International Journal Dental and Medical Sciences Research
Volume 7, Issue 5, Sept – Oct 2025 pp 184-192 www.ijdmsrjournal.com ISSN: 2582-6018

"Prevalence and Dentoskeletal Characteristics of Deep Bite Malocclusion among Himachali Adults"

Dr. Amit Mehra[1]; Dr. Shailaja Jain[2] ; Dr. Christy Nayyar[3] ; Dr. Saurabh Dhiman[4] ; Dr. Tanvi[5]

[1,2,3]Professor, Department of Orthodontics and Dentofacial Orthopaedics, HimachalInstitute of Dental Sciences, Paonta Sahib, Himachal Pradesh

[4]Reader, Department of Orthodontics and Dentofacial Orthopaedics, Himachal Institute of Dental Sciences, Paonta Sahib, Himachal Pradesh

[5]Post-graduate student, Department of Orthodontics and Dentofacial Orthopaedics, Himachal Institute of Dental Sciences, Paonta Sahib, Himachal Pradesh

Corresponding Author: Dr. Tanvi

Date of Submission: 15-09-2025 Date of Acceptance: 25-09-2025

ABSTRACT:

Aim: To evaluate prevalence and dentoskeletal features of deep-bite malocclusion among non-growing adults aged 18–40 years from the Upper Sirmaur region of Himachal Pradesh.

Methods: A total of 400 standardized lateral cephalograms were analyzed. Participants were classified into normal bite and deep bite group. Deep-bite group was further subdivided based on sagittal skeletal relationships into Class I, Class II/1, and Class II/2. Cephalometric analyses assessed both linear and angular parameters of craniofacial and dental morphology. Sex-based variations were also examined.

Results: Deep-bite was observed in **242** subjects. No significant correlation was found between overbite severity and sagittal skeletal jaw positions. **Class I deep-bite** group had retrusive mandibular incisors, reduced lower anterior facial height, increased interincisal angle. **Class II/1 deep-bite** group had retrognathic mandible, proclined and extrusive incisors, increased LAFH and mandibular plane angle. **Class II/2 deep-bite** had significantly retrusive incisors, reduced lower anterior facial height, molar intrusion contributing to deep-bite. Molar heights were reduced across all deep-bite subgroups, suggesting a **dentoalveolar component** to overbite. Notable **sex-based differences** were identified in both skeletal and dental parameters.

Conclusion:Deep-bite in adults exhibits multifactorial origins. Treatment approaches must consider individualized skeletal and dental characteristics. For stable correction in adults, **mandibular incisor intrusion** may be preferable to molar extrusion.

KEYWORDS:– Deep-bite, Prevalence, Dentoskeletal features, Deep-bite treatment, Himachali population

I. INTRODUCTION

Deepoverbite is defined as excessive vertical overlapping of mandibular incisors by maxillary incisors in centric occlusion. The cingulum of upper teeth, which is roughly 1-3 mm overbite, should normally be barely touched by incisal margins of lower teeth.[1] Deep bite is the most difficult malocclusion to treat effectively [2] and is commonly observed in orthodontic practices. The eruption of first permanent molars and early contact of tissue pad covering them as a natural bite opener rectify anterior deep bite, which also forms as a self-correcting abnormality during the mixed dentition phase. Adults with deep bites have fewer treatment options [3] because of their limited growth and are treated with orthodontic camouflage for dentoalveolar structures instead of functional therapy.

A deep bite can be caused by various factors, including genetics, environmental and behavioral factors. Being a frequently seen disharmony, this is one of the major concerns for an orthodontist as deep bite causing trauma to gingival or palatal tissues is considered as severe problem definitely needing treatment in orthodontic practice.A deep bite causes jaw to move abnormally, which strains the muscles that support the joint & results in strain and pain that are typical of TMJ disorder. Even though having a deep bite does not guarantee that a patient will experience TMJ issues, the longer the jaw must operate in an unnatural posture, more likely it is that its critical structures may eventually get overworked.

Diagnosis of deep bite is done by clinical examination that involves extra and intra-oral examination & cephalometric analysis. Orthodontic literature has various treatment strategies for

International Journal Dental and Medical Sciences Research
Volume 7, Issue 5, Sept – Oct 2025 pp 184-192 www.ijdmsrjournal.com ISSN: 2582-6018

treating dental and skeletal deep bites but the optimal treatment method is determined by treatment goals and etiology of deep bite. Both the morphologic characteristics of both jaws and dentoalveolar characteristics may be linked to increased overbite. Analysing each factor's impact is a crucial first step in diagnosing orthodontic problems and can determine whether treatment is successful or not. Nevertheless, there is no conclusive evidence linking craniofacial morphology to occlusal features.

Despite ongoing research, the underlying cause of deep bite remains inconclusive. Many studies have assessed deep bite in skeletally and dentally diverse populations, often overlooking important diagnostic distinctions. Notably, deep bite can occur even in individuals with Class I molar relationships, with an estimated prevalence of 20%–40%.[23] This indicates that relying solely on overbite depth as a diagnostic criterion may introduce bias and limit accurate classification. Moreover, earlier studies have typically compared different skeletal classes without accounting for overbite severity and have largely focused on growing children, making it difficult to evaluate the persistence or natural correction of deep bite into adulthood.

