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Changes in Archwidth of Class I Malocclusion Patients Treated With Extraction and Nonextraction in Indian Population

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ABSTRACT

Aim: The study was to determine the pre- and post-treatment width changes of class I malocclusion treated with extraction and non-extraction treatment.

Material and Method: - Pre- and post-treatment orthodontic study models of 70 patients irrespective of gender who underwent comprehensive orthodontic therapy were evaluated. Thirty-five were treated non-extraction with fi xed appliance therapy and thirty- five with extraction of the first premolars. Measurement where made in the canine and molar region using digital vernier caliper at labial aspect of the buccal surfaces of the canine and molar. Measurement where compared statistically to determine wheather the dental arches where narrower after extraction treatment.

Result: - No significant difference was observed in pre treatment intercanine and intermolar width of extraction and nonextraction group. In the posttreatment extraction group there is an decrease of 1mm in the intercanine and intermolar region. In the posttreatment nonextraction group, the intercanine width is decreased in both the arches, whereas intermolar width is increased in lower arch.

Conclusion:- This indicates that posttreatment record of extraction group results in narrower dental arches whereas posttreatment record of nonextraction group results increase of intermolar width that is wider posterior arches.

Keywords: Intermolar width, Intercanine width, Dental arch, Orthodontics.

INTRODUCTION

The success of orthodontic treatment is influenced by the clinician ability to develop an optimal treatment plan. For diagnosis and treatment planning arch dimension including archwidth, arch length and interalveolar width plays an important role in orthodontic practice. Dental arch width changes from natural growth and due to orthodontic treatment. Studies by Moores and others have shown that archlength decreases in the transition stage from the deciduous to the permanent dentition and then continuous to decrease with increasing age. Studies also shown that archwidth changes due to orthodontic treatment shows. larger arch width in males than in female.

Transverse/ Vertical malrelation can be treated by extraction and nonextraction treatment in permanent dentition. In the recent years the effect of extraction on the buccal corridor represents the space between

the buccal surface and the corresponding corner of the mouth representing it unesthetics and consums longer treatment duration. On the contrary nonextraction treatment is of shorter duration.

Data on archwidth, archform and circumference are available on Nepalese, Bangladesh and in American Black and White population. However studies comparing the changes in archwidth of Indian population is scare. Hence this study attempts to compare the archwidth of male and female Indian population treated with extraction and nonextraction treatment.

Materials and methods

Data collection A universal digital calliper (electronic carbon fiber vernier calliper gauge micrometer) with accuracy 0.01 mm dental arches were measured in the canine and the first molar regions from the most labial aspect of the buccal surfaces of these teeth.(Fig 01) The caliper was placed at right angle to the palatal suture in the maxillary arch and to a line bisecting the incisor segment in the mandibular arch.The average of first three measurements was considered the final value. The random error of measurement was assessed by Dahlberg's formula:7 Sx = 2 D 2N Σ

Where, D is the difference between duplicate measurements, and N is the number of double determinations. The range of error of measurement was 0.22 to 0.50. The collected data was treated statistically by using two tailed t-test ($p < 0.05$).

Inclusion criteria

- Patient's sample where of Indian population.
- Class I dental and skeletal malocclusion
- Patient's treated with MBT edgewise appliances in both arches without use of any extraoral or temporary anchorage device.

Exclusion criteria

- Patient's had no history of cleft, dentofacial deformity or syndrome.
- Patient's had never received orthodontic and orthognathic surgery
- The sample was randomly selected and then for descriptive purposes, sample was classified into following groups.
- (1) Extraction group = (a) Pretreatment (b) Posttreatment

(2) Nonextraction group =(a) Pretreatment (b) Posttreatment

- The archwidth measurement where done using digital electronic carbon fiber vernier calliper gauge micrometer.
- The measurement where taken from most labial aspect of canine and molar region in the upper and lower cast.

