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Research Article

A CHAIR SIDE METHOD TO EVALUATE CANT OF OCCLUSAL PLANE

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A B S T R A C T

Introduction: The "art of the smile" lies in the clinician's ability to recognize the positive elements of beauty in each patient and then create a strategy to enhance the attributes that fall outside the parameters of the prevailing esthetic concept. Smile analysis and smile design important aspects in orthodontics. Inclination in the occlusal plane becomes an important parameter for obtaining harmonious orofacial relations.

Materials And Method: A total of 300 subjects with Angle's Class I, Class II and Class III malocclusion were included in the study, who were evaluated for the cant of occlusal plane in the transverse dimension. This study utilized a fox plane, android phone and an android application which is taken from play store called ''clinometer'' (plaincode TM). Subject was asked to sit upright on a dental chair such that the F-H plane is parallel to the floor. To ensure natural head position he/she was made to look forward and look into the reflection of his/her eyes in the mirror. Android phone with the android application – ''clinometer'' opened was placed, on the fox plane in the center where the two extra oral arms meet, in a horizontal manner. Intra oral part of the fox plane was placed on the occlusal surfaces of the lower teeth and the subject was told to bite to evaluate the cant of the occlusal plane. The readings displayed on the ''clinometer'' application, were made note of while making sure there was no head tilting.

Result: From the 300 subjects who were examined, 225 had class I malocclusion wherein, 97 were males with a mean cant of 0.57° and 128 were females with a mean cant of 0.53°. 65 subjects had class II malocclusion, of which 17 were males and 48 were females, with a mean cant of 1.37° and 1.32° respectively. The remaining 10 had class III malocclusion, of which 4 were males and 6 were females, with a mean cant of 1.45° and 1.41° respectively.

Conclusion: It can be concluded that cant of occlusal plane exists in all the three classes of malocclusion in varying numbers. Occlusal cants within the 0° to 3° range have been observed in normal, healthy patients. Heimansohn suggested that individuals normally have a natural tilt to the occlusal plane.

INTRODUCTION

The "art of the smile" lies in the clinician's ability to recognize the positive elements of beauty in each patient and then create a strategy to enhance the attributes that fall outside the parameters of the prevailing esthetic concept[1]. A canted occlusal plane is the cause of unaesthetic smile, also is one of the asymmetries that represents a challenge, due to the complex orthodontic procedures involved in its treatment[2]. Smile analysis and smile design is one of the important aspects in orthodontics. Occlusal cant is frequently related to facial asymmetries due to hereditary, developmental anomalies, environmental trauma, etc. Evaluation of occlusal cant is highly challenging, and its accuracy is always questionable[3]. It has been reported that all patients have some degree of craniofacial asymmetry, including those who are perceived as normal[4]. Tilting of the head slightly may "correct" a canted occlusal plane. It is important to remember that an assessment of craniofacial and dental asymmetry should be a part of the clinical evaluation of patients with dentofacial deformity[5]. Inclination in the occlusal plane becomes an important parameter for obtaining harmonious orofacial relations[6].

MATERIALS AND METHOD

A total of 300 subjects with Angle's Class I, Class II and Class III malocclusion were included in the study, who were evaluated for the cant of occlusal plane in the transverse dimension. Subjects with missing first molars, any prosthesis on the first molars, deciduous first molar were excluded from the study, whereas those with a complete set of permanent teeth, no prosthesis on the first molars, facial asymmetry, were included in the study.

This study utilized a fox plane, android phone and an android application which was taken from play store called ''clinometer'' (plaincode TM). This application used

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gyroscope and accelerometer sensor to help us measure the slopes or inclinations using three different units of measure: degrees, percent and topo. Fox plane consists of an intra oral part and two extraoral arms which is used to check the parallelism between occlusal rims.

Subject was asked to sit upright on a dental chair such that the F-H plane was parallel to the floor. To ensure natural head position he/she is made to look forward and look into the reflection of his/her eyes in the mirror. Android phone with the android application – ''clinometer'' opened was placed, on the fox plane in the center where the two extra oral arms meet, in a horizontal manner. Intra oral part of the fox plane was placed on the occlusal surfaces of the lower teeth and the subject was told to bite to evaluate the cant of the occlusal plane (FIG : 1). The readings displayed on the ''clinometer'' application, were made note of while making sure there was no head tilting (FIG : 2).

