Type of manuscript: *Original Research*

Soft Tissue Upper Lip Thickness in Different Skeletal Malocclusion Subjects -A Comparative Cephalometric Study

S.Abirami, Ravindra Kumar Jain,

[1]Research Associate, Dental Research Cell, [2]Associate Professor, Department of Orthodontics and Dentofacial Orthopaedics, [3]Senior lecturer, Department of Orthodontics and Dentofacial Orthopaedics, Saveetha Dental College and Hospital, Saveetha Institute of Medical and Technical Sciences (SIMATS), Saveetha University, Chennai

Abstract

The purpose of this study was to determine the soft tissue upper lip thickness of subjects with different skeletal malocclusions. Lateral cephalograms of 30 patients (control group : skeletal malocclusion I - 10, Case group : skeletal malocclusion II - 10 , skeletal malocclusion III - 10) were selected randomly from orthodontic records of subjects who reported to the Department of Orthodontics in Saveetha Dental College.All cephalograms were traced and upper lip thickness was measured using FACAD software. One way - ANOVA test was done, soft tissue upper lip thickness was found to be statistically significant ($p<0.05$) among different skeletal malocclusions. Post hoc test (Tukey HSD) was performed to find out the differences between each skeletal class , the upper lip thickness was found to be comparatively high in Class III compared to Class I and Class II ($p<0.001$). This study concluded that soft tissue upper lip thickness was found to be greater in skeletal class III malocclusion compared to other skeletal class I and II malocclusion.

Keywords: *Soft tissue upper lip thickness; Skeletal malocclusions; Lateral cephalograms.*

Introduction

Harmonious facial aesthetics have long been considered as the most important goal of orthodontic treatment , hence knowledge about hard tissues and its overlying soft tissue in determining facial harmony is essential for diagnosis and treatment planning[1]. Assessment of facial anatomical structures has practical applications mainly in orthodontics and evaluation of ratio of the soft tissue transition to the hard tissue change should be done especially when visualized treatment objectives are assessed in planning orthognathic surgery [2,3]. Soft tissue evaluation in patients undergoing orthodontic treatment or orthognathic surgery plays a crucial role in diagnosis and treatment planning[4]. Different thickness of soft tissue changes noted after bimaxillary surgery in patients with thick and thin soft tissues[5].The harmonious profile depends on ethnic or racial factors[6].The facial form of each individual arises from the profile and dental arches of the individual[7]. According to Riedel, the relationship of the incisors with their respective bony bases and growth pattern had a significant influence on soft tissue profile[8]. To reduce convexity more retrusive lip position is preferable for improving facial esthetics in both genders[9].

Previous research compared the lip thickness among different skeletal malocclusion showed that increased thickness was found in class III malocclusion in both genders[4,10–12].Previous studies have analyzed facial soft tissue thickness in Japanese children representing several different skeletal classes and reported that measurements differed among these various classes[13,14]. Several studies have made similar measurements in the Turkish population and found significant differences

Corresponding Author:
Ravindra Kumar Jain,
Associate Professor, Department of Orthodontics and Dentofacial Orthopaedics, Saveetha Dental College and Hospital, Saveetha Institute of Medical and Technical Sciences (SIMATS), Saveetha University,
162, Poonamallee High Road, Chennai-600077, Tamil Nadu, India. Email id : ravindrakumar@saveetha.com.
Contact number: 9884729660.

between genders for soft tissue chin thickness and upper lip thickness.[15–17].

The aim of the present study was to determine the soft tissue upper lip thickness of subjects with different skeletal malocclusions for diagnosis and surgical-treatment planning.

Materials and Methods

Lateral cephalogram of 30 patients of both genders (5 male and 5 female patients in each skeletal group; Control group : skeletal malocclusion I - 10, Case group : skeletal malocclusion II - 10 , skeletal malocclusion III - 10) were selected by using a random sampling method from the orthodontic records available from july 2019 to february 2020 . This retrospective cross sectional cephalometric study was conducted in Saveetha dental college in the department of orthodontics. This study got approved from the ethical review board in saveetha university.

Inclusion Criteria:

Patients with skeletal class I ,II,II malocclusion.

High quality radiographs with adequate sharpness were taken by using standard techniques and exposure conditions in natural head position.