Statistical analysis

- Statistical analysis was done by using descriptive and inferential statistics using student's paired and unpaired 't' test and software used in the analysis where SPSS 24.0 version and Graphpad prism 7.0 version and $p < 0.05$ is considered as level of significance

RESULT

- Table 1, Graph 1: Mean intercanine width for upper cast was 32.33±0.20 and mean intermolar width was 57.45±0.28. By using student's unpaired t test statistically significant difference was found in upper cast between intercanine width and intermolar width(t=419.85,p=0.0001).
- Mean intercanine width for lower cast was 28.44±0.20 and mean intermolar width was 56.44±0.19. By using student's unpaired t test statistically significant difference was found in lower cast between intercanine width and intermolar width(t=583.85,p=0.0001).
- Table 2 , Graph 2 : Mean intercanine width of upper cast (34.47±0.22) and mean intermolar width of upper cast (58.52±0.24) Mean intercanine width of lower cast (33.43±0.18) and mean intermolar width of lower cast (57.43±0.21), upper cast(t = 424.47, P= 0.0001,S),lower cast (t = 491.31

  , P = 0.0001,S)
- Table 3, Graph 3: Mean intercanine width of upper cast (32.31±0.19) and mean intermolar width of upper cast (57.42±0.16) Mean intercanine width of lower cast (28.42±0.18) and mean intermolar width of lower cast

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(56.46±0.17), upper cast(t = 586.51, P= 0.0001,S),lower cast (t = 643.2

, P = 0.0001,S)

- Table 4, Graph 4 : Comparison of post treatment and upper and lower cast in intercanine width and intermolar width in non extraction group Mean intercanine width of upper cast (31.35±0.17) and mean intermolar width of upper cast (56.56±0.24) Mean intercanine width of lower cast (27.45±0.20) and mean intermolar width of lower cast (58.48±0.21), upper cast(t = 491.67, P= 0.0001,S),lower cast (t = 612.63, P = 0.0001,S)

Discussion

- This investigation incorporated the issue of maxillary expansion into the extraction versus non-extraction debate. However, it should be borne in mind that this study only relates to the treatment fi ndings and that the long-term stability of the treatment approaches may lead to differences between the groups in terms of relapse and post-treatment changes. For many years, the use of extraction treatment to treat malocclusion has been debated and found to be in same results. The implication of nonextraction treatment will result in boarder dental arches and more attractive smiles. The data on the present study mainly focuses on change in archwidth in the canine and premolar region of pretreatment and post treatment cast dimension. The measurement done using digital electronic carbon fiber vernier calliper gauge micrometer on the labial surface of canine and molar instead of cusp tip of canine and molar was also done by Gianelly etal for reason 1) to determine the widest possible width of the arches 2) to prevent confusion when selected cusp tip where not distinct 3) to avoid identifying specific molar for measurement in extraction treatment as noted by Johnson and Smith.

- The study done by Meyer etal, Kim etal, Ghafari J, Spahl T has advocated the current trend of nonextraction treatment in patients because of social media influences and partly because of the belief by some that extraction of premolar leads to poor esthetic result through creating larger buccal corridor from constriction of dental arches.

- According to findings of the present study the arch widths in both canine and molar region in the mandibular arches did not show any statistical significant results. In fact the arches in both posttreatment extraction group and posttreatment nonextraction group was decreased by 1 mm in intercanine region whereas thearchwidth in the intermolar region remained stable in both extraction and nonextraction group. The results of this study can be compared with studies in which posttreatment long term stability of mandibular intermolar width stability was found acceptable.

- Weinberg and Sadowsky found significant increase in mandibular intercanine and intermolar width in class 1 malocclusion treated nonextraction and stated that the expansion of buccal segments in the mandibular arches helped in resolution of class I crowding.

- To some investigators maxillary arch width is determinant of smile esthetics, the maxillary arch widths in extraction and nonextraction groups were same so it can be expected that the treatment effects in maxillary arches will be the same, and there will be no difference in esthetic scores in both the groups. In fact the pretreatment intercanine widths in extraction groups and nonextraction group was found stable in class I malocclusion. However, the future studies in the maxillary arches in various malocclusion classifications with various treatment mechanics will be productive. However, future studies with various malocclusion groups, treatment mechanics, larger sample size and long-term changes in arch dimensions will be useful

Conclusion

- In the initial phase of treatment the intercanine and intermolar width of extraction and nonextraction group are stable in both the arches.

