Original Article

REVERSE SMILE AND LOSS OF VERTICAL DIMENSION -INDICATIONS FOR TOOTH SUPPORTED FULL MOUTH REHABILITATION.

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Abstract

Tooth loss or wear of the teeth is dependent on various factors. Tooth loss and wear have multiple consequences and require a lot of corrections to restore the teeth condition to normal. The consequence includes loss of vertical dimension, unesthetic smile or reverse smile, angular cheilitis, pulpal exposure etc.To evaluate the prevalence of reverse smile and loss of vertical dimension in cases requiring tooth supported full mouth rehabilitation cases (FMR). It is designed as a retrospective study. A total of 66 patient records who underwent tooth supported FMR treatment were acquired. It was done analysing records of 86000 patient data who were treated from June 2019- March 2020. Descriptive statistics were used to analyse the frequency and percentage of loss of vertical dimension (VD) in mm and presence of reverse smile. Chi square test was used to evaluate the correlation between age and gender with the presence of reverse smile and loss of VD in mm. SPSS version 20 software was used to perform statistics. Reverse smile was present in 28.8% of cases requiring tooth supported FMR. 36.4% of the cases had a loss of VD ranging from 1-5mm. 9.1% of the cases had loss of VD ranging from 5-9mm. 4.5% cases had loss of VD greater than 9mm. most of the VD loss was seen in the age group groups ranging from 51-60 years. Females showed more amount of VD loss as compared to males. Reverse smiles were seen mainly in the age group of 50-60 years. Female population showed a higher percentage of reverse smiles compared to male population. There was no significant correlation between the age and gender with loss of VD and presence of reverse smile. P values >0.05 suggesting that the relation was insignificant. Within the limitation of the study it was observed that a higher amount of VD loss and presence of reverse smile was seen in older age groups especially in female populations. There was no significant correlation between the age and gender with the presence of reverse smile and loss of VD.

Key words: Tooth supported full mouth rehabilitation; Reverse smile; loss of vertical dimension; Aesthetic restoration.

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INTRODUCTION

Tooth loss and occlusal wear are one of the most common conditions seen in older age groups. Many treatment plans can be used for treating loss of teeth. Implant and fixed bridges being the most preferable among other treatment measures.Occlusal wear and tooth loss can lead to various consequences such as loss of VD and development of reverse smile (Sede and Enabulele, 2016) , (Vallittu, Vallittu and Lassila, 1996). With the increasing demand for dental aesthetics, the patient desires to have a pleasant and appealing smile. Hence esthetic restoration is a very important aspect in the current scenario of treatment planning.

Three basic physical and chemical mechanisms mainly lead to tooth surface wear i) Stress ii) Corrosion iii) Attrition and abrasion (Dawson, 2007)·· It is very crucial to manage loss of tooth structure occurring due to attrition which eventually leads to loss of VD and reverse smile (Spijker *et al.*, 2007). Resultant tooth eruption and alveolar growth usually compensated for the lost occlusal VD caused by physiologic tooth wear (Murphy, 1959). However, this

compensated mechanism is eventually exceeded by the amount of tooth wear thus leading to the loss of VD. Sometimes the gradual eruption of the opposing teeth also leads to a reverse smile line and additionally eliminates the space available for restoration. Increase in the overbite due to loss of VD eventually leads to an unesthetic display of mandibular incisors. The teeth seem to be aligned in an opposite fashion to that of the lower lip line which gives a very anesthetic look (Ackerman *et al.*, 1998). A multidisciplinary is advised in order to treat cases with severe VD loss. The patients undergoing smile correction usually require endodontic, periodontal and prosthetic therapies to restore their VD and esthetic smile.Our team has extensive knowledge and research experience that has translate into high quality publications (Kamisetty *et al.*, 2015; Patturaja and Pradeep, 2016; Felicita, 2017; Jain, 2017; Kumar, 2017) (Neelakantan *et al.*, 2011; Jain, Kumar and Manjula, 2014; Kamisetty *et al.*, 2015; Varghese *et al.*, 2015; Azeem and Sureshbabu, 2018).This study aims at evaluating the prevalence of reverse smile and loss of vertical dimension and their relation with age and gender of the patient in cases requiring tooth supported FMR .