Fig 1

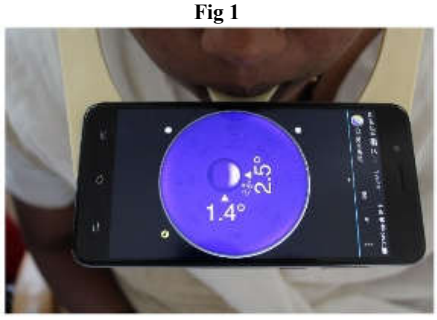

Fig 2

RESULTS

From the 300 subjects who were examined, 225 had class I malocclusion wherein, 97 were males with a mean cant of 0.57° and 128 were females with a mean cant of 0.53° (TABLE : 1). 65 subjects had class II malocclusion, of which 17 were males and 48 were females, with a mean cant of 1.37° and 1.32° respectively (TABLE : 2). The remaining 10 had class III malocclusion, of which 4 were males and 6 were females, with a mean cant of 1.45° and 1.41° respectively (TABLE : 3).

Table 1 Class I Malocclusion

Sl. No.	Name	Age	Readings
1	Poornima	19	0.5
2	Nandini	17	0.4
3	Tanmayee	19	0.1
4	Monalica	19	0.9
5	Deepika	18	0.7
6	Sridevi	18	0.3
7	Ashmitha	19	1.0
8	Manasa	19	0.6
9	Nethra	19	0.7
10	Hiba	17	0.5
11	Bhagya	21	0.9
12	Arya	18	0.2
13	Monica	22	0.1
14	Lakshmi	20	0.1
15	Pooja	21	0.4
16	Shivani	24	0.5
17	Priyanka	20	0.2
18	Uma	20	0.8
19	Padma	22	0.9
20	Hiran	22	0.2
21	Prashanth	23	0.7
22	Uday	23	0.9
23	Suraj	25	0.8
24	Vasantha	25	0.1
25	Geetha	21	0.4
26	Varun	26	0.1
27	Anjana	24	0.8
28	John	24	1.0
29	Chethan	19	1.0
30	Shamon	25	0.4
31	Adarsh	24	0.5
32	Kiran	20	0.3
33	Dhanush	26	0.2
34	Bhavana	25	0.1
35	Nikitha	19	1.0
36	Namrutha	20	1.0
37	Spoorti	18	0.8
38	Suhas	21	0.9
39	Vandana	22	0.7
40	Hamsa	21	0.5
41	Pruthvi	28	1.0
42	Sandhya	30	0.4
43	Harish	21	0.2
44	Aishwarya	23	1.0
45	Lakshmi	23	0.3
46	Praveen	25	1.0
47	Siddharth	21	0.5
48	Bhagya Patil	18	0.6
49	Ann Mary	18	0.1
50	Jyothi	18	0.3
51	Madiha	18	0.9
52	Aishwarya G.	19	0.1
53	Akash	18	0.8
54	Manasa	18	0.5
55	Meghana	18	0.1
56	Channa Reddy	18	0.4
57	Pravalika	19	0.1
58	Dinesh	18	1.0
59	Arun P.	18	0.9
60	Rakesh	18	0.2
61	Charishma	18	1.0
62	Sheshanth M.	19	0.7
63	Sonali	18	0.9
64	Nandana	18	0.5
65	Nethra	18	0.5
66	Nandini R.	18	0.3
67	Niraj	18	0.4
68	Pallavi R.	19	0.1
69	Shaik	20	0.8
70	Uma	21	0.5
71	Y. Yasaswini	20	0.3
72	Jyothsna	21	0.6
73	Apeksha	21	0.4
74	Sabari S.	22	0.5
75	Likitha M.	21	1.0
76	Ancy	24	0.1
77	Anumol	23	0.3
78	Pranavi	23	0.2
79	Vinod	18	0.7
80	Sridevi	18	0.5
81	Sriram	18	1.0
82	B. Harsha	18	0.8
83	Gireesh Kumar	18	0.9
84	Hibah	18	0.5
85	K. Hemaraj	18	0.8
86	More Asmitha	18	0.5
87	Rahul	18	0.9
88	Pankaj	18	0.4
89	Poornima	18	0.6
90	Sanjay Kumar	18	0.8