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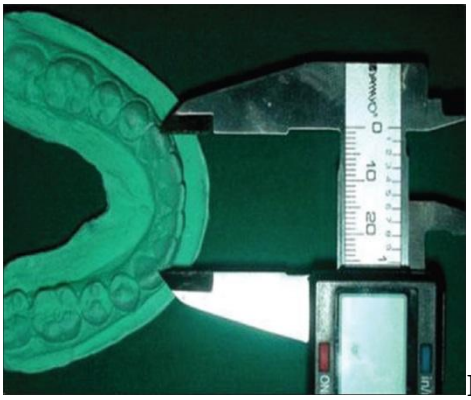
- In the posttreatment extraction group there is an decrease of 1mm in the intercanine and intermolar region.
- In the posttreatment nonextraction group, the intercanine width is decreased in both the arches,whereas intermolar width is increased in lower arch.



- **FIG ; 01, ELECTRONIC VERNIER CALLIPER MEASURING LABIAL ASPECT OF CANINE OF UPPER AND LOWER CAST**

Table 1: Comparison of pre treatment and upper and lower cast in intercanine width and intermolar width in extraction group

	Intercanine Width	Intermolar Width	t-value	p-value
Upper Cast	32.33±0.20	57.45±0.28	419.85	0.0001,S
Lower Cast	28.44±0.20	56.44±0.19	583.85	0.0001,S

Table 2: Comparison of post treatment and upper and lower cast in intercanine width and intermolar width in extraction group

	Intercanine Width	**Intermolar Width**	**t-value**	**p-value**
Upper Cast	34.47±0.22	58.52±0.24	424.47	0.0001,S
Lower Cast	33.43±0.18	57.43±0.21	491.31	0.0001,S

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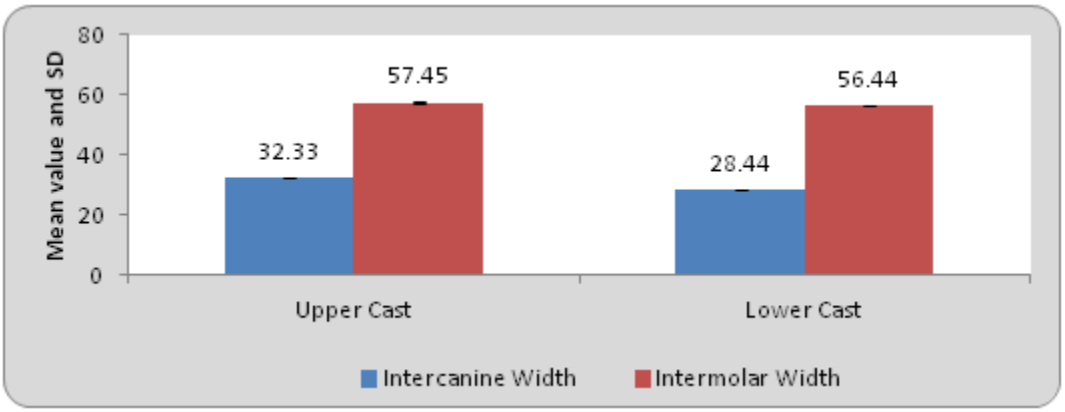
Graph 1: Comparison of pre treatment and upper and lower cast in intercanine width and intermolar width in extraction group



Graph 2: Comparison of post treatment and upper and lower cast in intercanine width and intermolar width in extraction group