MATERIALS AND METHODS

Study design was that of retrospective type. The study was performed in a University setup in the southern part of India. Ethical approval was received from the Ethical research committee SIMATS Chennai.
Data extraction was done by reviewing the patient data bases of 86000 cases performed between June 2019- March 2020. Out of these 66 patients had undergone tooth supported FMR treatment. The presence of reverse smiles and loss of VD in mm among these cases was evaluated. A few patients belonged to the age group between 15- 20 years. These were medically compromised patients with syndromes affecting their teeth that required full mouth rehabilitation treatment for correction.

Descriptive statistics was used to evaluate the prevalence of reverse smile and loss of VD among all the cases undergoing tooth supported FMR. The correlation between the age and gender was done with the presence of reverse smile and loss of VD using Chi square test.
Descriptive statistics were used to check for the correlation between age and gender of the patient with the presence of reverse smile and loss of VD. Statistics were carried out using SPSS version 20 software. Dependent variables- attrition cases, presence of reverse smiles, patients belonging to older age groups, supra erupted teeth, patients with overclosure of mouth. Independent variables were patients undergoing FMR other than tooth supported one, patients with orthodontic problems, patients with syndromes affecting teeth alignment.

RESULTS AND DISCUSSION

25.76%of the patients undergoing tooth supported FMR had reverse smiles present (Table 1). of the cases showed loss of VD wherin1-5mm loss was shown by 39.39% of the cases, 5-9mm loss was shown by 9.09% of the cases and more than 9mm loss was shown by 4.55% of the cases Table(2). Females showed higher amounts of VD loss as compared to males. The presence of reverse smile was also seen majorly in the male population Table (4)

Presence of reverse smile and loss of VD was mainly seen in the age group between 50-70 years especially in female gender. However, age and gender were not found to be statistically significant with the loss of VD and presence of reverse smiles. p values for age and gender when correlated with presence of reverse smile were 0.206 and 0.207 respectively. p values for age and gender when correlated with presence of vertical dimension loss were 0.647 and .074 respectively Table (3).

There have been many studies evaluating FMR and type of smile present preoperatively (Lindauer, Lewis and Shroff, 2005), (Passia, Blatz and Strub, 2011). Restoring the OVD is a very technique sensitive and a very tactful procedure. Any kind of alteration of the VD causes adaptable changes in the occlusal morphology, periodontium and the TMJ. The dental physiology and adaptation can be disrupted if the OVD is increased drastically.

In a retrospective study done by Chacona et al similar kind of results were found where OVD loss due to attrition was seen mostly due to presence of attrition . The increased percentage of people with VD loss in the age group between 50-70 years is understandable due to loss of tooth material due to wear of enamel. Also, the attrition is mainly seen in the anterior region leading to development of deep bite (Chacona, 2003).
Smile being the most primordial form of expression plays an important role in enhancing personal attractiveness and builds personal confidence. The smile arc, dental alignment, tooth shape and colour, incisal edge regularity, gum and incisal display and buccal corridor space display are very important components of smile (Chacona, 2003; Ackerman, 2005). The smile

arc can be defined as the relation of the incisal edge contours of maxillary incisors with the curvatures of the lower lip (Singla and Lehl, 2014) .

Reverse smile and VD loss go hand in hand. Since, the arc of smile directly depends on the plane of occlusion or inclination and second order crown angulation in the upper anteriors, there are a few constraints to the achievement of ideal smile arch on every patient (Nanda, 2005).

