ISSN (Online) : 2319 - 8753
ISSN (Print) : 2347 - 6710

International Journal of Innovative Research in Science, Engineering and Technology

An ISO 3297: 2007 Certified Organization Volume 4, Special Issue 2, February 2015

5th International Conference in Magna on Emerging Engineering Trends 2015 [ICMEET 2015]

On 27th & 28th February, 2015

Organized by

Department of Mechanical Engineering, Magna College of Engineering, Chennai-600055, India.

Stress Distribution Analysis in Children Fractures by Nail Fixation Methods

A.D.Raja, R.Vignesh, M.Vineeth, Dr.S.Sathish

Final Year Student, Department of Mechanical Engineering, AMS College of Engineering, Chennai, India

Final Year Student, Department of Mechanical Engineering, AMS College of Engineering, Chennai, India

Final Year Student, Department of Mechanical Engineering, AMS College of Engineering, Chennai, India

Associate Professor, Department of Mechanical Engineering, AMS College of Engineering, Chennai, India

ABSTRACT: Fractures are common in childhood. Incidence varies between geographical areas, and it has been proposed that the fractures in children are increasing. Repeated fractures, and especially vertebral fractures, in children may be a sign of impaired bone health, but it remains unestablished when and how fracture-prone children should be assessed. Bone mineral density (BMD) affects bone strength, and it can be measured with dual-energy X-ray absorptiometry (DXA). In this work, we studied epidemiology of fractures in children. Special attention was given to those children with frequent fractures or vertebral fractures; their bone health was thoroughly assessed. To evaluate the clinical use of two rarely used methods in children, we assessed the accuracy and advantages of vertebral fracture assessment (VFA) by densitometry, and histomorphometry from bone biopsy in children with suspected osteoporosis.

KEYWORDS: Bone fracture, Epidemiology, Material Properties, Stress variation

I. INTRODUCTION

Fractures are common in children, and an increase in the incidence has been suspected. Underlying disease or life-style factors can influence bone health in children, and the risk for fractures might be modifiable. The diagnostic criteria of osteoporosis or the criteria for when to assess overall bone health in children without secondary causes have not been established. The present study was intended to obtain epidemiologic data on childhood fractures in Chennai; a 12-month survey was performed in all public health institutions in Chennai. All children with fractures were recorded for trauma and history of fractures; population-based incidence was obtained for children under 16 years. Further, a subgroup of apparently healthy children with frequent fractures or history of a vertebral fracture was assessed for bone health and risk factors for fractures. The usefulness of two methods that have not been widely used in children, vertebral fracture assessment from densitometerderived images and transiliac bone biopsy, were evaluated in children with suspected osteoporosis.

Presented Work Methodology:
The present work will focus on the ender nail fixation of fractured femoral bones (type of material and the size of nails).

ISSN (Online) : 2319 - 8753
ISSN (Print) : 2347 - 6710

International Journal of Innovative Research in Science, Engineering and Technology

An ISO 3297: 2007 Certified Organization Volume 4, Special Issue 2, February 2015

5th International Conference in Magna on Emerging Engineering Trends 2015 [ICMEET 2015]

On 27th & 28th February, 2015

Organized by

Department of Mechanical Engineering, Magna College of Engineering, Chennai-600055, India.

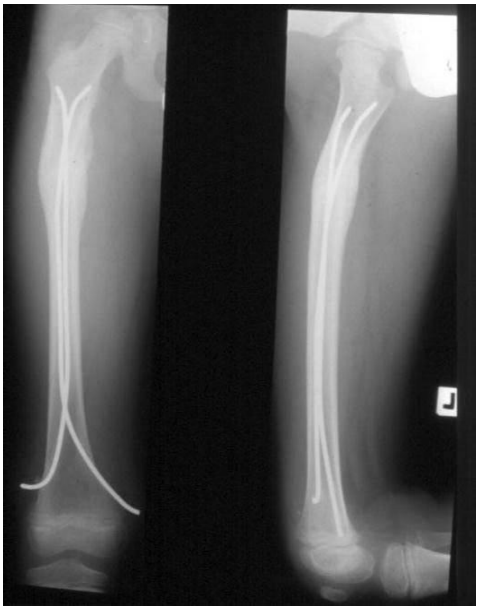

Fig 1.1. Presented work terminology

II. METHODOLOGY

- Getting the x-ray from hospital as jpg file.
- Importing the jpg file as raster image from Auto-Cad.
- Scaling and getting the actual dimensions and exporting the file asDXF file.
- Building the solid model using GID program.