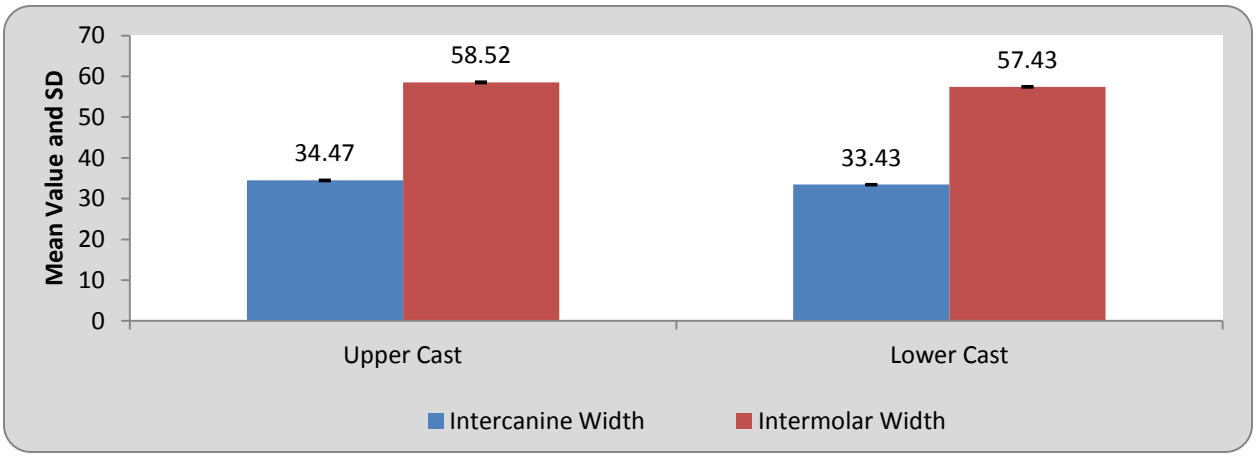


Table 3: Comparison of pre treatment and upper and lower cast in intercanine width and intermolar width in non extraction group

	Intercanine Width	Intermolar Width	t-value	p-value
Upper Cast	32.31±0.19	57.42±0.16	586.51	0.0001,S
Lower Cast	28.42±0.18	56.46±0.17	643.22	0.0001,S

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Graph 3: Comparison of pre treatment and upper and lower cast in intercanine width and intermolar width in non extraction group

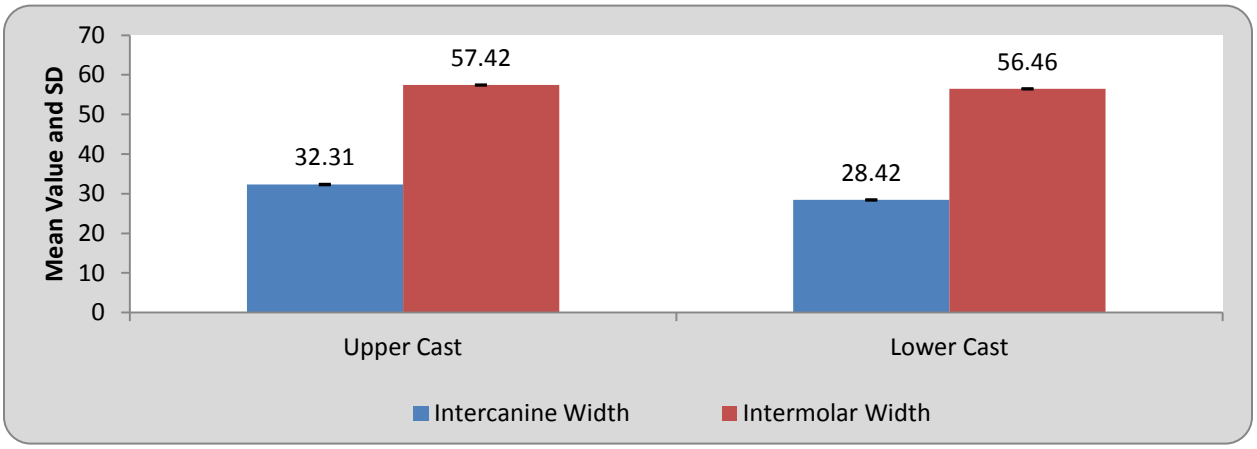
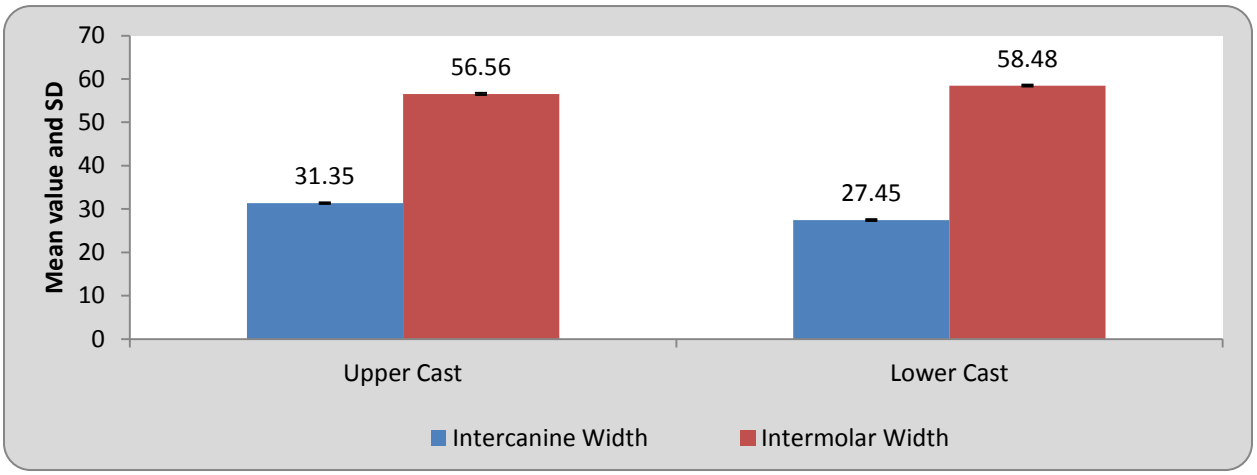


