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## Prevalence and Gender Distribution of Lower Arch Crowding - A Retrospective study

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**Abstract:** Malocclusion is an irregularity or malalignment of teeth. Malocclusion can be either skeletal or dental. Several reasons exist that can result in the malocclusion, of which the most common is the tooth size arch length discrepancy. When the arch development is within the expected size or the size of the tooth is abnormally large, it can result in the crowding. Several other reasons have also been attributed with lower arch crowding. This study was done to assess the prevalence and gender distribution in patients with lower arch crowding. This study was carried out in an institutional setting. Data were collected regarding the lower arch crowding in the population and tabulated in the excel and transferred to statistical software SPSS. Descriptive statistics and chi square tests were done. Out of the total population (41545), 5602 of them had lower arch crowding either alone or in combination with other malocclusion. Among those with lower arch crowding, 3067 of the males had only crowding and 293 had crowding in association with other malocclusion, whereas 1951 of the females had only lower arch crowding and 291 of them had crowding in association with other malocclusions. From the present study, we can conclude that the prevalence of crowding is relatively high(13.48%) compared to any other malocclusion. Higher male predilection in the study sample and more number of cases with crowding as the only malocclusion was also noted. Gender and age association showed a significant association with more numbers of males especially in the age group of 19-35 years in the study population had crowding.

**Keywords:** Crowding; Innovation; lower arch; malocclusion.

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### INTRODUCTION

People equate good dental appearance with success in many aspects. The malocclusion is an occlusion in which there are anomalies in tooth position beyond the normal limits. The reasons to develop malocclusion could be genetic or environmental or a combination of both the factors along with various local factors such as adverse oral habits, tooth anomalies, form and developmental portion of teeth can cause malocclusion.(Taylor, 1934) Dental crowding can be defined as a disparity in the relationship between tooth size and jaw size which results in imbrication and rotation of teeth. There are three conditions which may predispose the dental arches to crowding are excessively large teeth, excessively small bony bases of the jaws, and a combination of large teeth and small jaws.

The lower arch crowding is associated with eruption of the third molars, tooth mass ratio, mandibular length and growth pattern. Mandibular anterior crowding occurs as a result of disparity between the tooth size of anterior teeth and available space in the alveolar process which results in abnormal angulations and rotations of teeth. The anterior arch crowding increases the chances of having a third molar impacted because of lack of space for their eruption. It is said that erupting third molars push anterior teeth forward and cause anterior crowding. In absence of third molars, the dentition could settle distally in response to forces generated by growth changes or soft tissue pressure. This implies a passive role of third molars in the development of late crowding by resisting those forces.(Pilo et al., 1987) The correction of dental crowding can be accomplished via a variety of orthodontic procedures. Few treatment procedures include extraction of permanent teeth and the mesiodistal reduction of tooth size are procedures that are designed to fit less total tooth mass into a particular arch. Other treatments may include the use of various functional appliances, directed at expanding the dental arches in order to accommodate the existing teeth.

Previously our team has conducted numerous studies which include in vitro studies (Kamisetty et al., 2015), review (Viswanath et al., 2015), case report (Felicita and Sumathi Felicita, 2017), survey, microscopic studies (Ramesh Kumar et al., 2011) and clinical trial (Dinesh et al., 2013; Felicita, 2017; Felicita et al., 2012; Felicita and Sumathi Felicita, 2017, 2018; Jain et al., 2014; Krishnan, 2015; Rubika et al., 2015; Samantha, 2017; Saravana Pandian et al., 2018; Sivamurthy and Sundari, 2016; Vikram et al., 2017) (Saravana Pandian et al., 2018). Now we are focussing on retrospective study, Our department is passionate about research we have published numerous high quality articles in this domain over the past years ( (Kavitha et al., 2014) , (Praveen et al., 2001), (Devi and Gnanavel, 2014), (Putchala et al., 2013), (Vijayakumar et al., 2010), (Lekha et al., 2014a, 2014b) (Danda, 2010) (Danda, 2010) (Parthasarathy et al., 2016) (Gopalakannan et al., 2012), (Rajendran et al., 2019), (Govindaraju et al., 2017), (P. Neelakantan et al., 2015), (PradeepKumar et al., 2016), (Sajan et al., 2011), (Lekha et al., 2014a), (Neelakantan et al., 2013), (Patil et al., 2017), (Jeevanandan and Govindaraju, 2018), (Abdul Wahab et al., 2017), (Eapen et al., 2017), (Menon et al., 2018), (Wahab et al., 2018), (Vishnu Prasad et al., 2018), (Uthrakumar et al., 2010), (Ashok et al., 2017), (Prasanna Neelakantan et al., 2015). Hence the aim of this study was to determine the prevalence and gender distribution of lower arch crowding.