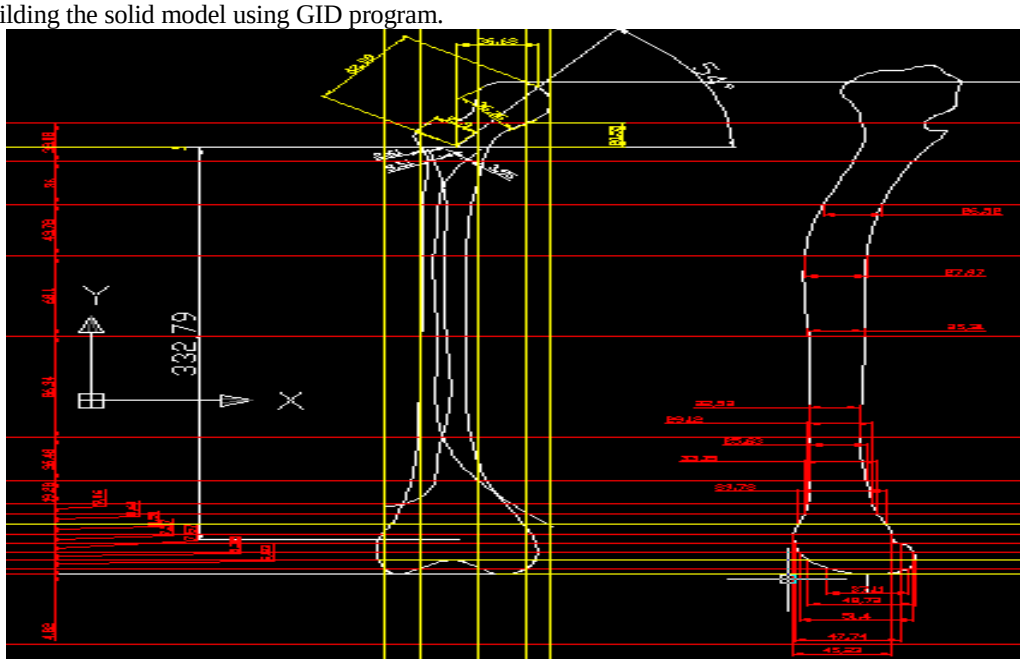

Fig 1.2. AutoCAD Diagram

ISSN (Online) : 2319 - 8753
ISSN (Print) : 2347 - 6710

International Journal of Innovative Research in Science, Engineering and Technology

An ISO 3297: 2007 Certified Organization Volume 4, Special Issue 2, February 2015

5th International Conference in Magna on Emerging Engineering Trends 2015 [ICMEET 2015]

On 27th & 28th February, 2015

Organized by

Department of Mechanical Engineering, Magna College of Engineering, Chennai-600055, India.

Finite Element Modeling:

SOLID MODELS UN BENDED BENDED

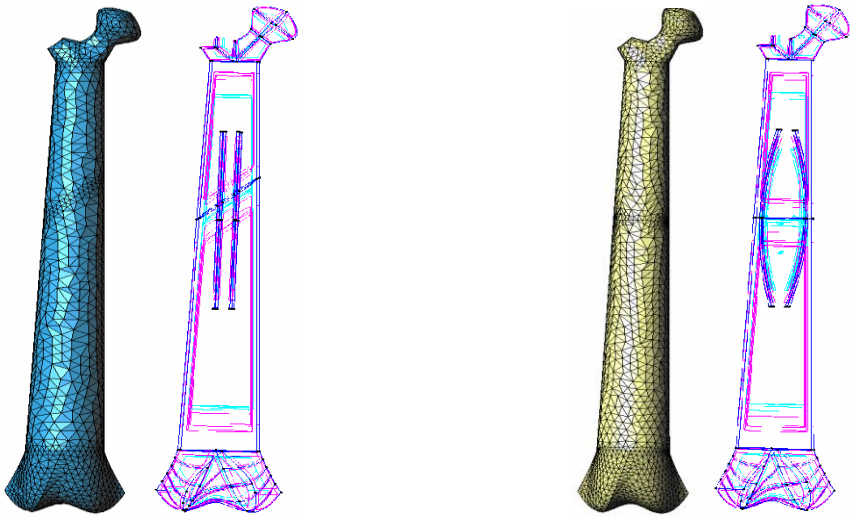

Fig 1.3.Finite element modeling

Boundary Conditions:

