MEASUREMENT OF TRUNCAL IMBALANCE IN SCOLIOSIS X-RAY IMAGE

[1]Bhoomika P, [2]Tabitha Janumala, [3]Dr. K.B Ramesh
[1]MTech , [2]Assistant Professor, [3]Associate Professor,
[1]RV College of Engineering, Bangalore.

Abstract : *Scoliosis characterized by a side-by-side spine curvature >2cm, is the most common 3-D spinal disorder affecting adolescents 10-18 years of age . scoliosis is the musculoskeletal disease of which it can bend it like 'S' or 'C' shaped . scoliosis analysis and detection based in the two main parameter thoracic trunk shift and coronal balance .Thoracic trunk shift refers to C7 plumb line to vertical trunk reference line coronal balance refers to the shifted from its normal position. Based on these two parameter whether the shift taken or not. The truncal shift can be find it out by the manual and automatic method where as in manual method by drawing the lines normal to abnormal the difference between these two lines will be the distance how much shift taken. In automatic method not drawing the lines when we applied the scoliosis affected image then will get the exact value .one drawback of this manually method is that we are not getting the exact value , in automatic method we may expect a exact value. Automatic method can be done by artificial neural network or convolutional neural network algorithm to find the truncal in scoliosis .the main goal of this paper to find the truncal imbalance in scoliosis x-ray image. The feature work is done by automating the manually method using the dataset , train and test the model.*

***Keywords*- Truncal imbalance, Coronal balance, Vertical Trunk reference line, Artificial neural network.**

I. INTRODUCTION

Scoliosis is a spine disorder phenomenon that makes spine bend and it will form letter C or S. For a normal person the spine will be like straight when the person is affected from the scoliosis the spine will bended or twisted either to the left or to the right so in our project we are going to find the how much distance it vary it from the normal position. Manual method in determining the curvature of the spine results in a very low accuracy value[1]. This is because of the noise present in the spinal x-ray images of patient with scoliosis [1].Thoracic trunk shift and coronal balance are main feature to be considered while planning treatment for scoliosis patient[2].Thoracic trunk shift refers to deviation of trunk from its normal portion [2]. Coronal balance refers to deviation of seventh cervical bone from sacrum in coronal plane[2].

Post-operative truncal shift in lenke1 and lenke2 in this paper they have done a retrospective, multicenter data analysis of 1,555 patients with AIS[6]. Patients with a Lenke type 1 or 2 curve pattern and a minimum follow-up of 24 months after surgery were included. deviation of the trunk in relation to the pelvis was considered positive trunk shift[6]. A sub analysis was performed to identify potential risk factors for trunk shift. 273 patients meeting the inclusion criteria were analyzed[6]. While the preoperative prevalence of trunk shift was surgically reduced from 29.3 to 13.6%, 24 patients (8.8%) with postoperative trunk shift had not had preoperative trunk shift, and the trunk shift was considered iatrogenic[6]. One of the limitation of this paper is that it cannot differentiate between the surgical approach or the instrumentation in the feature work can be done by automating it. Progression of truncal imbalance in adolescent idiopathic scoliosis in thoracolumbar and lumbar curve [7], In this paper mainly concentrating on the whole Spine Standing AP and lateral radiographs method[7]. The below are the main parameter to be considered while planning treatment for the scoliosis :

A) Cobb angle, the angle between the upper end vertebrae (UEV) and lower end vertebrae (LEV) [7].
B) LEV tilt, the angle between the upper endplate of the LEV and a horizontal line. [7]
C) Disc wedging below the LEV, the angle between the lower endplate of the LEV and the upper endplate of the LEV+1 [7].
D) Typical vertebral rotation (AVR), the degree of rotation of the apical vertebra according to Nash-Moe grading [7].
G) Pelvic obliquity trunk shift, the distance between a C-7 plumb line and a CSVL [7].
E) Apical vertebral translation (AVT),the distance between the center of the apical vertebra and the CSVL[7].

