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## Choice of Appliance System in Adult Patients with Different Types of Malocclusion

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**Abstract:** The aim of this study was to assess the choice of appliance system in adult patients namely those over 30 years of age with different malocclusions. There is an array of various orthodontic appliances used for the correction of different malocclusion in orthodontics. The appliances required for a particular type of malocclusion may not be well suited for another type of malocclusion. Orthodontic treatments are generally considered to cause discomfort to the patient and are time-consuming. Hence, the selection of the orthodontic appliance has a paramount role in the treatment of malocclusion. This was an University based cross sectional study conducted on male and female patients ranging from 30 to 50 years of age who reported for orthodontic treatment. The type of malocclusion, and the type of appliance used to correct the malocclusion present were assessed. The data was collected and tabulated in excel sheet, and exported to SPSS software for statistical analysis. The most common type of malocclusion in patients over 30 years of age who had reported for orthodontic treatment was class I malocclusion (81.43%), followed by class II malocclusion (17.14%) and the least number of patients had class III malocclusion (1.43%). Among these patients, fixed appliances were the most commonly used treatment modality (95.7%). There was a statistically significant difference in the prevalence of malocclusion in patients over 30 years of age with Class I malocclusion being the most prevalent ( $p=0.000$ ). There was no statistical significance between the different types of appliances used for the correction of class I and class II malocclusion ( $p= 0.687$ ). Among fixed appliance metal brackets were the most commonly used compared to ceramic and lingual brackets ( $p=0.000$ ).

**Keywords:** Adult patients; Clear aligners; Fixed appliance; Removable appliance; Type of malocclusion, innovative

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### INTRODUCTION

The frequency of malocclusion in adults is observed in equal prevalence if not more when compared to children. (Sato, 1973) The most common problems in an adult patient is crowding and spacing, along with class I and II malocclusion. (Krzypow, Lieberaian and Modan, 1975). However, despite the need for orthodontic treatment adult patients do not prefer to undergo orthodontic treatment. (Boyd, Miller and Vlaskalic, 2000) Orthodontic treatments are generally considered to be painful, time-consuming and more often than not causes an unaesthetic appearance during the treatment period. (Naqvi and Salama, 2019) Hence the number of patients seeking orthodontic treatment, above the age of 30 is significantly less than the amount of patients seeking orthodontic treatment as children and adolescents. (Brignardello-Petersen, 2020) During orthodontic treatment, debonding of brackets can hinder the treatment progress and is expensive and time consuming as well. (Tang, King and Tang, no date; Naqvi and Salama, 2019) The overall failure rate of brackets bonded using orthofix was 2.7% while the brackets bonded using Transbond XT had a failure rate of 3.6%. (Samantha *et al.*, 2017) For a good bonding between the teeth surfaces and the brackets the etching, binding and resin penetration remains imperative. Maximum resin penetration was observed in teeth that we're etched with 37% orthophosphoric acid, than a self etching primer the least resin penetration was seen in brackets bonded with only air abrasion type of conditioning. (Kumar *et al.*, 2011)

In patients who are under bisphosphonate medication, the duration of the orthodontic treatment is increased, as it interferes with osteoclastic resorption. However the use of bisphosphonates has been proved beneficial in patients who require anchorage treatments. (Krishnan, Pandian and Kumar S, 2015) The current trend in

orthodontics is the use of mini implants, the dimension of the mini-implant is important for the safe clinical usage during orthodontic anchorage treatment. The recommended size of mini implants for anterior segment is 1.3x 6mm and 1.3x8 mm for the molar intrusion.(Sivamurthy and Sundari, 2016) Intrusion of proclined maxillary incisors can pose as the most difficult task in an orthodontic treatment. (Jain, Kumar and Manjula, 2014) In patients, for the en -masse retraction and intrusion of the anterior maxillary teeth 212 grams per side is required (Felicita, 2017b) and these forces can be measured with indigenous apparatus (Dinesh and Saravana Dinesh, 2013) Class III skeletal malocclusion may present with maxillary retrognathism or mandibular prognathism or as a combination of both. In growing patients face mask therapy can be used, in recent times mini implants are also being used as anchorage devices in class III patients.(Vikram *et al.*, 2017) Recycling and the methods employed of orthodontic brackets is also pertinent to the outcome of orthodontic treatment(Kamisetty *et al.*, 2015) Previously multiple original studies have been carried out by our team (Viswanath *et al.*, 2015),(Rubika, Felicita and Sivambiga, 2015) ,(Felicita, Chandrasekar and Shanthasundari, 2013) ,(Krishnan, Pandian and Kumar, 2018) over the past 5 years. The idea for this cross sectional study stemmed due to the piqued interest in our community.