LOADING CONDITION BOUNDARY CONSTRAINS

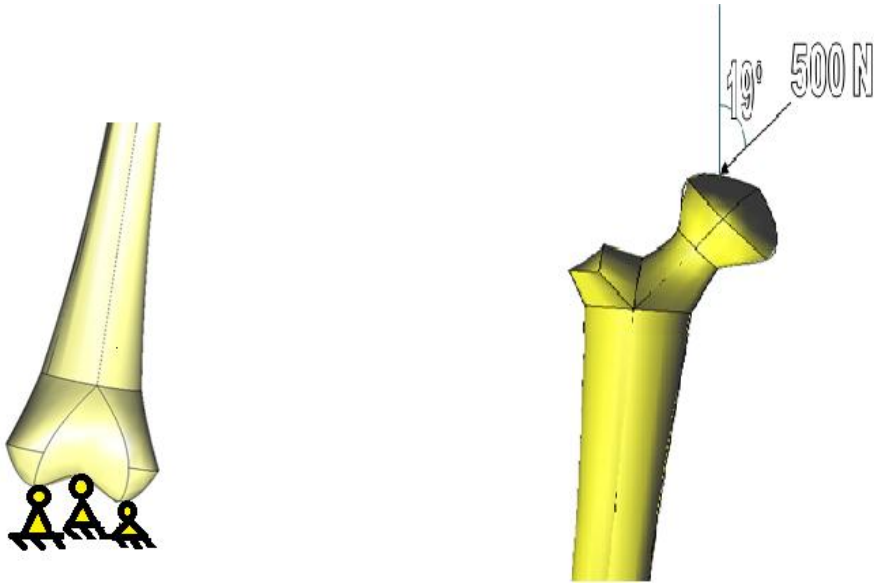

Fig 1.4. Boundary conditions at loading condition

ISSN (Online) : 2319 - 8753
ISSN (Print) : 2347 - 6710

International Journal of Innovative Research in Science, Engineering and Technology

An ISO 3297: 2007 Certified Organization Volume 4, Special Issue 2, February 2015

5th International Conference in Magna on Emerging Engineering Trends 2015 [ICMEET 2015]

On 27th & 28th February, 2015

Organized by

Department of Mechanical Engineering, Magna College of Engineering, Chennai-600055, India.

Mesh Generation:

	NODES	ELEMENT (TETRAHEDRAL)
MODEL I UNBENDED NAILS	5093	24293
MODEL II BENDED NAILS	8176	32000

Meshing was generated for two models .The table below shows the meshing data for the models.

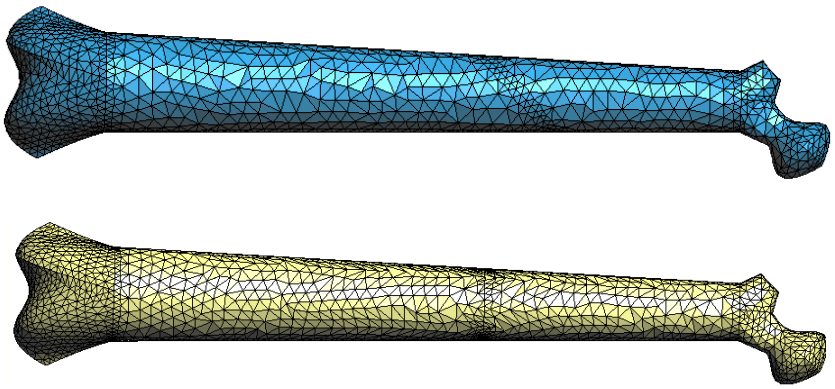

Fig 1.5. Mesh generation

Material Properties:

MATERIAL	ELASTIC MODULUS N/mm2	POISSON'S RATIO
Nail: Titanium- Ni-chrome	1.1e5 6.55e5	0.34 0.2
Cortical Bone	5.2e2	0.29
Cancelouse bone	3e4	0.29

ISSN (Online) : 2319 - 8753
ISSN (Print) : 2347 - 6710

International Journal of Innovative Research in Science, Engineering and Technology

An ISO 3297: 2007 Certified Organization Volume 4, Special Issue 2, February 2015

5th International Conference in Magna on Emerging Engineering Trends 2015 [ICMEET 2015]

On 27th & 28th February, 2015

Organized by

Department of Mechanical Engineering, Magna College of Engineering, Chennai-600055, India.