Exclusion Criteria:

Patients of cleft lip and palate , facial asymmetry , syndromes or any other congenital anomalies and patients who underwent orthognathic surgeries were excluded.

All cephalograms were traced digitally by using FACAD software for accurate measurements by a single observer.

Skeletal malocclusion was determined based upon the ANB angle and Wits, which indicates the sagittal relationship of the maxilla and mandible. The 3 skeletal types were classified as: Class I= ANB angle 1-5 degrees (10 subjects) ,Class II =ANB angle greater than 5 degrees (10 subjects) and Class III= ANB angle less than 1 degrees (10 subjects).

Measuring variable :

Upper lip thickness:

a) the distance between point A and subnasale

b) the distance between prosthion (lowest point of the alveolar bone between two upper central incisors) and labrale superius (vermilion border of the upper lip).

The collected data were tabulated in excel and analysed by SPSS software. One-way ANOVA test was used to make a comparison between the skeletal classes. Association between gender and soft tissue lip thickness was evaluated by Pearson’s Chi-square association test.

Results and Discussion

Figure 1- represents one-way ANOVA. Table 1 represents one way -ANOVA post hoc test (Tukey HSD) to determine the significant differences in between different skeletal malocclusions. Figure 2 - Bar graph represents the association between gender and soft tissue lip thickness in different skeletal malocclusions.

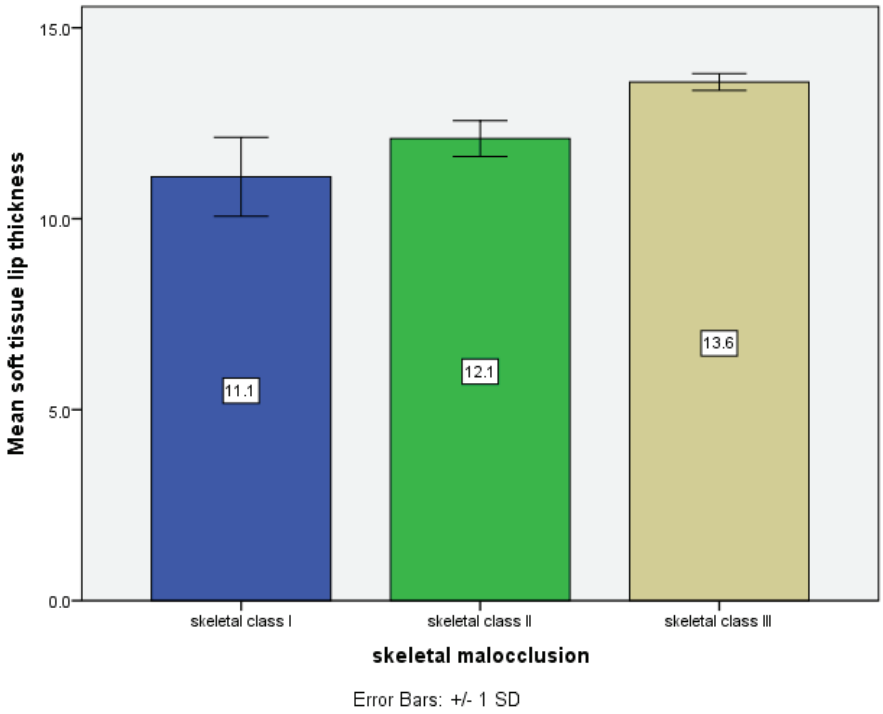

Figure 1: Bar graph represents the comparison between soft tissue lip thickness and skeletal malocclusion.X axis represents skeletal malocclusion. Y axis represents mean soft tissue lip thickness. One way ANOVA was done and the difference of mean values for upper lip thickness between skeletal class I(blue) ,II(green), III(Khaki) was statistically significant. The soft tissue upper lip thickness is higher in skeletal class III(khaki) malocclusion compared to other malocclusions.

One-way ANOVA (f value - 34.98 and p value - 0.000)..

(I) upper lip thickness		Mean Difference (I-J)	Std. Error	Sig.
Class I	class II	-1.00*	0.29	.007
	class III	-2.48*	0.29	.001
class II	class I	1.00*	0.29	.007
	class III	-1.48*	0.29	.001
class III	class I	2.48*	0.29	.001
	class II	1.48*	0.29	.001

Table 1 - one way ANOVA post hoc tests (Tukey HSD) showing differences between each skeletal class. The upper lip thickness was found to be comparatively higher in skeletal Class III malocclusion than Class I and Class II malocclusion and was statistically significant($p<0.001$).

