47.1	36.3	31.0	30.6	28.3	26.3	27.2	27.0	24.8	23.0	22.3	17.8
26.0	MUNIYAMMAL	50.0	918 RT 6012	55.3	43.9	37.4	37.8	36.8	33.9	32.5	33.1	32.5	26.5	27.7	24.9				53.0	45.5	36.9	38.2	35.4	32.9	32.7	34.6	31.2	29.0	27.1	22.9
27.0	MUTHU LAKSHMI	40.0	487 RT 56282	45.5	36.3	31.9	31.5	28.3	28.0	26.6	24.7	23.1	20.3	19.0				46.8	36.0	30.9	30.4	28.3	26.2	26.9	26.7	24.8	22.9	22.2	17.7	
28.0	PANDIAMMAL	50.0	262 RT 58835	38.0	30.5	26.1	22.9	21.8	22.1	21.7	21.5	18.7	17.9	17.8	13.6				40.6	30.3	21.5	24.4	22.4	20.3	20.8	17.6	19.8	17.0	15.9	11.2
29.0	PAPPU	38.0	302 RT 6552	42.4	33.6	28.8	27.8	25.7	26.7	25.1	25.6	21.6	21.4	19.3	17.2				43.9	34.3	29.3	28.2	26.1	22.8	24.7	23.8	22.7	21.0	19.9	16.0
30.0	PONNU MANI	46.0	483 RT 6888	49.1	39.1	32.9	32.7	29.3	29.9	29.5	28.1	26.0	23.8	21.5	19.8				48.9	39.1	33.0	32.1	29.7	27.2	28.4	28.5	25.9	24.0	23.8	18.6
31.0	POTHUM PONNU	29.0	546 RT 59373	57.6	46.9	39.4	42.1	41.0	35.2	33.8	33.3	33.6	28.7	28.6	26.5				59.9	47.3	43.0	38.5	38.8	34.7	33.4	37.5	34.3	30.1	29.8	27.9
32.0	POTHUMANI	35.0	331 RT 58942	53.6	43.2	35.8	35.7	35.5	32.5	32.4	32.5	31.1	25.9	26.6	24.2				51.7	45.1	35.0	36.5	34.1	31.7	31.6	32.5	29.3	27.2	26.8	22.6
33.0	PREMALATHA	45.0	930 RT 604	44.5	36.1	31.0	30.4	28.1	28.2	27.3	26.5	23.9	22.8	20.1	18.6				46.0	35.5	30.8	30.3	27.9	25.6	26.8	25.9	24.1	22.8	20.8	17.6
34.0	PRIYA	26.0	266 RT 58847	54.1	43.8	36.3	36.0	35.5	32.7	32.4	33.0	31.4	25.9	27.0	24.8				52.6	45.4	35.9	37.4	35.0	32.1	32.6	34.0	29.6	28.3	27.0	22.8
35.0	RAJESHWARI	45.0	436 RT 6807	45.5	36.2	31.5	31.2	28.2	28.2	27.5	26.5	23.9	22.8	20.2	18.8				46.1	35.8	30.8	30.3	27.9	25.8	26.9	26.7	24.8	22.9	20.9	17.6
36.0	RAMAKKAL	40.0	431 RT 6813	38.6	30.6	26.2	23.6	22.1	22.8	22.0	21.7	18.9	18.0	18.0	14.8				41.2	30.9	23.3	24.6	23.7	20.9	22.1	18.2	21.0	17.3	16.6	11.3
37.0	RAMYA	19.0	514 RT 6967	42.8	33.8	29.4	28.3	25.7	26.9	26.0	25.7	21.7	21.6	19.5	17.3				44.1	34.5	29.5	28.4	26.4	23.5	24.9	24.1	23.0	21.1	20.0	16.1