III. RESULTS

DIFFERENT CRANK ANGLES

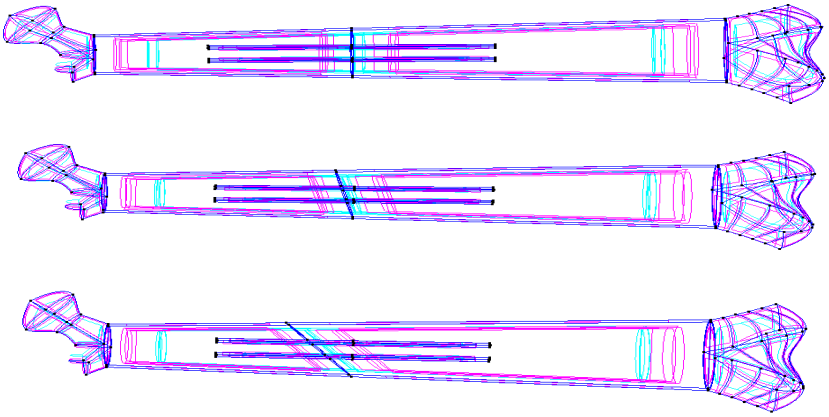

Fig 1.6. Results of different crank angles

IV. DEFORMATION RESULTS

DEFORMATION ON CORTICAL BONE

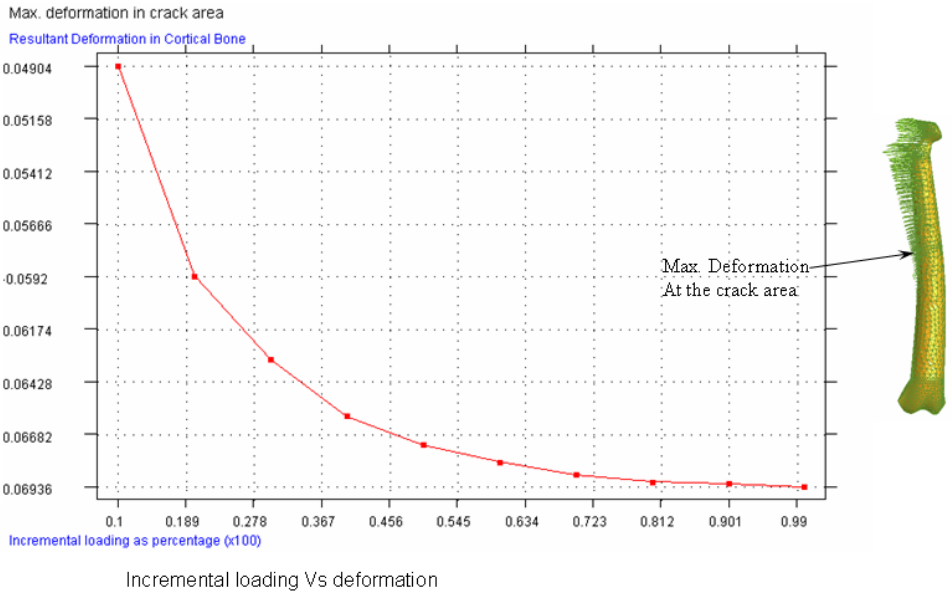

Fig 1.7. Deformation on cortical bone

ISSN (Online) : 2319 - 8753
ISSN (Print) : 2347 - 6710

International Journal of Innovative Research in Science, Engineering and Technology

An ISO 3297: 2007 Certified Organization Volume 4, Special Issue 2, February 2015

5th International Conference in Magna on Emerging Engineering Trends 2015 [ICMEET 2015]

On 27th & 28th February, 2015

Organized by

Department of Mechanical Engineering, Magna College of Engineering, Chennai-600055, India.