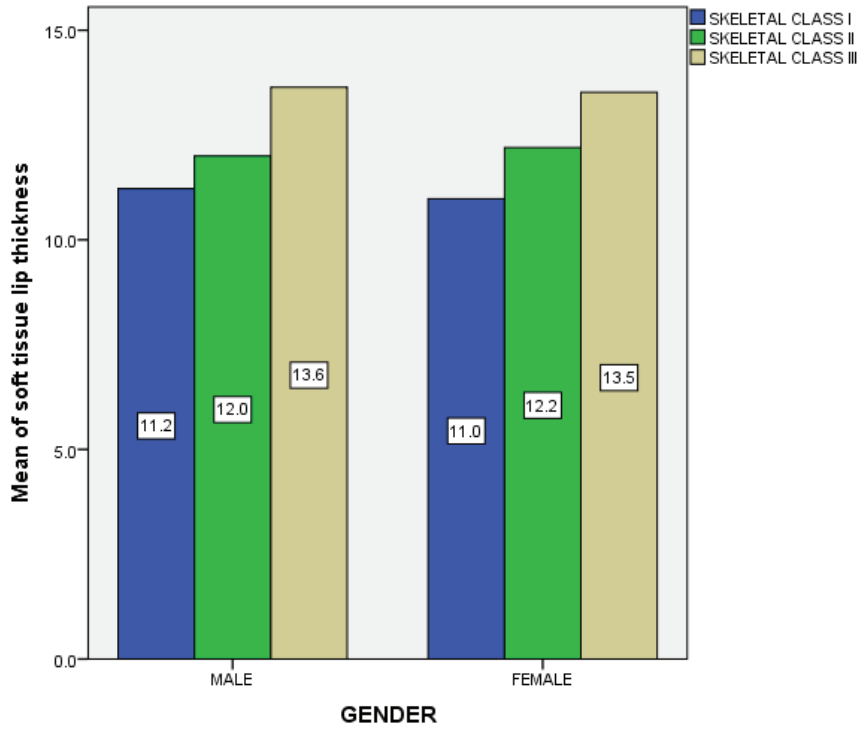

Figure 2: Bar Graph represents the association between gender and soft tissue lip thickness in different malocclusions. X- axis represents the gender and Y-axis represents the mean of upper lip soft tissue thickness in different classes of malocclusion. Blue denotes Skeletal class I malocclusions, green denotes class II and khaki denotes class III malocclusion. Both male and female have no difference with soft tissue lip thickness among various skeletal malocclusions both in percentage and also statistically..Chi-square value- 0.00 , df -2 ,p value - 1.000(p >0.05), hence it is not satistically significant.

Some considerations should be taken into account while taking lateral cephalogram such as the patient should be positioned in a relaxed lip position for evaluating the soft tissue profile since this position demonstrates the relationship of soft tissues to hard tissues without muscular compensation for dentoskeletal abnormalities[18,19]. In agreement with these studies, the relaxed lip position was used in the present study while taking the cephalograms for accurate assessment of soft tissue thickness. Since orthodontic or prosthodontic treatment may produce changes in the soft tissue profile, patients undergoing such treatment were not included in this study.

Previously our team had conducted numerous clinical trials [20–26], lab animal studies[27–31]and in - vitro studies[32–34]over the past 5 years. The idea for this study stemmed from the current interest in our community.

In the present study, we found that soft tissue upper lip thickness was found to be greater in skeletal class III malocclusion compared to other skeletal malocclusion (Figure 1 and Table 1).Gender is not associated with soft tissue lip thickness among various skeletal malocclusions(Figure 2).The present study is complemented by an another study done by Kamak et al,Tanic et al they compared the soft tissue thickness in both male and female orthodontic patients with different skeletal malocclusions and concluded that the thickness at labrale superius and stomion points among each skeletal type was significantly greatest in Class III for both males and females[4,35]. Also Uysal et al showed that statistically significant differences were determined for the thickness of the labrale superius, labrale inferius, pogonion, and menton measurements among different malocclusion[18]. Kurkcuoglu et al in a Turkish population demonstrated that highest differences were found among different malocclusions at labrale superior especially in Class III females[36]. Gungor et al in a Central Anatolian group found differences in soft tissue thicknesses at rhinion, labrale superius especially in class III males,