## **MATERIALS AND METHODS**

### **Study design:**

This was a retrospective cross sectional study. It was done in a university setting. The samples for the study were collected from among the case records of patients who had their dental visit between June 2019 to March 2020.

### **Ethical approval:**

The study was commenced after approval from the Institutional Scientific Review Board . Ethical approval number for the study was SDC/SIHEC/2020/DIASDATA/0619-0320.

### **Inclusion and Exclusion criteria:**

i) Patients in either mixed dentition or permanent dentition stage (8 years and above) ii) Patient who had crowding in lower arch with or without any associated malocclusions. iii) Patient who had no missing teeth in the lower arch, iv) Incomplete data and records of patients and those with missing teeth were excluded from the study.

### **Data Tabulation**

The parameters considered include age, gender and presence of crowding with or without any other associated malocclusion. After the initial data collection was performed, cross checking was done with the available clinical photographs and any further exclusion was done. To avoid the bias in the study.

### **Statistical Analysis**

After the data tabulation was done in excel, it was then transferred to SPSS statistical software (SPSS Inc., Chicago, IL, USA, version 20.0) for further analysis. Descriptive statistics (percentage) and Inferential statistics was done. Chi square test was used to find the association between different parameters considered in the study which included lower arch crowding among different age groups and genders.

## **RESULTS AND DISCUSSION**

In the present study, the age of the examined sample varied and ranged from 8 years to adult age because at 8 years of age all the lower permanent incisors are fully erupted to the level of occlusion and this was necessary in order to obtain a clear and valid picture of the prevalence and distribution pattern of incisors crowding in the presence of all of the permanent teeth.

The overall patients records reviewed were 41,451 of which, 13.48% had lower arch crowding which is similar to the study done by Isiekwe et al (Isiekwe, 1983), where the prevalence rate was 12.9% (Figure 1). Gender distribution showed more number of males (59.98%) with lower arch crowding compared to females (40.02%). (Figure 2) This can also be attributed to the uneven distribution of the study population with more number of male patients than females.

Gender association of the study samples showed more number of patients reported with isolated crowding in the lower arch (87% female and 91% male) and a very few patients (nearly 10% in each gender) reported some other associated malocclusion. Chi square test was done to find the statistical significance of the values obtained and it was found that the difference in the results obtained were statistically significant. (Figure 3)

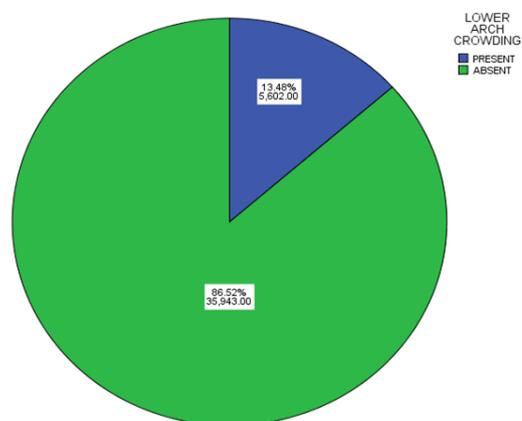
Age association of the lower arch crowding also showed more number of isolated crowding among all age groups. The crowding was increased during 18- 35 years of age which can be attributed to the tooth material-arch length deficiency because of the eruption of all permanent teeth. There is also significant reduction in the amount of crowding in patients > 35 years of age which can be due to extraction of teeth leading to the drift of adjacent teeth into the edentulous space. The results obtained were statistically significant.

The number of patients seeking orthodontic treatment has increased markedly during recent years. Therefore it is important to have relevant epidemiological data on different types of malocclusion in order to estimate the total need for treatment. Although many studies have been published that describe the prevalence and the types of malocclusion, (Dinesh et al., 2013) it is difficult to compare and contrast these findings, in past, because of varying methods and indices used to assess and record occlusal relationships, (Felicita, 2018) age differences of the study population, examiner subjectivity, specific objectives, different sampling sizes. (Angle, 1907)