DEFORMATION ON CANCELOUSE BONE

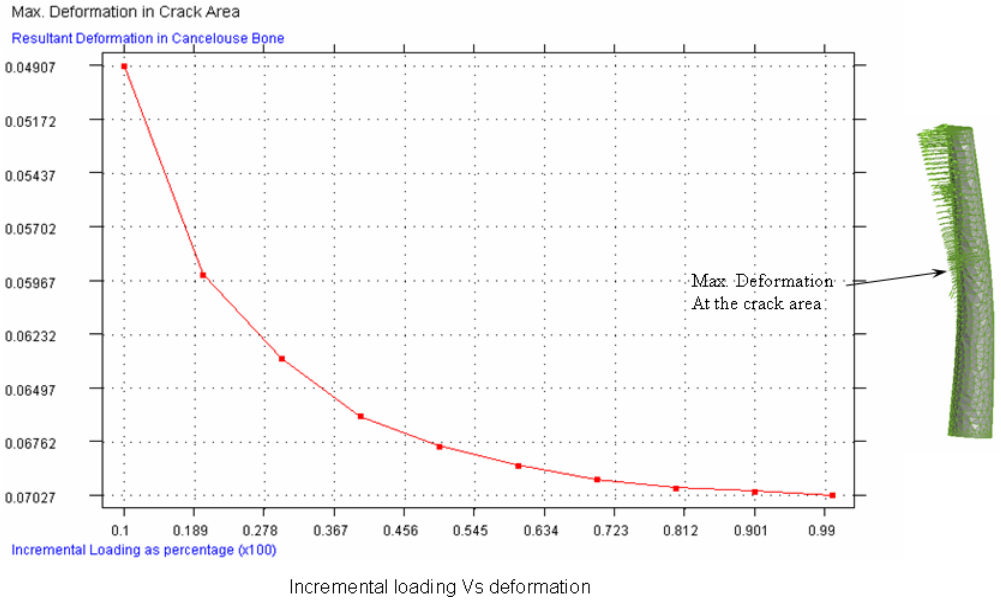

Fig 1.8 Deformation on cancelouse bone

DEFORMATION ON NAILS

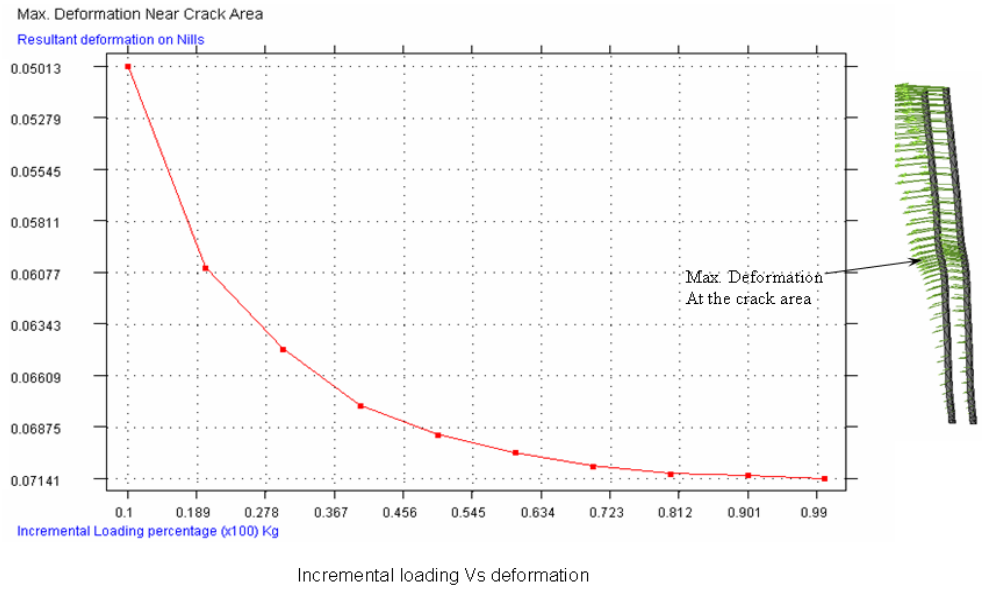

Fig1.9. Deformation on nails

ISSN (Online) : 2319 - 8753
ISSN (Print) : 2347 - 6710

International Journal of Innovative Research in Science, Engineering and Technology

An ISO 3297: 2007 Certified Organization Volume 4, Special Issue 2, February 2015

5th International Conference in Magna on Emerging Engineering Trends 2015 [ICMEET 2015]

On 27th & 28th February, 2015

Organized by

Department of Mechanical Engineering, Magna College of Engineering, Chennai-600055, India.