38.0	SAKILA	29.0	524 RT 6968	49.2	39.3	32.9	32.7	29.8	30.0	29.6	28.3	26.2	24.1	21.8	20.0				49.3	39.4	33.1	32.4	30.2	27.9	28.7	28.6	26.1	24.6	24.1	18.7
39.0	SAROJA	60.0	320 RT 58930	52.1	42.9	35.7	35.5	35.3	32.5	32.1	32.1	30.5	25.8	26.3	24.0				51.3	44.1	34.4	36.3	33.7	31.3	31.6	32.3	28.4	26.7	26.8	22.6
40.0	SIVAGAMI SUNDARI	47.0	427 RT 6793	44.5	35.7	30.7	30.3	28.0	27.8	27.2	26.4	23.9	22.7	20.0	18.3				45.4	35.4	30.7	30.0	27.8	25.6	26.8	25.6	23.9	22.6	20.7	17.5
41.0	SUNDARA JOTHY	45.0	467 RT 6838	42.8	34.4	29.5	28.6	25.8	27.1	26.1	25.8	21.8	21.7	19.5	17.4				44.4	34.9	29.5	28.5	26.4	23.6	25.6	24.4	23.1	21.3	20.1	16.7
42.0	THAULAH	40.0	77 RT 11037	49.8	39.6	33.5	32.9	29.8	30.1	29.9	28.3	26.7	24.1	21.9	20.8				49.3	39.5	33.1	32.7	31.0	27.9	28.8	28.9	26.2	24.8	24.1	18.8
43.0	THENAMMAL	70.0	469 RT 6914	51.9	42.0	35.2	35.0	35.0	32.3	31.5	31.1	29.4	24.7	24.0	23.1				50.9	43.7	34.3	34.7	33.3	30.8	31.1	32.2	28.0	26.3	26.1	21.7
44.0	UMADEVI	21.0	340 RT 11770	51.8	41.3	35.0	34.9	33.5	31.9	31.5	30.7	29.3	24.6	23.8	23.0				50.7	43.3	34.2	34.7	32.8	30.5	30.7	31.7	27.8	26.2	25.6	21.6
45.0	UTHRA	22.0	612 RT 10662	52.0	42.4	35.6	35.3	35.0	32.4	31.8	31.4	29.6	25.1	24.9	23.9				51.1	43.7	34.3	36.0	33.4	31.1	31.2	32.2	28.4	26.4	26.3	22.4
46.0	VAIRAM	62.0	218 RT 32990	44.0	35.6	30.2	30.3	28.0	27.7	27.1	26.4	23.6	22.4	20.0	18.1				45.1	35.3	30.2	30.0	27.3	25.5	26.8	25.3	23.8	22.6	20.6	17.5
47.0	VALLI	40.0	366 RT 58989	43.1	34.6	29.5	28.6	26.2	27.2	26.4	25.9	22.1	22.1	19.6	17.5				44.8	35.0	29.7	28.6	26.5	24.0	25.9	24.5	23.6	21.9	20.2	17.0
48.0	VASANTHA	25.0	434 RT 6822	49.9	39.6	33.6	33.0	29.9	30.5	30.1	28.9	26.8	24.1	21.9	20.8				49.3	39.8	33.1	32.7	31.4	28.4	29.3	29.2	26.4	25.4	24.3	19.2
49.0	VEERAMMAL	58.0	300 RT 6557	39.1	32.2	26.4	24.4	22.8	24.0	22.2	21.8	19.0	18.2	18.2	15.0				41.6	32.0	24.6	25.1	23.8	21.3	22.9	21.0	21.4	17.3	16.8	11.6
50.0	VIJAYA	40.0	413 RT 6753	43.3	34.8	29.6	28.7	27.0	27.4	26.6	26.1	22.7	22.2	19.7	17.8				44.8	35.1	29.8	29.3	26.9	24.1	26.5	24.7	23.7	22.2	20.4	17.0