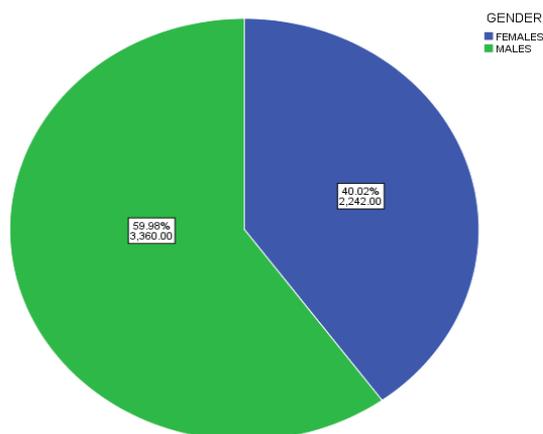
It is obvious that several genetic and environmental and environmental interacting factors are related to the aetiology of malocclusions- soft diet, mouth breathing, tongue thrusting, sleeping posture, sucking and other habits as well as specific factors ( skeletal growth disturbances, muscle dysfunction, disturbances, embryological disturbances. (Korkhaus, 1928) Crowding is one of the essentially noted risk factors for caries and other periodontal disease. Crowding left untreated can result in the areas of improper cleansing that can host pathogenic bacteria posing a sequelae that can even result in mobility and tooth loss in some worst cases (Hellman, 1933) (Huber and Reynolds, 1946).

### Study Limitations

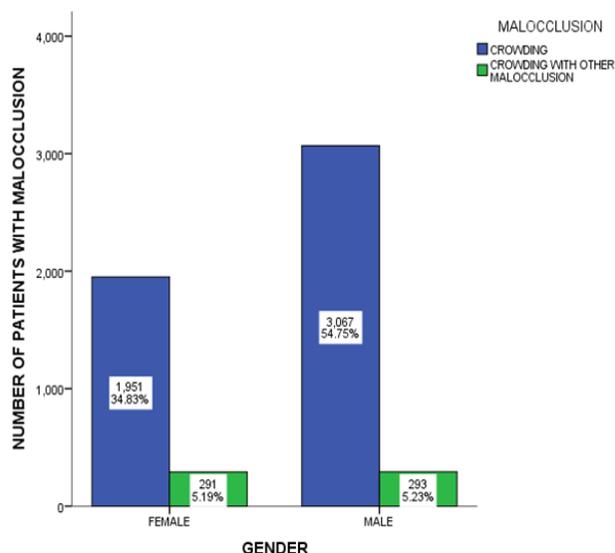
This study cannot be generalised to a larger population. It is done in a small sample. The future scope of this study is to study a larger population involving diverse ethnic groups.



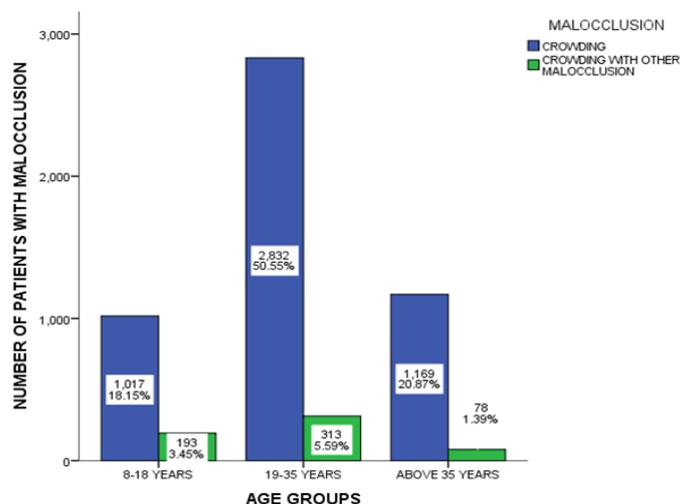
**Fig.1: This piechart represents the number of patients with and without lower arch crowding. Overall 13.48% patients reported with lower arch crowding.\**



**Fig.2: This figure represents the gender distribution of the study sample. There was more male predilection seen in the lower arch crowding**



**Fig.3:** This figure represents the gender association of lower arch crowding with or without other malocclusion. X axis represents gender and the Y axis represents the number of patients with malocclusion. (Chi square test p value-0.001 (0.05, hence statistically significant)). Crowding with other associated malocclusion was equal between both the genders. Comparatively more number of male patients reported with crowding in the lower arch and the results were statistically significant.



**Fig.4:** This figure represents the age association of lower arch crowding with or without other malocclusion. X axis represents age groups and the Y-axis represents the number of patients with malocclusion. (Chi square test p value 0.001 (<0.05, hence statistically significant)). Among all the age groups, patients in 19-35 years reported more with crowding and also in all age groups, isolated crowding was noted mostly in patients, in comparison to the crowding with other malocclusion and the differences was statistically significant.