In current times, there is a surge in patients, including adult patients, who are willing to undergo orthodontic treatment, to correct their dental anomalies and to achieve an aesthetically pleasing appearance. Though removal appliances and clear aligners are aesthetically better when compared to fixed appliances, the treatment prognosis depends upon the patient's compliance, such as the cumulative time the appliance is being worn by the patient. The removable appliance can only be used to correct minor abnormalities, while the sophisticated fixed appliances can be used to treat all types of dental anomalies, and they can be used along with head gears in growing patients. A person's appearance can have a significant effect on how they perceive themselves and can affect their self esteem and social standing.

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, Senthilvelan and Ranganathan, 2012), (Rajendran *et al.*, 2019), (Govindaraju, Neelakantan and Gutmann, 2017), (P. Neelakantan *et al.*, 2015), (PradeepKumar *et al.*, 2016), (Sajan *et al.*, 2011), (Lekha *et al.*, 2014a), (Neelakantan, Grotra and Sharma, 2013), (Patil *et al.*, 2017), (Jeevanandan and Govindaraju, 2018), (Abdul Wahab *et al.*, 2017), (Eapen, Baig and Avinash, 2017), (Menon *et al.*, 2018), (Wahab *et al.*, 2018), (Vishnu Prasad *et al.*, 2018), (Uthrakumar *et al.*, 2010), (Ashok, Ajith and Sivanesan, 2017), (Prasanna Neelakantan *et al.*, 2015). The aim of this study is to assess the type of malocclusion and the choice of appliance system used in the treatment of these malocclusion in patients over 30 years of age.

## **MATERIALS AND METHODS**

### **Study design**

This cross-sectional study was conducted in an University based setting. The data was obtained by reviewing and screening the 86,000 case sheets of patients reporting to Saveetha dental college from June 2019 to March 2020. All the data of the patients over 30 years of age undergoing orthodontic treatment were included. No data samples were exempted and no sorting of data was done. Cases with insufficient data and missing data as well as time constraints were excluded from this study. Informed consents were obtained from the patients. The ethical board clearance was obtained from the IERB; IEC approval number: SDC/SIHEC/2020/DIASDATA/0619-0320.

### **Sampling**

Simple random sampling was used. The dates of sample collection were from June 2019 to March 2020. The digital records of male and female patients over 30 years of age who reported for orthodontic treatment archived in the university database were reviewed. The data was verified using the patient photographs. 70 patients over the age of 30 years with no previous history of orthodontic treatment were selected.

### **Data collection**

The data collected contained parameters such as age, gender, type of malocclusion, type of appliance used and the type of brackets used. The patient data obtained was cross verified with the treatment photographs. The data was collected and tabulated in the excel sheet and imported to SPSS software for statistical analysis.

### **Statistical analysis**

The data was imported to the SPSS software by IBM version 25.0 for Windows OS. in which the output variables were defined. The independent variables were age and gender while the dependent variables were the type of malocclusion, type of appliance used, type of brackets used. The statistical test used was the chi square test to establish the association between the variables. A P value below 0.05 was considered statistically significant.