91	Moin	18	1.0
92	Manoj	19	0.1
93	Vaibhav	18	0.5
94	Santhosh	18	0.8
95	Abdul	18	1.0
96	Bhavya	18	0.9
97	Shamitha	18	1.0
98	Alok	18	0.6
99	Amburi	18	0.9
100	Bheemavva	18	1.0
101	Puneeth	22	0.1
102	Bharath	23	0.4
103	Mamatha	24	0.6
104	Ashwini	20	0.3
105	Divya	25	1.0
106	Chaithra	23	1.0
107	Lakshmi P.	22	0.2
108	Neethu	21	0.7
109	Rajashekar	25	0.5
110	Sushmitha	24	0.8
111	Ravi	18	0.3
112	Pavani Durga	25	0.9
113	Bhargav	33	0.4
114	Kaveri	30	0.6
115	Vishala	26	0.7
116	Saranya	32	0.1
117	Shahezaad	26	1.0
118	Sai Rohith	24	0.1
119	Rashmi	27	0.3
120	Parikshit	22	0.4
121	Mohnish	24	0.8
122	Hima	24	0.4
123	Shravani	21	0.1
124	Saman	22	0.4
125	Rifa	20	0.8
126	Shobha	24	0.7
127	Sowmya S.	20	0.4
128	Mahendra	18	0.5
129	Almas	18	0.1
130	Tabassum	29	0.8
131	Ariya	18	0.6
132	Pattan Ameer	18	0.3
133	Sushma	18	0.9
134	Revanasidda	18	0.8
135	Sai Padmini	18	0.9
136	Lahiri	18	0.7
137	Aruna Kumari	18	0.9
138	Akanksha	18	0.8
139	Preethi	18	0.5
140	Shebberahmad	18	0.7
141	Rahmathulla	18	0.5
142	Nagajyothi	18	0.3
143	Mahin Kumar	19	0.2
144	Deepti	18	0.1
145	Afshah	18	0.5
146	Arusha	20	0.2
147	T. Sreenivas	18	0.9
148	Abdul Gani	18	0.8
149	Naga Sowmya	18	0.4
150	S. Kiran	18	0.1
151	Shashikiran	18	0.2
152	Shashikala	18	0.9
153	Sohan Raj	18	0.7
154	Khalid	18	0.8
155	Tharun	18	0.6
156	Shabaaz	18	0.5
157	Rittikraj	33	0.8
158	Kushal	21	0.5
159	Kalyani	21	0.7
160	Pragna	20	0.3
161	Chandana	21	0.2
162	Lavanya	21	0.7
163	Khushi	21	0.1
164	Ayesha	21	0.6
165	Keerthana	21	1.0
166	Harshitha	22	0.6
167	Charani	21	0.3
168	Kavya	21	0.9
169	Annapurna	20	0.7
170	Kusuma	21	0.5
171	Kajal	21	0.2
172	Vijayalakshmi	21	0.4
173	Arshitha	20	0.1
174	Bhagya	22	0.3
175	Maheshwari	21	1.0
176	Revati	21	0.8
177	Dideepya	22	0.3
178	Sindhoora	21	0.5
179	Shrinidhi	21	0.7
180	Sharan	21	0.5
181	Anand	21	0.9
182	Amit	22	0.8
183	Neeraj	21	0.1
184	Ganesh	21	0.7
185	Praful	21	0.9
186	Alvin	21	0.4
187	John	20	0.9
188	Fayaz	21	0.2
189	Prasad	21	0.1
190	Vinay	21	0.3
191	Sudha	28	0.8
192	Nagesh	27	0.4
193	Kiran N.	22	0.1
194	Vikram	22	0.3
195	Eshwar	23	0.5
196	Arun	22	0.7
197	Mallikarjun	22	0.9
198	Ningaraj	22	0.2
199	Navneet	22	0.9
200	Kaushik	25	0.8
201	Vinil	21	0.6
202	Kamal	21	0.5
203	Chaithra	24	0.2
204	Malsawma	26	0.4
205	Shashikumar	25	1.0
206	Aishwarya	23	0.8
207	Nayak	24	1.0
208	Subbu Laxmi	24	0.5
209	Ruthu	27	0.9
210	Divya	22	0.3
211	Akshay	20	0.1
212	Madhu Kumar	25	0.4
213	Anvi	23	0.7
214	Farhan	27	0.3
215	Waseem	28	0.8
216	Karan	21	0.6
217	Catherine	25	0.8
218	Ahalya	21	0.7
219	Asma	26	0.6
220	SreeLekha	25	0.2
221	Rukhshar	20	0.6
222	Raj	20	0.1
223	Moiz	18	1.0
224	Gautham	26	0.5
225	Ruthvik	26	0.4