**CONCLUSION**

From the present study, we can conclude that the prevalence of crowding is relatively high(13.48%) compared to any other malocclusion. Higher male predilection in the study sample and more number of cases with crowding as the only malocclusion was also noted. Gender and age association showed a significant association with more numbers of males especially in the age group of 19-35 years in the study population had crowding.

**Author Contributions**

First author (Rushabh S.Kamdar) performed the analysis,interpretation and wrote the manuscript. Second author ( Dr. Nivethigaa) contributed to conception, data design, analysis, interpretation and critically revised the

manuscript. Third author (Dr.Arun) participated in the study and revised the manuscript. All the three authors have discussed the results and contributed to the final manuscript.

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#### Conflicts of Interest

The authors declare no conflicts of interest.

#### REFERENCES

1. Abdul Wahab PU, Senthil Nathan P, Madhulaxmi M, et al. (2017) Risk Factors for Post-operative Infection Following Single Piece Osteotomy. *Journal of maxillofacial and oral surgery* 16(3): 328–332.
2. Angle EH (1907) *Treatment of Malocclusion of the Teeth: Angle's System. Greatly Enl. and Entirely Rewritten, with Six Hundred and Forty-One Illustrations.* SS White dental manufacturing Company.
3. Ashok BS, Ajith TA and Sivanesan S (2017) Hypoxia-inducible factors as neuroprotective agent in Alzheimer's disease. *Clinical and experimental pharmacology & physiology* 44(3): 327–334.
4. Danda AK (2010) Comparison of a single noncompression miniplate versus 2 noncompression miniplates in the treatment of mandibular angle fractures: a prospective, randomized clinical trial. *Journal of oral and maxillofacial surgery: official journal of the American Association of Oral and Maxillofacial Surgeons* 68(7): 1565–1567.
5. Devi VS and Gnanavel BK (2014) Properties of Concrete Manufactured Using Steel Slag. *Procedia Engineering* 97: 95–104.
6. Dinesh SPS, Arun AV, Sundari KKS, et al. (2013) An indigenously designed apparatus for measuring orthodontic force. *Journal of clinical and diagnostic research: JCDR* 7(11): 2623–2626.
7. Eapen BV, Baig MF and Avinash S (2017) An Assessment of the Incidence of Prolonged Postoperative Bleeding After Dental Extraction Among Patients on Uninterrupted Low Dose Aspirin Therapy and to Evaluate the Need to Stop Such Medication Prior to Dental Extractions. *Journal of maxillofacial and oral surgery* 16(1): 48–52.
8. Felicita A, Shanthasundari KK and Chandrasekar S (2012) Determination of craniofacial relation among the subethnic Indian population: A modified approach - (Sagittal relation). *Indian Journal of Dental Research.* DOI: 10.4103/0970-9290.102210.
9. Felicita AS (2017) Quantification of intrusive/retraction force and moment generated during en-masse retraction of maxillary anterior teeth using mini-implants: A conceptual approach. *Dental press journal of orthodontics* 22(5): 47–55.
10. Felicita AS (2018) Orthodontic extrusion of Ellis Class VIII fracture of maxillary lateral incisor--The sling shot method. *The Saudi dental journal* 30(3). Elsevier: 265–269.
11. Felicita AS and Sumathi Felicita A (2017) Orthodontic management of a dilacerated central incisor and partially impacted canine with unilateral extraction – A case report. *The Saudi Dental Journal.* DOI: 10.1016/j.sdentj.2017.04.001.
12. Felicita AS and Sumathi Felicita A (2018) Orthodontic extrusion of Ellis Class VIII fracture of maxillary lateral incisor – The sling shot method. *The Saudi Dental Journal.* DOI: 10.1016/j.sdentj.2018.05.001.
13. Gopalakannan S, Senthilvelan T and Ranganathan S (2012) Modeling and Optimization of EDM Process Parameters on Machining of Al 7075-B4C MMC Using RSM. *Procedia Engineering* 38: 685–690.
14. Govindaraju L, Neelakantan P and Gutmann JL (2017) Effect of root canal irrigating solutions on the compressive strength of tricalcium silicate cements. *Clinical oral investigations* 21(2): 567–571.
15. Hellman M (1933) Growth of the face and occlusion of the teeth in relation to orthodontic treatment. *International Journal of Orthodontia and Dentistry for Children* 19(11): 1116–1147.
16. Huber RE and Reynolds JW (1946) A dentofacial study of male students at the University of Michigan in the physical hardening program. *American journal of orthodontics and oral surgery* 32: 1–21.
17. Isiekwe MC (1983) Malocclusion in Lagos, Nigeria. *Community dentistry and oral epidemiology* 11(1): 59–62.
18. Jain RK, Kumar SP and Manjula WS (2014) Comparison of intrusion effects on maxillary incisors among mini implant anchorage, j-hook headgear and utility arch. *Journal of clinical and diagnostic research: JCDR* 8(7): ZC21–4.
19. Jeevanandan G and Govindaraju L (2018) Clinical comparison of Kedo-S paediatric rotary files vs manual instrumentation for root canal preparation in primary molars: a double blinded randomised clinical trial. *European Archives of Paediatric Dentistry.* DOI: 10.1007/s40368-018-0356-6.
20. Kamisetty SK, Verma JK, Arun, et al. (2015) SBS vs Inhouse Recycling Methods-An Invitro Evaluation. *Journal of clinical and diagnostic research: JCDR* 9(9): ZC04–8.