Limitations of the study include-The study has reduced sample size, The study is limited geographically as it is institutional based,Other parameters of smile aesthetics were not considered.Loss of VD was evaluated only in tooth supported FMR cases and no other types of FMR cases. With the increase in awareness regarding the importance of esthetic smile and VD further studies and research should be encouraged. Also, with increasing technology and software it will be easier to correct the VD and smile much more conveniently. Our institution is passionate about high quality evidence based research and has excelled in various fields (Pc, Marimuthu and Devadoss, 2018; Ramesh *et al.*, 2018; Ezhilarasan, Apoorva and Ashok Vardhan, 2019; Ramadurai *et al.*, 2019; Sridharan *et al.*, 2019; Vijayashree Priyadharsini, 2019; Mathew *et al.*, 2020). We hope this study adds to this rich legacy.

CHARTS AND TABLES

Reverse smile	Percent
absent	74.24%
present	25.76%
Total	100.0%

Table 1: This table shows the presence of reverse smile in patients undergoing tooth supported full mouth rehabilitation. It shows that 74.24% of the places did not show presence of reverse smile whereas 25.76% of the cases showed presence of reverse smile. This signifies that reverse smile was not a very common feature in all the patients undergoing tooth supported full mouth rehabilitation.

Loss of VD in mm	Percent
1-5mm	39.39%
5-9mm	9.09%
>9mm	4.55%
no loss in vd	50%
Total	100%

Table 2: This table shows the percentage of loss of VD in mm in patients undergoing tooth supported full mouth rehabilitation. it signify that 50% of the cases did not have loss of vertical dimension, 39.39% of the cases had loss of VD ranging from 1 to 5 mm, 9.09% of the cases had loss of VD ranging from 5 to 9 mm, 4.5 % of the cases had loss of VD more than 9mm.

		loss of vd in mm	reverse smile
age	df	18	6
	Sig.	.647[a,b]	.206[a,b]
gender	df	3	1
	Sig.	.074[a]	.207

Table 3: This table shows the correlation of age and gender with loss of VD and presence of reverse smile. The p-values obtained when age and gender were correlated with loss of vertical dimension were 0.647 and 0.074 respectively. The p value obtained when age and gender were correlated with presence of reverse smile were 0.206 and 0.207 respectively. This signify that age and gender had a negative correlation with presence of reverse smile and loss of vertical dimension.

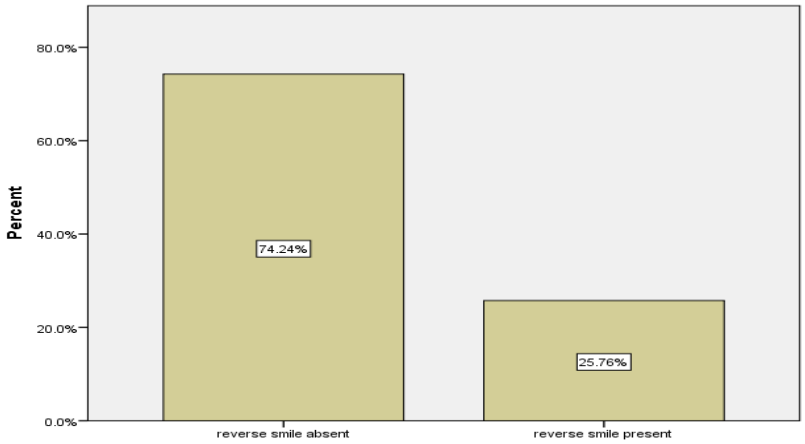

Figure 1: This bar graph shows the presence of reverse smile in the population undergoing tooth supported full mouth rehabilitation. The x-axis signifies the presence or absence of reverse smile, the y-axis signifies the percentage of occurrence. The figure shows that 74.24% of the population did not show reverse smile whereas 25.76% of the population showed presence of reverse smile.