Table 2 Class II Malocclusion

Sl. No.	Name	Age	Readings
1	Chaya	19	1.3
2	Ravi	25	1.1
3	Sai Sudeepti	19	0.9
4	Rashmi	19	1.7
5	Swathi	21	0.6
6	Vasundara	21	1.1
7	Sindhoora	19	1.4
8	Supraja	20	1.8
9	Priyanka	21	1.7
10	Souparnika	21	0.5
11	Aparna K.	21	1.2
12	Amitha	23	1.1
13	Prem	24	1.8
14	Chirag	21	1.5
15	Karthik	24	0.7
16	Dheeraj	20	1.2
17	Krishna	20	1.3
18	Priyanka	22	1.5
19	Sai Srija	20	0.9
20	Subhash	21	1.8

21	Mohammad Samir	20	1.4
22	Shimroze	20	1.0
23	Anoop	19	1.6
24	Darshan	21	1.3
25	Kruthika	22	1.5
26	Roopa	23	1.7
27	Megha	23	1.6
28	Pooja Patil	25	1.4
29	Nishanth	19	1.3
30	Sushmitha John	24	1.1
31	Jagruthi S.	24	0.9
32	Anna	18	1.6
33	Monalisa	18	1.8
34	Sri Koushika	18	1.1
35	D. Bhumika	18	1.5
36	Shamitha	18	1.7
37	Elizabeth	18	1.6
38	Nandini K.	18	0.9
39	Sukrutha	22	1.8
40	Vishal	18	1.2
41	Anusha	19	1.1
42	Amitha	18	0.8
43	Ramesh	21	1.0
44	Taneesha	22	1.1
45	Chandana	20	1.3
46	Priya	21	0.8
47	Aishwarya	24	1.1
48	Sindhu	20	1.9
49	Keerthana	25	1.3
50	Sneha Patil	23	1.2
51	Sri Vidya	25	1.6
52	B. Rashmi	18	1.9
53	Swara	19	1.0
54	Ayesha	21	1.7
55	Veeresh	20	1.1
56	Manoj	21	1.9
57	Narayani	25	1.8
58	Sirisha	21	1.5
59	Meghana	20	1.4
60	Bhuvana	21	1.2
61	Joharika	21	1.7
62	Antony	25	1.3
63	Arjun	24	1.8
64	Vaishali	23	1.6
65	Sadhana	25	0.8

Table 3 Class III Malocclusion

Sl. No.	Name	Age	Readings
1	Jaya	22	1.8
2	Amruth	21	1.7
3	Vaibhav	20	1.5
4	Pooja	21	1.6
5	Ashly	22	1.4
6	Sirisha	19	1.8
7	Lavanya	19	1.1
8	Swetha	24	1.3
9	Priyanka	22	0.9
10	Harinder	20	1.2

DISCUSSION

The most important esthetic goal in orthodontics is to achieve a ‘‘balanced’’ smile, which can be best described as an appropriate positioning of the teeth and gingival scaffold within the dynamic display zone. The display zone is affected by the size, shape, position, and color of the displayed teeth as well as the gingival contour, buccal corridor, and framing of the lips. Smile design and mechanotherapy must take into account an esthetic plane of occlusion, which is often different from the natural plane of occlusion[14].

It is widely recognized that asymmetry is often present in the craniofacial complex. Despite this fact, asymmetric features are not always easily detected because soft tissues may compensate for underlying skeletal imbalances[4]. Balanced transverse relationships, particularly with regard to maxillary arch widths, are important when assessing the attractiveness of a smile[12].