21. Kavitha M, Subramanian R, Narayanan R, et al. (2014) Solution combustion synthesis and characterization of strontium substituted hydroxyapatite nanocrystals. *Powder Technology* 253: 129–137.
22. Korkhaus G (1928) The frequency of orthodontic anomalies at various ages. *International Journal of Orthodontia, Oral Surgery and Radiography* 14(2): 120–135.
23. Krishnan S (2015) Effect of Bisphosphonates on Orthodontic Tooth Movement—An Update. *JOURNAL OF CLINICAL AND DIAGNOSTIC RESEARCH*. DOI: 10.7860/jcdr/2015/11162.5769.
24. Lekha L, Kanmani Raja K, Rajagopal G, et al. (2014a) Schiff base complexes of rare earth metal ions: Synthesis, characterization and catalytic activity for the oxidation of aniline and substituted anilines. *Journal of organometallic chemistry* 753: 72–80.
25. Lekha L, Kanmani Raja K, Rajagopal G, et al. (2014b) Synthesis, spectroscopic characterization and antibacterial studies of lanthanide(III) Schiff base complexes containing N, O donor atoms. *Journal of Molecular Structure*. DOI: 10.1016/j.molstruc.2013.10.014.
26. Menon S, Ks SD, R S, et al. (2018) Selenium nanoparticles: A potent chemotherapeutic agent and an elucidation of its mechanism. *Colloids and surfaces. B, Biointerfaces* 170: 280–292.
27. Neelakantan P, Grotra D and Sharma S (2013) Retreatability of 2 mineral trioxide aggregate-based root canal sealers: a cone-beam computed tomography analysis. *Journal of endodontia* 39(7): 893–896.
28. Neelakantan P., Cheng CQ, Mohanraj R, et al. (2015) Antibiofilm activity of three irrigation protocols activated by ultrasonic, diode laser or Er:YAG laser in vitro. *International endodontic journal* 48(6): 602–610.
29. Neelakantan Prasanna, Sharma S, Shemesh H, et al. (2015) Influence of Irrigation Sequence on the Adhesion of Root Canal Sealers to Dentin: A Fourier Transform Infrared Spectroscopy and Push-out Bond Strength Analysis. *Journal of endodontia* 41(7): 1108–1111.
30. Parthasarathy M, Isaac Joshua Ramesh Lalvani J, Dhinesh B, et al. (2016) Effect of hydrogen on ethanol-biodiesel blend on performance and emission characteristics of a direct injection diesel engine. *Ecotoxicology and environmental safety* 134(Pt 2): 433–439.
31. Patil SB, Durairaj D, Suresh Kumar G, et al. (2017) Comparison of Extended Nasolabial Flap Versus Buccal Fat Pad Graft in the Surgical Management of Oral Submucous Fibrosis: A Prospective Pilot Study. *Journal of maxillofacial and oral surgery* 16(3): 312–321.
32. Pilo R, Kaffe I, Amir E, et al. (1987) Diagnosis of developmental dental anomalies using panoramic radiographs. *ASDC journal of dentistry for children*. europepmc.org. Available at: <https://europepmc.org/article/med/3476529>.
33. PradeepKumar AR, Shemesh H, Jothilatha S, et al. (2016) Diagnosis of Vertical Root Fractures in Restored Endodontically Treated Teeth: A Time-dependent Retrospective Cohort Study. *Journal of endodontia* 42(8): 1175–1180.
34. Praveen K, Narayanan V, Muthusekhar MR, et al. (2001) Hypotensive anaesthesia and blood loss in orthognathic surgery: a clinical study. *The British journal of oral & maxillofacial surgery* 39(2): 138–140.
35. Putchala MC, Ramani P, Herald J. Sherlin, et al. (2013) Ascorbic acid and its pro-oxidant activity as a therapy for tumours of oral cavity – A systematic review. *Archives of Oral Biology*. DOI: 10.1016/j.archoralbio.2013.01.016.
36. Rajendran R, Kunjusankaran RN, Sandhya R, et al. (2019) Comparative Evaluation of Remineralizing Potential of a Paste Containing Bioactive Glass and a Topical Cream Containing Casein Phosphopeptide-Amorphous Calcium Phosphate: An in Vitro Study. *Pesquisa Brasileira em Odontopediatria e Clínica Integrada*. DOI: 10.4034/pboci.2019.191.61.
37. Ramesh Kumar KR, Shanta Sundari KK, Venkatesan A, et al. (2011) Depth of resin penetration into enamel with 3 types of enamel conditioning methods: a confocal microscopic study. *American journal of orthodontics and dentofacial orthopedics: official publication of the American Association of Orthodontists, its constituent societies, and the American Board of Orthodontics* 140(4): 479–485.
38. Rubika J, Felicita AS and Sivambiga V (2015) Gonial angle as an indicator for the prediction of growth pattern. *World J Dent* 6(3): 161–163.
39. Sajan D, Udaya Lakshmi K, Erdogdu Y, et al. (2011) Molecular structure and vibrational spectra of 2,6-bis(benzylidene)cyclohexanone: a density functional theoretical study. *Spectrochimica acta. Part A, Molecular and biomolecular spectroscopy* 78(1): 113–121.
40. Samantha C (2017) Comparative Evaluation of Two Bis-GMA Based Orthodontic Bonding Adhesives - A Randomized Clinical Trial. *JOURNAL OF CLINICAL AND DIAGNOSTIC RESEARCH*. DOI: 10.7860/jcdr/2017/16716.9665.
41. Saravana Pandian K, Krishnan S and Aravind Kumar S (2018) Angular photogrammetric analysis of the soft-tissue facial profile of Indian adults. *Indian journal of dental research: official publication of Indian Society for Dental Research* 29(2). Medknow Publications and Media Pvt. Ltd.: 137.
42. Sivamurthy G and Sundari S (2016) Stress distribution patterns at mini-implant site during retraction and intrusion—a three-dimensional finite element study. *Progress in orthodontics* 17(1): 4.