and at nasion[37]. Few studies comparing the lip thickness among different skeletal malocclusion showed that increased thickness was found in class III malocclusion in both genders[10–12]. According to Subtelny the thickness of subspinale region (A-A') region incrementally increased on an average of 5 mm, from 3 to 18 years old, and comparatively, there is more soft tissue covering point A region therefore soft profile tends to change more in the direction of increased thickness than in the reduction of facial convexity[38]. Aggarwal and Singla et al reported that presence of significant differences between men and women, and men had increased values for soft tissue thickness for the labrale superius, labrale inferius, pogonion and menton, compared with women, and recommended that this difference should be taken into consideration when planning orthodontic therapy[39]. On the contrary , no studies have been found against the findings of this study. Hence the overall consensus of the available literature is in agreement with the present study the upper lip thickness was found to be greater in skeletal class III malocclusion compared to other skeletal malocclusions.

This finding might be due to the angulation of the maxillary and mandibular central incisor. In skeletal class III malocclusion , maxillary incisors are tipped labially and the mandibular incisors lingually therefore, Mandibular anterior teeth might push the upper lip upward and outward[4]. The limitations of the present study was small sample size and restricted to specific race and ethnicity.

Conclusion

With this study, we conclude that soft tissue upper lip thickness was found to be greater in skeletal class III malocclusion when compared to other malocclusions. Gender has no association with soft tissue lip thickness among various skeletal malocclusions. Hence, this study will help the clinicians in diagnosis and treatment planning.

Conflict of Interest: There are no conflicts of interest declared.

Acknowledgement: We would like to thank the patients who have participated in this study and to our Department of Orthodontics in Saveetha Dental College,Chennai.

Source of Funding: Self .

Ethical Clearance: It is taken from "Saveetha Institute Human Ethical Committee" (Ethical Approval Number- SDC/SIHEC/2020/DIASDATA/0619-0320)

References

1. AlBarakati SF. Soft tissue facial profile of adult Saudis. Saudi Med J [Internet]. 2011; Available from: https://www.researchgate.net/profile/Sahar_Albarakati2/publication/304657206_Soft_tissue_facial_profile_of_adult_Saudis_Lateral_cephalometric_analysis/links/5776240708aeb9427e275583/Soft-tissue-facial-profile-of-adult-Saudis-Lateral-cephalometric-analysis.pdf
2. Arnett GW, Gunson MJ. Facial planning for orthodontists and oral surgeons. Am J Orthod Dentofacial Orthop. 2004 Sep;126(3):290–5.
3. Cha K-S. Soft-tissue thickness of South Korean adults with normal facial profiles. Korean J Orthod. 2013 Aug;43(4):178–85.
4. Kamak H, Celikoglu M. Facial soft tissue thickness among skeletal malocclusions: is there a difference? [Internet]. Vol. 42, The Korean Journal of Orthodontics. 2012. p. 23. Available from: http://dx.doi.org/10.4041/kjod.2012.42.1.23
5. Abeltins A, Jakobsone G. Soft tissue thickness changes after correcting Class III malocclusion with bimaxillary surgery. Stomatologija. 2011;13(3):87–91.
6. Burstone CJ. The integumental profile [Internet]. Vol. 44, American Journal of Orthodontics. 1958. p. 1–25. Available from: http://dx.doi.org/10.1016/s0002-9416(58)90178-7
7. Enlow DH, Tr Sapiña Renard S. Crecimiento maxilofacial. sidalc.net; 1984.
8. Riedel RA. The relation of maxillary structures to cranium in malocclusion and in normal occlusion. Angle Orthod. 1952;22(3):142–5.
9. Ioi H, Nakata S, Nakasima A, Counts AL. Anteroposterior lip positions of the most-favored Japanese facial profiles [Internet]. Vol. 128, American Journal of Orthodontics and Dentofacial Orthopedics. 2005. p. 206–11. Available from: http://dx.doi.org/10.1016/j.ajodo.2004.04.030
10. Rasool G, Alam T. COMPARISON OF LIP THICKNESS AMONG DIFFERENT SKELETAL MALOCCLUSION CLASSES. Pakistan Oral & Dental Journal [Internet].