DEFORMATION ON CORTICAL BONE WITH BENDED NAILS

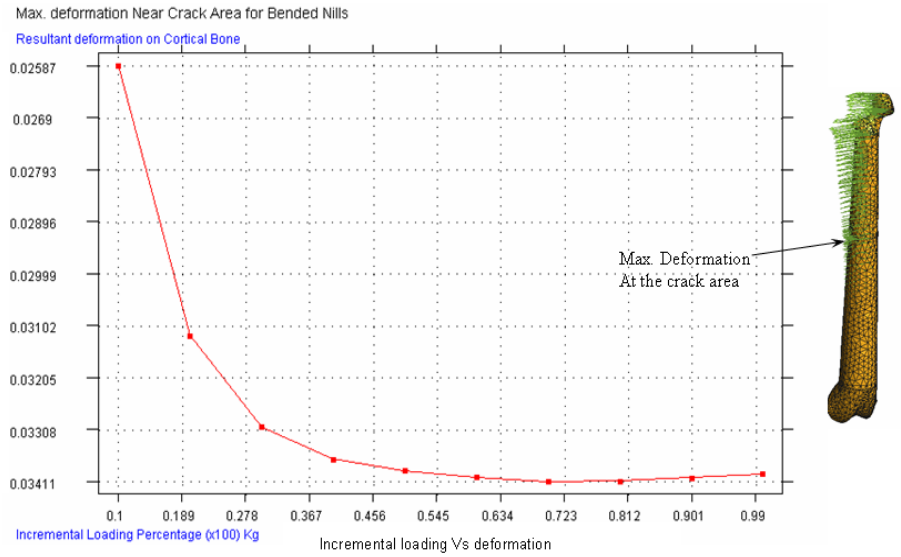

Fig1.10. Deformation on cortical bone with bended nails

DEFORMATION ON CANCELOUSE BONE FOR BENDED NAILS

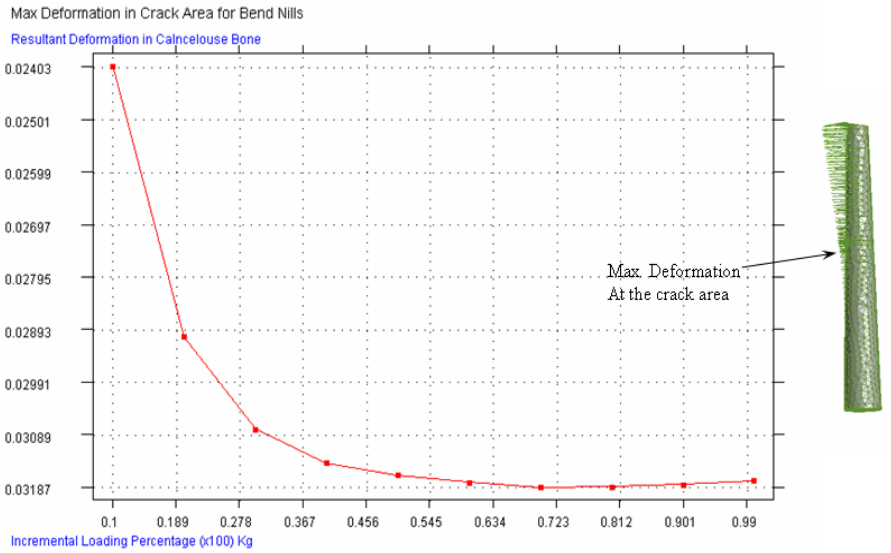

Fig 1.11. Deformation on cancelouse bone for bended nails

ISSN (Online) : 2319 - 8753
ISSN (Print) : 2347 - 6710

International Journal of Innovative Research in Science, Engineering and Technology

An ISO 3297: 2007 Certified Organization Volume 4, Special Issue 2, February 2015

5th International Conference in Magna on Emerging Engineering Trends 2015 [ICMEET 2015]

On 27th & 28th February, 2015

Organized by

Department of Mechanical Engineering, Magna College of Engineering, Chennai-600055, India.