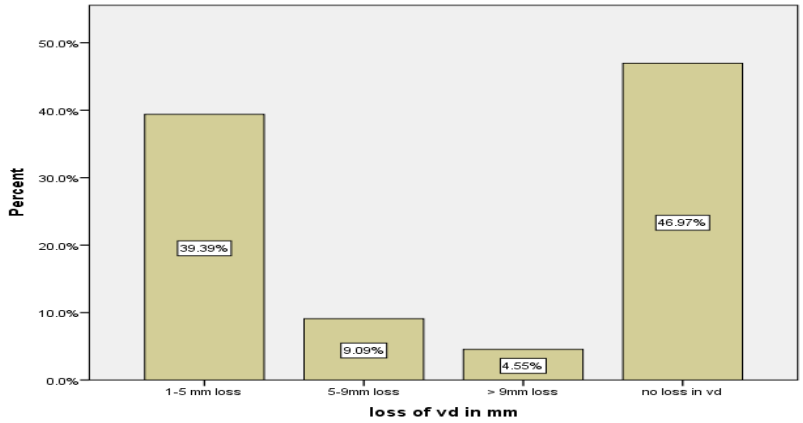

Figure 2: Bar graph showing the presence of vertical dimension loss in patients undergoing tooth supported full mouth rehabilitation. The X axis shows the loss of vertical dimension in mm and the y axis shows the percentage of occurrence.The figure depicts that 46.97% of the cases did not have loss of vertical dimension, 39.3 9% of the cases showed vertical dimension loss from 1 to 5 mm, 9.09% of the cases showed loss of VD ranging from 5 to 9 mm. 4.5% of the cases showed loss of VD greater than 9 mm. This signifies that the loss of vertical dimension was shown mostly in the 1 to 5 mm range.

Age range and gender	loss of vd in mm				reverse smile	
	1-5 mm loss	5-9mm loss	> 9mm loss	no loss in vd	reverse smile present	reverse smile absent
11-20	3.8%	33.3%	0.0%	3.2%	8.2%	0.0%
21-30	3.8%	0.0%	0.0%	9.7%	2.0%	17.6%
31-40	23.1%	16.7%	0.0%	9.7%	12.2%	23.5%

41-50	15.4%	0.0%	33.3%	12.9%	14.3%	11.8%
51-60	26.9%	33.3%	33.3%	35.5%	34.7%	23.5%
61-70	26.9%	16.7%	33.3%	25.8%	26.5%	23.5%
71-80	0.0%	0.0%	0.0%	3.2%	2.0%	0.0%
81-90	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
male	42.3%	100.0%	33.3%	51.6%	46.9%	64.7%
female	57.7%	0.0%	66.7%	48.4%	53.1%	35.3%

Table 4: It shows the relation of age and gender with loss of vertical dimension and presence of reverse smile. Loss of vertical dimension and presence of reverse smile was mainly seen in the female population. The age range that was mostly affected with loss of vertical dimension and presence of reverse smile was between 51 to 70 years.It can be concluded from this table that females lying in the older age group were more affected with vertical dimension loss and reverse smile.