Table 4: Comparison of post treatment and upper and lower cast in intercanine width and intermolar width in non extraction group

	Intercanine Width	Intermolar Width	t-value	p-value
Upper Cast	31.35±0.17	56.56±0.24	491.67	0.0001,S
Lower Cast	27.45±0.20	58.48±0.21	612.63	0.0001,S

Graph 4: Comparison of post treatment and upper and lower cast in intercanine width and intermolar width in non extraction group



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References:

1. Meyer AH, Woods MG, Manton DJ. Maxillary arch width and buccal corridor changes with orthodontic treatment. Part 1: differences between premolar extraction and nonextraction treatment outcomes. American Journal of Orthodontics and Dentofacial Orthopedics. 2014 Feb 1;145(2):207-16.
2. Gianelly AA. Arch width after extraction and nonextraction treatment. American journal of orthodontics and dentofacial orthopedics. 2003 Jan 1;123(1):25-8.
3. Shapiro PA. Mandibular dental arch form and dimension: treatment and postretention changes. American journal of orthodontics. 1974 Jul 1;66(1):58-70.
4. Bowman SJ, Johnston Jr LE. The esthetic impact of extraction and nonextraction treatments on Caucasian patients. The Angle Orthodontist. 2000 Feb;70(1):3-10.
5. Bishara SE, Bayati P, Zaher AR, Jakobsen JR. Comparisons of the dental arch changes in patients with Class II, division 1 malocclusions: extraction vs nonextraction treatments. The Angle Orthodontist. 1994 Oct;64(5):351-8.
6. Bishara SE, Ortho D, Jakobsen JR, Treder J, Nowak A. Arch width changes from 6 weeks to 45 years of age. American Journal of Orthodontics and Dentofacial Orthopedics. 1997 Apr 1;111(4):401-9.
7. Ward DE, Workman J, Brown R, Richmond S. Changes in arch width: a 20-year longitudinal study of orthodontic treatment. The Angle Orthodontist. 2006 Jan;76(1):6-13.
8. Motoyoshi M, Hirabayashi M, Shimazaki T, Namura S. An experimental study on mandibular expansion: increases in arch width and perimeter. The European Journal of Orthodontics. 2002 Apr 1;24(2):125-30.
9. Kim E, Gianelly AA. Extraction vs nonextraction: arch widths and smile esthetics. The Angle Orthodontist. 2003 Aug;73(4):354-8.
10. Miyake H, Ryu T, Himuro T. Effects on the dental arch form using a preadjusted appliance with premolar extraction in Class I crowding. The Angle Orthodontist. 2008 Nov;78(6):1043-9.
11. Anuwongnukroh N, Dechkunakorn S, Kunakornporamut K, Tua-Ngam P. Dental arch changes in postretention in Class II division 1 extraction cases. International Orthodontics. 2017 Jun 1;15(2):208-20.
12. Herzog C, Konstantonis D, Konstantoni N, Eliades T. Arch-width changes in extraction vs nonextraction treatments in matched Class I borderline malocclusions. American Journal of Orthodontics and Dentofacial Orthopedics. 2017 Apr 1;151(4):735-43.
13. Glisic O, Hoejbjerre L, Sonnesen L. A comparison of patient experience, chair-side time, accuracy of dental arch measurements and costs of acquisition of dental models. The Angle Orthodontist. 2019 Nov;89(6):868-75.
14. Ward DE, Workman J, Brown R, Richmond S. Changes in arch width: a 20-year longitudinal study of orthodontic treatment. The Angle Orthodontist. 2006 Jan;76(1):6-13.
15. Gianelly AA. Arch width after extraction and nonextraction treatment. American journal of orthodontics and dentofacial orthopedics. 2003 Jan 1;123(1):25-8.
16. McNamaraa JA. Maxillary transverse deficiency. American journal of orthodontics and dentofacial orthopedics. 2000 May 1;117(5):567-70.
17. Heiser W, Richter M, Niederwanger A, Neunteufel N, Kulmer S. Association of the canine guidance angle with maxillary and mandibular intercanine widths and anterior alignment relapse: extraction vs nonextraction treatment. American journal of orthodontics