2015;35(1). Available from: http://search.ebscohost.com/login.aspx?direct=true&profile=ehost&scope=site& authtype=crawler& jrnl=10128700& AN=102677896&h=89h%2 FrrtPdAYk7Fzq7vGGvIa78seD%2Fu%2BcTFu0k TEXZsZZbdYD69NIhsEFQ0q18ss9wB8pN3YRl1A%2Fc2ubmh6AOw%3 D%3D&crl=c

11. Gibelli D, Zago M, Cappella A, Dolci C, Sforza C. Modifications of Midfacial Soft-Tissue Thickness Among Different Skeletal Classes in Italian Children [Internet]. Vol. 10, The Open Medical Imaging Journal. 2018. p. 1–8. Available from: http://dx.doi.org/10.2174/1874347101810010001
12. Celikoglu M, Buyuk SK, Ekizer A, Sekerci AE, Sisman Y. Assessment of the soft tissue thickness at the lower anterior face in adult patients with different skeletal vertical patterns using cone-beam computed tomography. Angle Orthod. 2015 Mar;85(2):211–7.
13. Utsuno H, Kageyama T, Uchida K, Yoshino M, Miyazawa H, Inoue K. Facial soft tissue thickness in Japanese children [Internet]. Vol. 199, Forensic Science International. 2010. p. 109.e1–109.e6. Available from: http://dx.doi.org/10.1016/j.forsciint.2010.02.016
14. Utsuno H, Kageyama T, Uchida K, Yoshino M, Oohigashi S, Miyazawa H, et al. Pilot study of facial soft tissue thickness differences among three skeletal classes in Japanese females [Internet]. Vol. 195, Forensic Science International. 2010. p. 165.e1–165.e5. Available from: http://dx.doi.org/10.1016/j.forsciint.2009.10.013
15. Basciftci FA, Uysal T, Buyukerkmen A. Determination of Holdaway soft tissue norms in Anatolian Turkish adults [Internet]. Vol. 123, American Journal of Orthodontics and Dentofacial Orthopedics. 2003. p. 395–400. Available from: http://dx.doi.org/10.1067/mod.2003.139
16. Erbay EF, Caniklioğlu CM. Soft tissue profile in Anatolian Turkish adults: Part II. Comparison of different soft tissue analyses in the evaluation of beauty [Internet]. Vol. 121, American Journal of Orthodontics and Dentofacial Orthopedics. 2002. p. 65–72. Available from: http://dx.doi.org/10.1067/mod.2002.119573
17. Erbay EF, Caniklioğlu CM, Erbay ŞK. Soft tissue profile in Anatolian Turkish adults: Part I. Evaluation of horizontal lip position using different soft tissue analyses [Internet]. Vol. 121, American Journal of Orthodontics and Dentofacial Orthopedics. 2002. p. 57–64. Available from: http://dx.doi.org/10.1067/mod.2002.119780
18. Uysal T, Yagci A, Basciftci FA, Sisman Y. Standards of soft tissue Arnett analysis for surgical planning in Turkish adults [Internet]. Vol. 31, The European Journal of Orthodontics. 2009. p. 449–56. Available from: http://dx.doi.org/10.1093/ejo/cjn123
19. William Arnett G, McLaughlin RP. Facial and Dental Planning for Orthodontists and Oral Surgeons. Mosby Incorporated; 2004. 320 p.
20. Kamisetty SK. SBS vs Inhouse Recycling Methods-An Invitro Evaluation [Internet]. JOURNAL OF CLINICAL AND DIAGNOSTIC RESEARCH. 2015. Available from: http://dx.doi.org/10.7860/jcdr/2015/13865.6432
21. Krishnan S, Pandian S, Kumar S A. Effect of bisphosphonates on orthodontic tooth movement-an update. J Clin Diagn Res. 2015 Apr;9(4):ZE01–5.
22. Viswanath A, Ramamurthy J, Dinesh SPS, Srinivas A. Obstructive sleep apnea: awakening the hidden truth. Niger J Clin Pract. 2015 Jan;18(1):1–7.
23. Sivamurthy G, Sundari S. Stress distribution patterns at mini-implant site during retraction and intrusion--a three-dimensional finite element study. Prog Orthod. 2016 Jan 18;17:4.
24. Samantha C, Sundari S, Chandrasekhar S, Sivamurty G, Dinesh S. Comparative Evaluation of Two Bis-GMA Based Orthodontic Bonding Adhesives - A Randomized Clinical Trial. J Clin Diagn Res. 2017 Apr;11(4):ZC40–4.
25. Vikram NR, Raj Vikram N. Ball Headed Mini Implant [Internet]. JOURNAL OF CLINICAL AND DIAGNOSTIC RESEARCH. 2017. Available from: http://dx.doi.org/10.7860/jcdr/2017/24358.9240
26. Felicita AS. Orthodontic management of a dilacerated central incisor and partially impacted canine with unilateral extraction - A case report. Saudi Dent J. 2017 Oct;29(4):185–93.
27. Pandian KS, Krishnan S, Kumar SA. Angular photogrammetric analysis of the soft-tissue facial profile of Indian adults. Indian J Dent Res. 2018 Mar;29(2):137–43.
28. Jain RK. Comparison of Intrusion Effects on Maxillary Incisors Among Mini Implant Anchorage,