DEFORMATION OF NAILS FOR BENDED NAILS

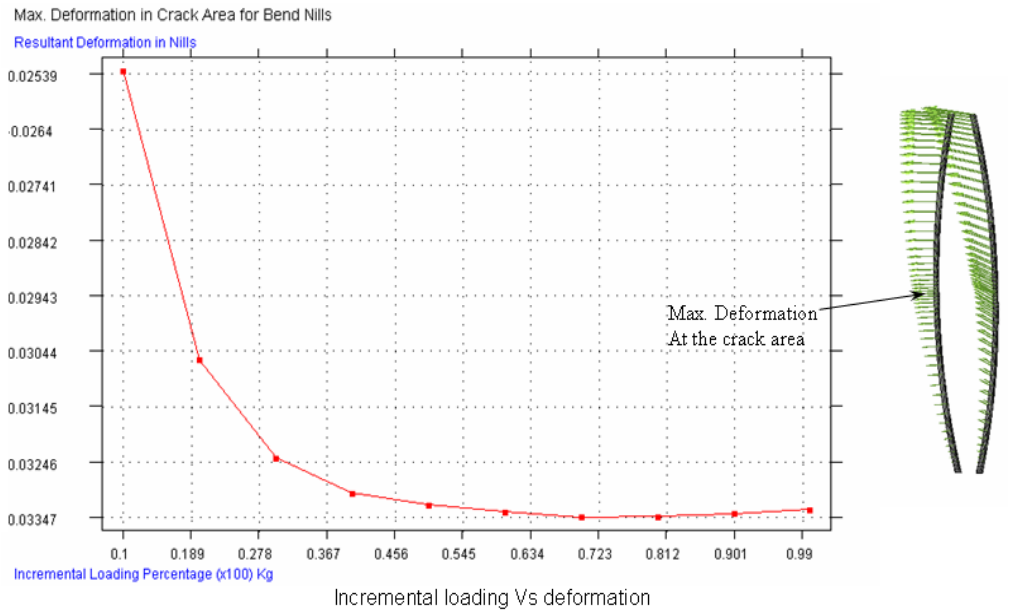

Fig 1.12. Deformation of nails for bended nails

V. CONCLUSION

There are no established criteria for when and how to examine children with fractures. Repeated fractures or vertebral compressions are rare findings in healthy children; this group of patients is at risk of having impaired bone health and requires thorough evaluation. Based on the present findings, these patients can be identified from the children with newly diagnosed fracture, and screening those with frequent low-energy fractures from the emergency cohort is valuable. Life-style factors, biochemical parameters, including vitamin D, and DXA should be assessed. Mineralized mass is clearly not the only factor relevant to bone strength. Attention to bone mass, as measured by DXA, however, is justified, in part because it does play a substantial role, and in part, because it is to some extent controllable. Histomorphometric findings in this work underscore the difficulties in diagnosing pediatric osteoporosis.

REFERENCES

1. Andersen, R., Mølgaard, C., Skovgaard, L.T., Brot, C., Cashman, K.D., Chabros, E., Charzewska, J., Flynn, A., Jakobsen, J., Kärkkäinen, M., Kiely, M., Lamberg-Allardt, C., Moreiras, O., Natri, A.M., O'brien, M., Rogalska-Niedzwiedz, M. & Ovesen, L. "Teenage girls and elderly women living in northern Europe have low winter vitamin D status", *Eur J Clin Nutr*, 2005 vol. 59, no. 4, pp. 533-541
2. Bonewald, L.F. "The amazing osteocyte", *J Bone Miner Res*, 2011 vol. 26, no. 2, pp. 229-238
3. Cummings, S.R., Bates, D. & Black, D.M. "Clinical use of bone densitometry: scientific review", *JAMA*, 2002 vol. 288, no. 15, pp. 1889-1897
4. Dalgleish, R. "The human type I collagen mutation database", *Nucleic Acids Res*, 1997 vol. 25, no. 1, pp. 181-187
5. Ehrenpreis, T. "The prevention of accidents in childhood in Sweden", *Arch Dis Child*, 1957 vol. 32, no. 166, pp. 495-498
6. Gärdsell, P., Johnell, O. & Nilsson, B.E. "The predictive value of bone loss for fragility fractures in women: a longitudinal study over 15 years", *Calcif Tissue Int*, 1991 vol. 49, no. 2, pp. 90-94
7. Hadjidakis, D.J. & Androulakis, I.I. "Bone Remodeling", *Ann NY Acad Sci*, 2006 vol. 1092, no. 1, pp. 385-396
8. Jowsey, J. & Johnson, K.A. "Juvenile osteoporosis: bone findings in seven patients", *J Pediatr*, 1972 vol. 81, no. 3, pp. 511-517
9. Kann, P.H., Pfützner, A., Delling, G., Schulz, G. & Meyer, S. "Transiliac bone biopsy in osteoporosis: frequency, indications, consequences and complications. An evaluation of 99 consecutive cases over a period of 14 years", *Clin Rheumatol*, 2006 vol. 25, no. 1, pp. 30-34