43. Taylor AT (1934) *A Study of the Incidence and Manifestations Malocclusion and Irregularity of the Teeth*. University of Sydney.
44. Uthrakumar R, Vesta C, Raj CJ, et al. (2010) Bulk crystal growth and characterization of non-linear optical bithiourea zinc chloride single crystal by unidirectional growth method. *Current applied physics: the official journal of the Korean Physical Society* 10(2): 548–552.
45. Vijayakumar GNS, Devashankar S, Rathnakumari M, et al. (2010) Synthesis of electrospun ZnO/CuO nanocomposite fibers and their dielectric and non-linear optic studies. *Journal of alloys and compounds* 507(1): 225–229.
46. Vikram NR, Prabhakar R, Kumar SA, et al. (2017) Ball Headed Mini Implant. *Journal of clinical and diagnostic research: JCDR* 11(1): ZL02–ZL03.
47. Vishnu Prasad S, Kumar M, Ramakrishnan M, et al. (2018) Report on oral health status and treatment needs of 5-15 years old children with sensory deficits in Chennai, India. *Special care in dentistry: official publication of the American Association of Hospital Dentists, the Academy of Dentistry for the Handicapped, and the American Society for Geriatric Dentistry* 38(1): 58–59.
48. Viswanath A, Ramamurthy J, Dinesh SPS, et al. (2015) Obstructive sleep apnea: Awakening the hidden truth. *Nigerian journal of clinical practice* 18(1): 1–7.
49. Wahab PUA, Madhulaxmi M, Senthilnathan P, et al. (2018) Scalpel Versus Diathermy in Wound Healing After Mucosal Incisions: A Split-Mouth Study. *Journal of oral and maxillofacial surgery: official journal of the American Association of Oral and Maxillofacial Surgeons* 76(6): 1160–1164.