J-Hook Headgear and Utility Arch [Internet]. JOURNAL OF CLINICAL AND DIAGNOSTIC RESEARCH. 2014. Available from: http://dx.doi.org/10.7860/jcdr/2014/8339.4554

29. Rubika J, Sumathi Felicita A, Sivambiga V. Gonial Angle as an Indicator for the Prediction of Growth Pattern [Internet]. Vol. 6, World Journal of Dentistry. 2015. p. 161–3. Available from: http://dx.doi.org/10.5005/jp-journals-10015-1334
30. Ramesh Kumar KR, Shanta Sundari KK, Venkatesan A, Chandrasekar S. Depth of resin penetration into enamel with 3 types of enamel conditioning methods: A confocal microscopic study. Am J Orthod Dentofacial Orthop. 2011 Oct 1;140(4):479–85.
31. Felicita AS. Quantification of intrusive/retraction force and moment generated during en-masse retraction of maxillary anterior teeth using mini-implants: A conceptual approach. Dental Press J Orthod. 2017 Sep;22(5):47–55.
32. Dinesh SPS, Saravana Dinesh SP. An Indigenously Designed Apparatus for Measuring Orthodontic Force [Internet]. JOURNAL OF CLINICAL AND DIAGNOSTIC RESEARCH. 2013. Available from: http://dx.doi.org/10.7860/jcdr/2013/7143.3631
33. Felicita AS, Chandrasekar S, Shanthasundari KK. Determination of craniofacial relation among the subethnic Indian population: a modified approach - (Sagittal relation). Indian J Dent Res. 2012 May;23(3):305–12.
34. Felicita AS, Sumathi Felicita A. Orthodontic extrusion of Ellis Class VIII fracture of maxillary lateral incisor – The sling shot method [Internet]. Vol. 30, The Saudi Dental Journal. 2018. p. 265–9. Available from: http://dx.doi.org/10.1016/j.sdentj.2018.05.001
35. Tanic T, Blazej Z, Mitic V. Soft tissue thickness of face profile conditioning by dento-skeletal anomalies [Internet]. Vol. 139, Srpski arhiv za celokupno lekarstvo. 2011. p. 439–45. Available from: http://dx.doi.org/10.2298/sarh1108439t
36. Kurkcuoglu A, Pelin C, Ozener B, Zagyapan R, Sahinoglu Z, Yazici AC. Facial soft tissue thickness in individuals with different occlusion patterns in adult Turkish subjects. Homo. 2011 Aug;62(4):288–97.
37. Gungor K, Bulut O, Hizliol I, Hekimoglu B, Gurcan S. Variations of midline facial soft tissue thicknesses among three skeletal classes in Central Anatolian adults. Leg Med . 2015 Nov;17(6):459–66.
38. Subtelny JD. A longitudinal study of soft tissue facial structures and their profile characteristics, defined in relation to underlying skeletal structures [Internet]. Vol. 45, American Journal of Orthodontics. 1959. p. 481–507. Available from: http://dx.doi.org/10.1016/0002-9416(59)90014-4
39. Aggarwal I, Singla A. Soft tissue cephalometric analysis applied to Himachali ethnic population [Internet]. Vol. 8, Indian Journal of Dental Sciences. 2016. p. 124. Available from: http://dx.doi.org/10.4103/0976-4003.191731