## RESULTS AND DISCUSSION

Out of 70 patients over 30 years of age who had reported for orthodontic treatment. Class I malocclusion was the most prevalent with 57 patients (81.43%) followed by Class II malocclusion with 12 patients (17.14%) and Class III malocclusion with 1 patient (1.47%). (Fig 1) In class I malocclusion patients 55 of the patients underwent treatment with fixed appliances, 2 patients had undergone treatment using removable appliances, while 1 patient with Class I malocclusion did not undergo any orthodontic treatment. 12 patients of the Class II malocclusion patients had undergone orthodontic treatment with fixed appliances. 1 patient with Class III malocclusion did not undergo any orthodontic treatment. (Fig 2). Overall, 58 who had undergone treatment using fixed appliances with metallic brackets, while 5 of the patients preferred ceramic brackets and 2 of the patients were treated using lingual brackets. (Fig 4) In patients who had been treated with removable appliances 1 was treated with clear aligners, while 1 patient was treated using Hawley's appliance. Comparing among groups 12 patients with class II malocclusion underwent treatment using metallic brackets, while 55 Class I patients underwent orthodontic treatment with metallic brackets.(Fig 3). There was a statistically significant difference in the prevalence of malocclusion in patients over 30 years of age with Class I malocclusion being the most prevalent ( $p=0.000$ ). There was no statistical significance between the different types of appliances used for the correction of class I and class II malocclusion ( $p= 0.687$ ). Among fixed appliance metal brackets were the most commonly used compared to ceramic and lingual brackets ( $p=0.000$ ).

In this present study, fixed appliances were more commonly used to treat malocclusions than the removal appliances. Though the patients preferred clear aligners and removable appliances to fixed appliances, fixed appliances were commonly used for the treatment of the patients as the patients presented with rotated and proclined teeth along with other malocclusion patterns such as severe crowding and spacing. Fixed appliances were chosen as the treatment option as it does not depend on the compliance of wear by the patients. In patients with fixed appliances, metallic brackets were more commonly employed than ceramic brackets. In patients with class II malocclusions, only metallic brackets were used, in class I patients metallic, ceramic brackets and lingual brackets were used in the descending order. Of the patients who had sought orthodontic treatment, the most common type of malocclusion was class I malocclusion followed by class II malocclusion with the least incident type of malocclusion being class III malocclusion.

A similar was conducted to evaluate the treatment of class II malocclusion in adolescents using fixed appliance systems (Vijayalakshmi and Veereshi, 2011). Although there are different modalities of treatment, fixed appliances had much better treatment outcomes than clear aligners(Papageorgiou *et al.*, 2019) Similarly in adolescent patients with class I malocclusion with anterior cross bite and severe crowding, fixed appliance system yielded good results (Ritter, 2014) Class I malocclusion with bimaxillary proclination was also better treated with conventional fixed appliance (Moresca, 2014). Adult patients with class II division 2 type of malocclusion, fixed appliance may be treated with ceramic brackets. (Uribe and Nanda, 2003). Class II patients treated with fixed inter maxillary devices in growing individuals produced good results. (Heinrichs *et al.*, 2014). Class I malocclusion with anterior crossbite can be effectively treated with acrylic removal appliance with a bite plane.(Ulusoy and Bodrumlu, 2013) Mirijam Hönn *et al.*, used removal appliances and functional appliances to treat class II malocclusions. The functional appliances yielded good results compared to removal appliances. (Hönn *et al.*, 2006). Orthodontic extrusion of Ellis class VIII fracture of maxillary lateral incisor was treated using slingshot elastics and good results were obtained and root resorption was absent. (Felicita, 2018) Treatment of dilacerated central incisor and partially impacted canine, orthodontic management was done using fixed appliances with metallic brackets and unilateral extraction. (Felicita, 2017a). Treatment of adult non growing female patient with class II division 1, malocclusion, with an orthognathic maxilla and retrognathic mandible who had refused surgery was carried out with fixed appliance with metallic brackets following the extraction of the first permanent molars (Naragond *et al.*, 2013) .

The limitations of the present study was that despite the inclusion of all data samples of patients over 30 years of age undergoing orthodontic treatment the sample population was limited as all the patient data samples belonged to a single university of a single region. In the future, further studies can be done among different universities within the state and country to increase the sample size and overcome the present study limitation. Accessing the different methods of correction of malocclusion among adult patients, can aid the clinicians in arriving at an efficient treatment plan.