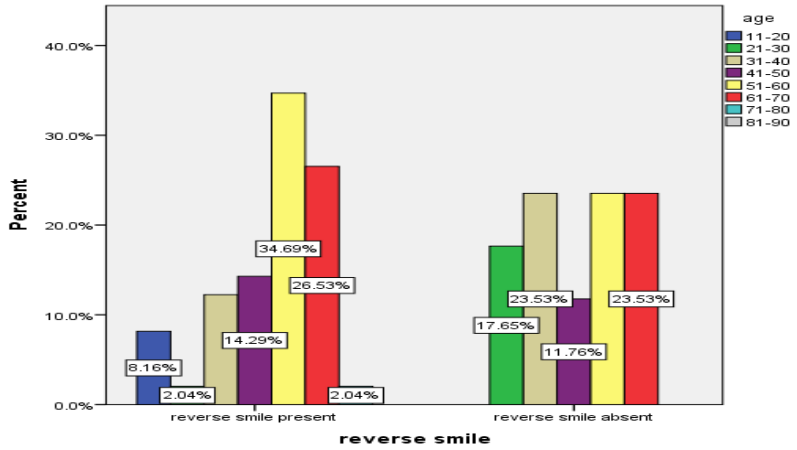

Figure 3: This figure shows the association of reverse smile with patients lying in various age groups. The X axis represents the presence or absence of reverse smile in various age groups whereas the Y axis represents the frequency of occurrence. The blue colour bars signify age range between 11 to 20 years, green colour bars bars signify age range between 21 to 30 years, the beige colour bars bars signify is range between 31 to 40 years, the purple colour bars bars signify the age range from 41 to 50 years, the yellow colour bars signify age range from 51 to 60 years, the red colour bars signify age range from 61 to 70 years the light blue colour bars signify age range from 71 to 80 years and grey colour bars signify age range from 81 to 90 years. The figure suggests that reverse smile was mainly seen in patients lying in the age group of 51 to 60 years (34.6%). The association between age and the presence of reverse smile was not statistically significant.(Chi square association value - 0.206)

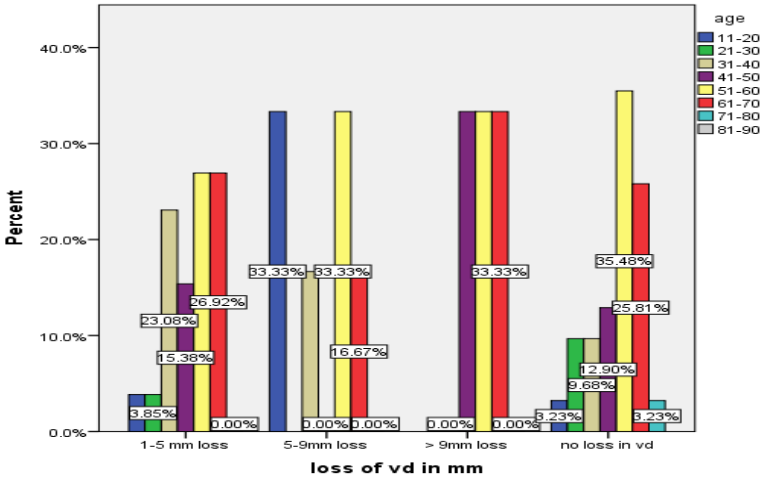

Figure 4: This figure shows the association of the presence of loss of vertical dimension with the age of the patients.The blue colour bars signify age range between 11 to 20 years, green colour bars signify age range between 21 to 30 years, the beige colour bars signify is range between 31 to 40 years, the purple colour bars signify the age range from 41 to 50 years, the yellow colour bars signify age range from 51 to 60 years, the red colour bars signify age range from 61 to 70 years the light blue colour bars signify age range from 71 to 80 years and grey colour bars signify age range from 81 to 90 years. 26.92% of the population lying in the age range of 51-60 years showed 1 to 5 mm loss of vertical. 33.33% of the population lying in the age range of 51 to 60 years showed 5 to 9 mm loss of vertical dimension loss of vertical dimension. 33.33% of the population lying in the age groups of 41 to 50 years, 51 to 60 years and 61 to 70 years showed loss of vertical dimension greater than 9 mm. This signifies that the maximum amount of loss of vertical dimension was shown in patients lying in the age group of 51 to 70 years. The association between age and the loss of vertical dimension was not statistically significant. (Chi square association value - 0.647).