The 3 transverse characteristics of the smile in the frontal dimension are arch form, buccal corridor and the transverse cant of the maxillary occlusal plane. Transverse cant can be due to differential eruption and placement of the anterior teeth or skeletal asymmetry of the mandible resulting in a compensatory cant of the maxilla. Intraoral images, even mounted dental casts, do not adequately reflect the relationship of the maxilla to the smile. Only frontal smile visualization permits the orthodontist to visualize any tooth-related or skeletal asymmetry transversely. The frontal smile photograph, either full face or close-up, is a much better indicator of transverse dental asymmetry than the frontal retractor view. Smile asymmetry may also be due to soft tissue considerations, such as an asymmetric smile curtain. In the asymmetric smile curtain, there is a differential elevation of the upper lip during smile, which gives the illusion of a transverse cant to the maxilla[1].

Smile symmetry, the relative positioning of the corners of the mouth in the vertical plane, can be assessed by the parallelism of the commissural and pupillary lines. A large differential elevation of the upper lip in an asymmetrical smile may be due to a deficiency of muscular tonus on one side of the face. Myofunctional exercises have been recommended to help overcome this deficiency and restore smile symmetry. An oblique commissural line in an asymmetrical smile can give the illusion of a transverse cant of the maxilla or a skeletal asymmetry[13].

What is often called a transverse cant of the occlusal plane, almost always viewed relative to a skeletal relationship such as the interocular line, is more clearly visualized and described as roll of the esthetic line - a curved line which follows the facial surfaces of the maxillary anterior and posterior teeth, and functional lines up and down on one side or the other. It is important to relate the esthetic line to the soft tissues of that area, by using the intercommissure line[11].

The cant of occlusal plane is closely related to function and significantly related to treatment. It is the line along which the teeth function and the line with which functional balance must be established[15].

In cases of canted occlusal plane, it is essential to define which side should be intruded or extruded to level the plane[2]. On physical examination it becomes most apparent when the patient smiles. At rest, however, the presence of an elevated labial commissure or alar base on one side is often an indication of vertical skeletal asymmetry. This should be documented during routine evaluation of patients for orthodontic or orthognathic surgical treatment[4].

To measure occlusal canting, a wooden tongue depressor can be placed across the right and left posterior teeth, and the parallelism or the angle of the tongue depressor to the interpupillary plane can be documented. Alternatively, the vertical distance between the maxillary canines and the medial canthi of the eyes can be measured. These methods require assessment of the patient’s eyes to ensure that discrepancies between right and left sides are not related to asymmetry of the orbits or globes[4].

Analysis of the PA cephalogram also can be used to determine occlusal cant. A line is drawn connecting the occlusal surfaces

of the left and right maxillary first molars. The angle of this plane relative to the transverse axis of the skull, that is, the angle of occlusal cant, is measured. This documents the skeletal asymmetry without the influence of the overlying soft tissue[4].

Standardized PA cephalometric analyses do not include evaluation of the relationship of the occlusal plane to the horizontal. This is an important deficiency, because leveling the occlusal plane, when necessary, should be a goal of surgical and orthodontic therapy. It has been suggested that a level occlusal plane is a prerequisite for success in all orthognathic surgical procedures and that failure to level it during surgery to correct dentofacial deformities may have a detrimental effect on masticatory function[9].

The position of the head in relation to the cervical column showed positive correlations with the anterior upper and lower dentoalveolar heights and with the inclinations of the upper and lower occlusal planes[10].

In this study a simple, easy and chair-side procedure to evaluate the cant of the occlusal plane was undertaken. However, position of the head, need to train a subject to bite in a proper manner, need of an android phone are the drawbacks.

CONCLUSION

Occlusal cants within the 0° to 3° range have been observed in normal, healthy patients 4. Thus, normal masticatory function is possible within this range. The cant will not be noticeable, and occlusal canting of this magnitude probably does not have detrimental effects on postoperative outcome. Heimansohn 7 suggested that normal individuals have a natural tilt to the occlusal plane, and that alteration of this tilt through restoration of the dentition and placement of prostheses may contribute to the development of temporomandibular joint dysfunction 8. Therefore, awareness of the presence of even mild levels of occlusal cant is important in restorative dentistry as well as in orthodontics and surgery.

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