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and dentofacial orthopedics. 2008 May 1;133(5):669-80.

18. Heiser W, Niederwanger A, Bancher B, Bittermann G, Neunteufel N, Kulmer S. Three-dimensional dental arch and palatal form changes after extraction and nonextraction treatment. Part 1. Arch length and area. American journal of orthodontics and dentofacial orthopedics. 2004 Jul 1;126(1):71-81
19. SOBHI AM, Ebadifar A. Dimensional changes of dental arch following non-extraction orthodontic treatment.
20. Işık F, Sayınsu K, Nalbantgil D, Arun T. A comparative study of dental arch widths: extraction and non-extraction treatment. The European Journal of Orthodontics. 2005 Dec 1;27(6):585-9.
21. Al–Sayagh NM. Maxillary Arch Dimensional Changes in the Extraction and Non Extraction Orthodontic Treatment. Al-Rafidain Dental Journal. 2008;8(11):26-37.
22. Dostalova T, Racek J, Tauferova E, Smutny V. Average arch widths and associated changes between initial, post-treatment and post-retention measurements. Brazilian dental journal. 2004 Dec;15(3):204-8.
23. Sampson P, Little RM, Årtun J, Shapiro PA. Long-term changes in arch form after orthodontic treatment and retention. American Journal of Orthodontics and Dentofacial Orthopedics. 1995 May 1;107(5):518-30.
24. Sondhi A, Cleall JF, BeGole EA. Dimensional changes in the dental arches of orthodontically treated cases. American Journal of Orthodontics. 1980 Jan 1;77(1):60-74.
25. Hashim HA, Dweik YG, Al-Hussain H. An odontometric study of arch dimensions among Qatari population sample with different malocclusions. International Journal of Orthodontic Rehabilitation. 2018 Jul 1;9(3):93.
26. Islam MM, Hossain MZ. A Comparative Study of Arch Widths of Bangladeshi Subject with Normal Occlusion and Class II Division 1 Malocclusion. Bangladesh Journal of Orthodontics and Dentofacial Orthopedics. 2012;2(2):18-23.
27. Burris BG, Harris EF. Maxillary arch size and shape in American blacks and whites. The Angle Orthodontist. 2000 Aug;70(4):297-302.
28. Basaran G, Hamamci N, Hamamci O. Comparision of dental arch widths in different types of malocclusions. World journal of orthodontics. 2008 Mar 1;9(1).
29. Burke SP, Silveira AM, Goldsmith LJ, Yancey JM, Van Stewart A, Scarfe WC. A meta-analysis of mandibular intercanine width in treatment and postretention. The Angle Orthodontist. 1998 Feb;68(1):53-60.
30. Dhakal J, Acharya A, Shrestha M, Shrestha RM. Evaluation of Dental Arch Widths In Different Malocclusion Groups.

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