## CONCLUSION

The aim of this study was to determine the type of malocclusion and choice of appliance system used in patients over 30 years of age for orthodontic treatment. Within the limits of the study, it was found that the class I malocclusion was the most prevalent and fixed orthodontic appliances were more commonly employed for the

treatment of class I and class II malocclusions. Metallic brackets were more commonly used than ceramic brackets and lingual brackets.

#### Author Contributions

Author 1 (P. Deeksheetha), carried out the study by collecting data and drafted the manuscript after performing the necessary statistical analysis. Author 2 (Dr.A.Sumathi Felicita) aided in conception of the topic, has participated in the study design, statistical analysis and has supervised in preparation of the manuscript. Author 3 (Dr. Nashra) has coordinated the development of the manuscript. All the authors have discussed the results among themselves and contributed to the final manuscript.

#### Conflict of Interest

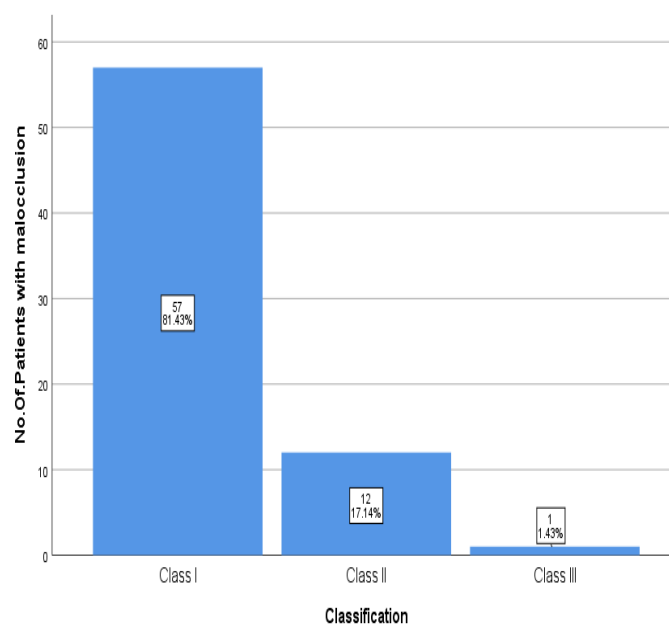
None declared

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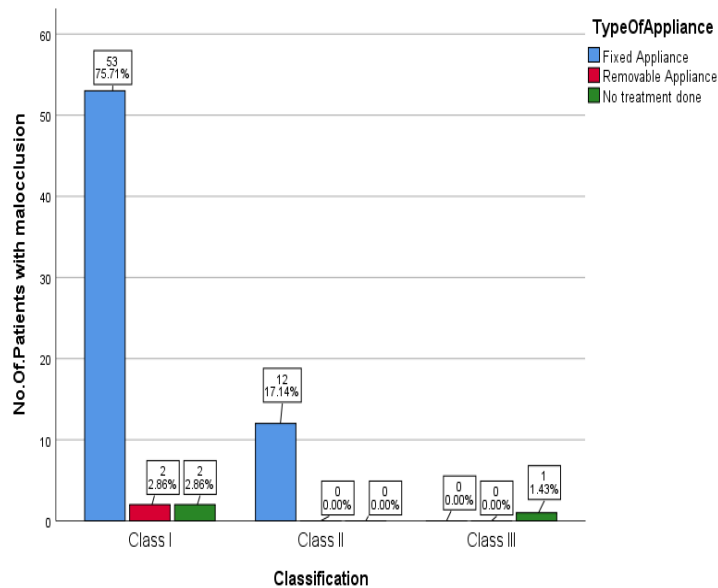
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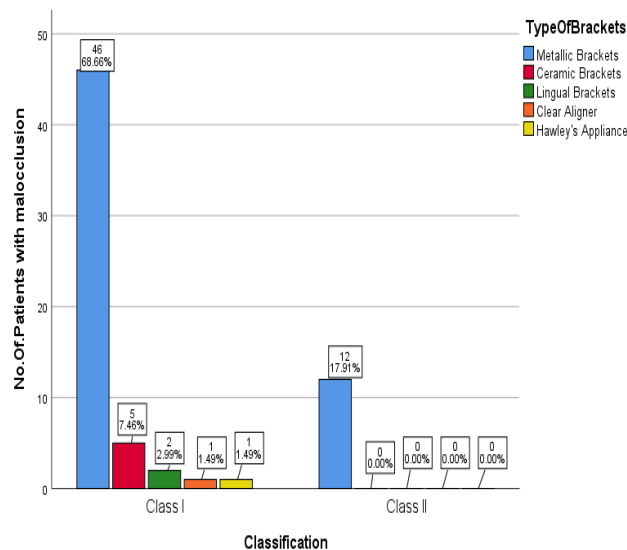
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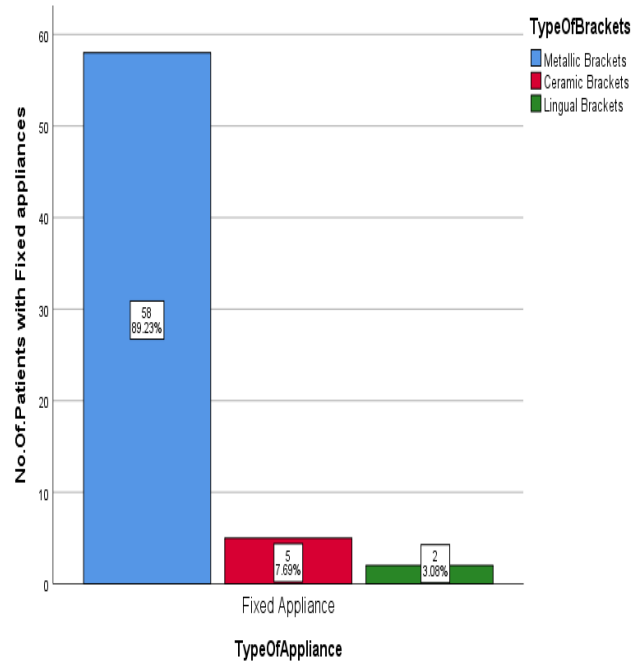
**Fig.1: This bar chart shows distribution of classification. Class I- 57 (81.4%), class II - 12 (17.1%), class III- 1 (1.4%).