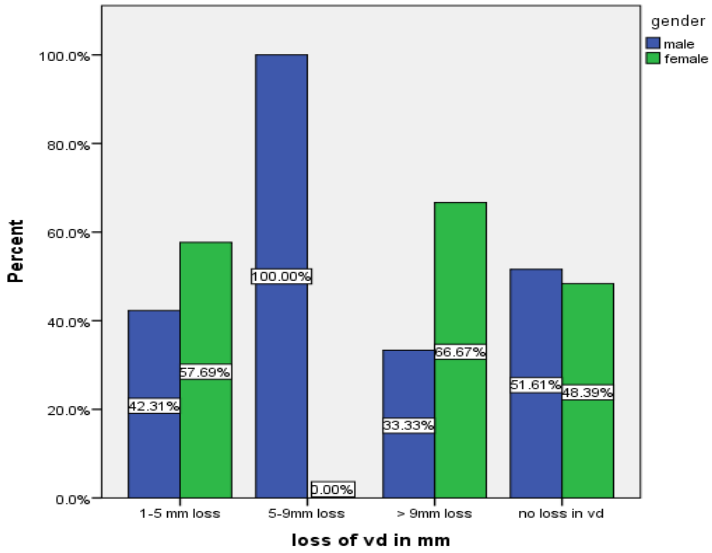

Figure 5: This figure shows the association of gender with the loss of vertical dimension. Blue colour bars signify male gender in green colour bars signify female gender.. The X axis shows the loss of vertical dimension in mm and Y axis shows the percentage of occurrence. 57.6 % of the females showed vertical dimension loss ranging from 1 to 5. 100% percent of males showed vertical dimension loss ranging from 5 to 9 mm, 66.67% of females showed vertical dimension loss greater than 9 mm. This figure suggests that females were more prone to loss of vertical dimension as compared to males. The was not statistically significant association between gender and the loss of vertical dimension (Chi square association value - 0.074).

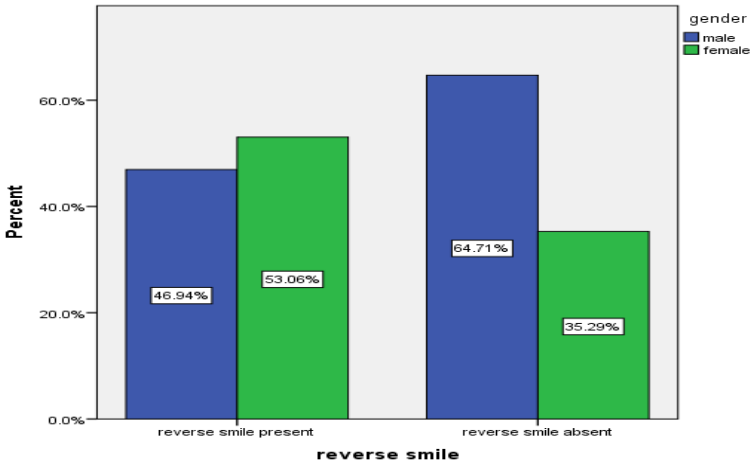

Figure 6: This figure shows the association of gender with the presence or absence of reverse smile the X axis shows the presence or absence of reverse smile and the y-axis shows the percentage of occurrence .Blue coloured bars signify male gender green coloured bars signify female gender. The figure depicts that 53.06 percent of females showed presence of reverse smile, where 46.94% of males showed presence of reverse smile. This signifies that females were more prone to developing reverse smiles. On correlating the gender with the presence or absence of reverse smile. The association between gender and the presence of reverse smile was not statistically significant.(Chi square association value - 0.207).

CONCLUSION:

Within the limitation of the study it can be concluded that a higher percentage of VD loss and reverse smile lines were seen in patients with older age groups. Loss of VD was seen mainly in the female population. Presence of a reverse smile was seen predominantly among males. No statistical correlation could be found between age and gender with presence of reverse smile and loss of VD.

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Author contributions: Author 1- Harsh Kasabwala carried out the study by collecting the raw data handwriting the manuscript with the necessary statistical analysis. Author 2 - Dr Shubhabrata Maiti and Author 3- Dr Kiran Kumar helped in guiding the study and supervised the statistics.
Conflict of interest: There was no conflict of interest among the authors

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