Ref. No1864/E4/2/2014,

Govt. Rajaji Hospital,
Madurai.20. Dated: 29.03.2014

Institutional Review Board / Independent Ethics Committee.

Capt. Dr.B. Santhakumar, M.D., (F.M.,) deanmdu@gmail.com

Dean, Madurai Medical College &

Govt Rajaji Hospital, Madurai 625020. **Convenor**

Sub: Establishment-Govt. Rajaji Hospital, Madurai-20-
Ethics committee-Meeting Minutes- for March 2014
Approved list - Regarding.

The Ethics Committee meeting of the Govt. Rajaji Hospital, Madurai was held on 05.03.2014, Wednesday at 10.00 am to 12.00.noon at the Auditorium, Govt. Rajaji Hospital, Madurai. The following members of the committee have attended the meeting.

- | | | |
|--|---|---------------------|
| 1. Dr.V. Nagarajan, M.D., D.M (Neuro)
Ph: 0452-2629629
Cell.No 9843052029
nag9999@gmail.com | Professor of Neurology
(Retired)
D.No.72, Vakkil New Street,
Simmakkal, Madurai -1 | Chairman |
| 2. Dr.Mohan Prasad , M.S M.Ch
Cell.No.9843050822 (Oncology)
drbkcmp@gmail.com | Professor & H.O.D of Surgical
Oncology(Retired)
D.No.32, West Avani Moola Street,
Madurai -1 | Member
Secretary |
| 3. Dr. Parameswari M.D (Pharmacology)
Cell.No.9994026056
drparameswari@yahoo.com | Director of Pharmacology
Madurai Medical College | Member |
| 4. Dr.S. Vadivel Murugan, MD.,
(Gen.Medicine)
Cell.No 9566543048
svadivelmurugan_2007@rediffmail.com | Professor & H.O.D of Medicine
Madurai Medical College | Member |
| 5. Dr.S. Meenakshi Sundaram, MS
(Gen.Surgery)
Cell.No 9842138031
drsundarms@gmail.com | Professor & H.O.D of Surgery
Madurai Medical College | Member |
| 6. Mrs. Mercy Immaculate
Rubalatha, M.A., Med.,
Cell. No. 9367792650
lathadevadoss86@gmail.com | 50/5, Corporation Officer's
quarters, Gandhi Museum Road,
Thamukam, Madurai-20 | Member |
| 7. Thiru..Pala. .Ramasamy , BA.,B.L.,
Cell.No 9842165127
palaramasamy2011@gmail.com | Advocate,
D.No.72.Palam Station Road,
Sellur, Madurai -2 | Member |
| 8. Thiru. P.K.M. Chelliah ,B.A
Cell.No 9894349599
pkmandco@gmail.com | Businessman, 21 Jawahar Street,
Gandhi Nagar, Madurai-20 | Member |

The following Projects was approved by the committee.

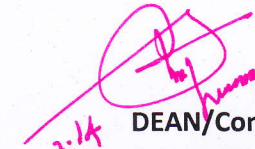
Name of P.G.	Course	Name of the Project	Remarks
Dr.R.Pragadhees pragadheesr@gmail.com	PG in MS (Neurosurgery) Madurai Medical College and Government Rajaji Hospital, Madurai	Computed tomographic analysis of thoracic spine for evaluation of safe length and safe trajectory for anterior and posterior screw instrumentation.	Approved

Please note that the investigator should adhere the following: She/He should get a detailed informed consent from the patients/participants and maintain it Confidentially.


1. She/He should carry out the work without detrimental to regular activities as well as without extra expenditure to the institution or to Government.
2. She/He should inform the institution Ethical Committee, in case of any change of study procedure, site and investigation or guide.
3. She/He should not deviate the area of the work for which applied for Ethical clearance. She/He should inform the IEC immediately, in case of any adverse events or Serious adverse reactions.
4. She/He should abide to the rules and regulations of the institution.
5. She/He should complete the work within the specific period and if any Extension of time is required He/She should apply for permission again and do the work.
6. She/He should submit the summary of the work to the Ethical Committee on Completion of the work.
7. She/He should not claim any funds from the institution while doing the work or on completion.
8. She/He should understand that the members of IEC have the right to monitor the work with prior intimation.


Member Secretary

Chairman
Ethical Committee


29.3.14
DEAN/Convenor
Govt. Rajaji Hospital,
Madurai- 20.

To
The above Applicant
-thro. Head of the Department concerned


19/3/14



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