**



**Fig.2: This bar graph compares the types of appliances used among different types of malocclusions. The X axis represents the Angle's Classification and the Y axis represents the number of patients with malocclusion. The blue colour represents fixed appliances, while the red colour represents removal appliances and the green colour represents no treatment done in patients with malocclusions. Fixed appliances were more commonly used to treat Class I and Class II malocclusions. There was a significant difference in the type of appliances used for different types of malocclusions. (Chi-square test, p value: 0.000 (p <0.05 statistically significant)).**



**Fig.3: This bar graph compares the types of brackets used among different types of Angle's classification. The X axis represents the Angle's classification and the Y axis represents the number of patients with malocclusion. Blue colour represents the usage of metallic brackets, while the red colour represents the ceramic brackets, Green colour denotes the usage of lingual brackets, the orange and yellow colour represents the usage of clear aligners and Hawley's appliance respectively. Metallic brackets were more commonly used to treat patients with Class I and Class II malocclusions, however it was not statistically significant. (Chi-square test, p value: 0.687 (p > 0.05 statistically not significant)).**



**Fig.4:** This bar chart compares the different types of brackets used among patients with fixed appliances. The X axis represents the fixed appliance appliance and the Y axis represents the number of patients with fixed appliances. The blue colour represents metallic brackets, while the ceramic brackets are represented by the red colour, and the green colour represents lingual brackets, used in patients with fixed appliances. There was a significant difference in the type of brackets used for different types of appliances. (Chi-square test, p value: 0.000 (p<0.05 statistically significant)).