Automatic human scoliosis detection by computer on more topographic images of human backs[3].in this paper they directly applied the truncal imbalance affected image in the computed they are they train and test the algorithm in such a way that the computer will get the values automatically how much distance its deviated, then using the deviation come to the conclusion of the scoliosis is sever , normal ,mild . optical method find the truncal imbalance in scoliosis x-ray image in this paper they are mainly concentrating on the optical method to find the truncal imbalance in scoliosis in this paper there are mainly two optical method to find the truncal imbalance in scoliosis first one is optical method based optical scanner device , second one is optical method based on the digital camera.

Screening method using Kinect camera to calculate the points of human body[8].kinematic camera is supporting equipment for x-box video game[8]. At present this camera is useful for creating three dimensional model applied in engineering and medical science such as movement analysis , gesture recognition and robotics[8].Kinematic camera is useful for measuring the balance of the human body for applying to screen scoliosis.We get an idea from this paper to find the scoliosis and measuring truncal imbalance in scoliosis by screening method .This paper proposes an attempt to measure truncal imbalance in scoliosis using manual method

Automatic method to quantitatively determine the spine curvature using spine column profile ,represented by the darkest region along the middle line of VPI image using image enhancement histogram equalization points row by row in enhanced image followed by polynomial curve fitting to the detected point[9].The spine curvature angle was finally calculated according to the infection point [9].This paper gives an idea to find the scoliosis by spine curvature using darkest region in the spine [9]. We are able to find scoliosis so this makes in consideration to adopt an idea by finding truncal imbalance by marking the infected points are dark and unaffected points are normal then will easly find out the distance from the darkest point to normal using image enhancement, histogram equalization using polynomial curve fitting.

Artificial neural network to find the spine curvature for scoliosis [10].ANN is used to classify scoliosis based on curvature of the spine.2stage in classification are training phase and testing stage [10].The patterns as input on the ANN produces output presents that is belived by ANN[9] .This paper suggest an idea to measure truncal imbalance in scoliosis using ANN using watershed method to automatically measure the truncal imbalance based on the classification of the scoliosis.
The main goal of this paper to find the truncal imbalance in scoliosis . Scoliosis musculoskeletal disease normally present in children it can be cured by various method by using cobb angle, truncal imbalance and various other parameters the confusion is on finding the truncal imbalance in scoliosis x-ray image .There are two main to find the truncal imbalance in scoliosis manually and automatically when coming to manual method by drawing the lines in C7 plumb line and vertical trunk reference line. Truncal imbalance in scoliosis manually by drawing the line where the shift taken and mark the points. The one drawback is that it is difficult

II. METHOD

Scoliosis is structural imbalance in Adolescent idiopathic scoliosis of which all are suffering from the truncal imbalance. Truncal imbalance can be detected based on the shift and then using the thoracis trunk shift and coronal balance detect the scoliosis. In our project first step is scoliosis detection then will get the image from the hospital after collecting the image will add median and edge filter to remove noise from the image after that find the truncal balance by thoracic trunk shift and coronal balance by manually by drawing the lines from the C7 plumb line to vertical trunk reference line then will get the value the difference between the two lines .After drawing the lines mark the point as x1, y1 ,x2, y2 the points are noncollinear using the Euclidean distance formula find the distance between the affected and the original one
Distance = 0.06* ½*(x1-x2)+(y1-y2)
Here x1,x2, y1,y2 are the points
0.06 is the soble operator value it is a discrete differentiation operator, computing an approximation of the gradient of the image intensity function[5]. At each point in the image, the result of the Sobel–Feldman operator is either the corresponding gradient vector or the norm of this vector[5]. The Sobel–Feldman operator is based on convolving the image with a small, separable, and integer-valued filter in the horizontal and vertical directions and is therefore relatively inexpensive in terms of computations[5].

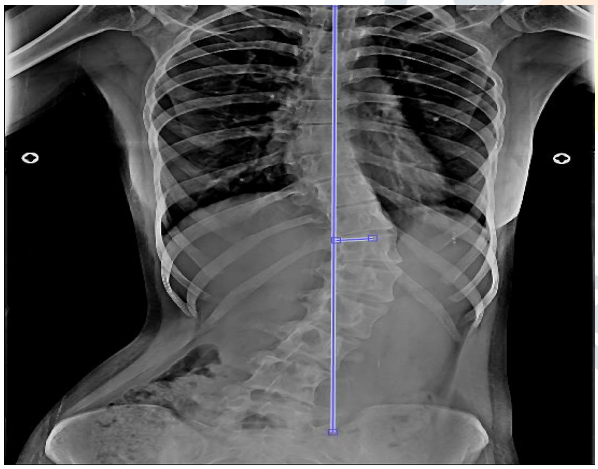

Fig 1: Truncal shift from C7 to VTRL (vertical trunk reference line)

Thoracic trunk shift and coronal balance are the main two parameter to be considered while planning treatment for the scoliosis. The plumb line is a vertical line drawn downward from the center of the C7 vertebral body, parallel to the lateral edges of the radiograph. It is used to evaluate coronal balance on standing frontal radiographs and sagittal balance on standing lateral radiographs. Coronal balance is evaluated by measuring the distance between the CSVL and the plumb line, and sagittal balance is evaluated by measuring the distance between the posterosuperior aspect of the S1 vertebral body and the plumb line. For both coronal and sagittal measurements, balance is considered abnormal if the distance is greater than 2 cm[4]. We implement this using the math lab using image processing technique to find the truncal imbalance in scoliosis

III. CONCLUSION

Scoliosis is structural imbalance in spine of the human body of which it is bended in the ‘S’, or ’C’ shaped of which it can be cured . The main goal of this paper is to find the truncal imbalance in scoliosis x-ray image .There are mainly two main method to find the truncal imbalance in scoliosis are manual method and automatic method .In this paper we are mainly concentrating on the manual method to find the truncal imbalance in scoliosis x-ray image the main drawback of this method is that result were not accurate feature work can be done by automating the truncal imbalance by get the value automatically using the convolutional neural network or artificial neural network to find the truncal imbalance in scoliosis x-ray image.

REFERENCES:

[1] Santa Kusuma Ward ani 1) Rimando Sigit,*2*) Setiawardhana,3)Seffiana Manik Syah Putri 4) DindaAyu Yunitasar, 5) Measurement of Spinal Curvature for Scoliosis Classification", I2018nternational Seminar on Application for Technology of Information and Communication (iSemantic).

[2] P. Mohankumar1_ and Leong Wai Yie11School of Engineering, Taylor's University,Taylor's Lakeside Campus, No. 1 Jalan Taylor's,47500, Subang Jaya,Selangor DE, Malaysia," Evaluation Thoracic Trunk Shift and Coronal balance in Post-Operative Scoliosis Patients", ASM Science Journal, Volume 11(1), 2018

[3] Hongbo Wu1, Chris Bailey1,3, Parham Rasoulinejad1,3, and Shuo Li1,2(B)"Automatic Landmark Estimation for Adolescent Idiopathic Scoliosis Assessment Using Boost Net,"

[4] www.rsna.org/rsnarights

[5]https://en.wikipedia.org/wiki/Sobel_opera00tor

[6] Per D. Trobisch . Amer F. Samdani , Joshua M. Pahys , "Postoperative trunk shift in Lenke 1 and 2 curves: how common is it? and analysis of risk factors"Patrick J,Cahill3 December 2010 / Revised: 28 February 2011 / Accepted: 15 April 2011 / Published online: 1 May 2011

[7] Chang Ju Hawng, Choon sung lee, Dong Ho Lee, "Progression of trunk imbalance in adolescent idiopathic scoliosis with a thoracolumbar/lumbar curve", clinical article, vol 20, November 2017.

[8] Siraprapa Tanee, Dusit Thanapatay, "Scoliosis Screening Using Depth Camera", 5th International Electrical Engineering Congress, Pattaya, Thailand, March 2017 .

[9] Guang-Quan Zhou, Yong-Ping Zheng , "Assessment of Scoliosis Using 3-D Ultrasound Volume Projection Imaging with Automatic Spine Curvature Detection", IEEE International Ultrasonics Symposium Proceeding, 2015

[10] Sinta Kusuma Wardani , Riyanto Sigit , Setiawardhana , Seffiana Manik Syah Putri , DindaAyu Yunitasari "Measurement of Spinal Curvature for Scoliosis", International Seminar on Application for Technology of Information and Communication,2018

[11]Shenzhen, "Clustering Property of Spinal Deformity Classification With Simplified 3-D Model and Principal Component Analysis", 5th International Conference on Information Technology and Application in Biomedicine, 2008