This malocclusion is not merely a cosmetic issue—it can lead to long-term problems such as tooth wear, temporomandibular joint dysfunction, compromised mastication, and periodontal damage if left untreated. As front-line providers, general dentists are often the first to identify such occlusal discrepancies during routine examinations. Early recognition and appropriate referral or intervention can prevent complications and improve patient outcomes.

Given these considerations, the current study aims to assess the relationship between increased overbite and dentoskeletal morphology in adult Himachali males and females across skeletal Class I and Class II groups. By improving understanding of deep bite patterns in adults, this research contributes to more informed diagnosis, treatment planning, and interdisciplinary collaboration between general dentists and orthodontic specialists.

II. MATERIAL AND METHOD

This study was conducted in the Department of Orthodontics & Dentofacial Orthopaedics at xxxxxxxxx, following approval from the institutional ethical committee {1982(A)}. A total of 400 good-quality pre-treatment lateral cephalograms, taken using a CARESTREAM cephalostat (model CS8100) in Natural Head Position, were selected from non-growing adolescents aged 18–40 years. These subjects had fully erupted second molars, were in cervical vertebral stage 6, and had no prior history of orthodontic, Orthopaedic/Prosthodontic treatment, craniofacial anomalies, trauma, or crossbites. Cases with large restorations, faulty cephalograms, or syndromic features were excluded. To eliminate influence of vertical growth patterns, only subjects with FMA angles within normal limits (males: 22.8º ± 5º; females: 26.8º ± 5º) were included. Manual cephalometric tracings were done. The sample was first categorized into 2 main groups based on overbite: Group I (normal overbite: 1–4 mm) and Group II (increased overbite >4 mm). Group II was further subdivided by sagittal skeletal classification using ANB angles into Class I (ANB 0.5º–4º), Class II Division 1 (ANB >4º), and Class II Division 2 (ANB >4º) malocclusions.

Various Cephalometric Parameters For the Study:

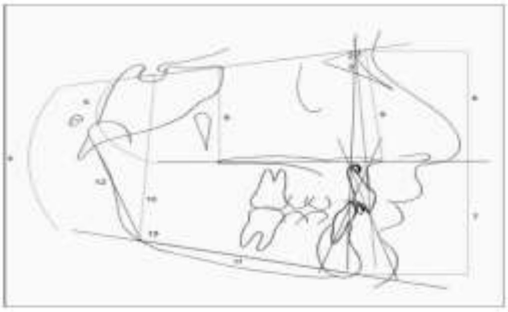

Fig 1 : Linear and angular measurements on lateral cephalograms to determine skeletal morphology: 1: SNA; 2: SNB; 3: ANB; 4: SN/GoGn; 5: SN/PP; 6: N-ANS; 7: ANS-Gn; 8: PNS-SN; 9: ANS-SN; 10: S-Go; 11: Go-Gn; 12: Ar-Go; 13: Gonial angle

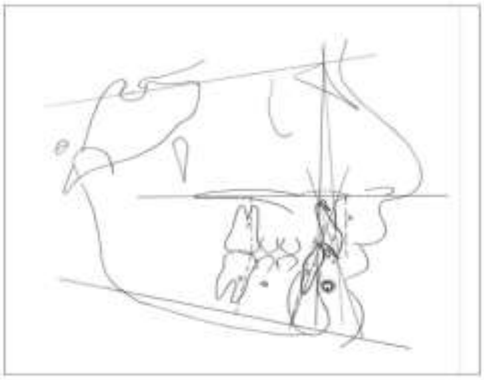

Fig 2 : Linear and angular measurements on lateral cephalograms to determine dental morphology: 1: interincisal angle; 2: U1-NA (degree); 3: L1-NB (degree); 4: U1-NA (mm), 5: L1- NB (mm); 6: U1-PP (mm); 7: U6-PP (mm); 8: L1-GoGn (mm); 9: L6-GoGn (mm)

International Journal Dental and Medical Sciences Research
Volume 7, Issue 5, Sept – Oct 2025 pp 184-192 www.ijdmsrjournal.com ISSN: 2582-6018

III. STATISTICAL ANALYSIS

The statistical analysis was done using SPSS (IBM SPSS Statistics for Windows, Version 19.0 Armonk, NY, USA: IBM Corp.). The descriptive statistics were calculated as mean and standard deviation. Prior to analysis, normality testing of data was done using Shapiro-Wilk test which showed that the data were normally distributed. The comparison of study parameters was done using independent t-test and analysis of variance (ANOVA) followed by Tukey's post-hoc test for multiple comparisons. The level of significance for study was set at a P-value of < 0.05.

IV. RESULTS

Table 1 shows overall population distribution. A total of 400 samples were randomly selected out of which 178 (44.5%) were males & 222 (55.5%) were females. The results reveal that deep bite is prevalent among ethnic Himachali adults of upper Sirmaur region with a prevalence of 60.5%.

Table 1 shows overall population distribution

Population	Total sample (N)	Males	Females
Normal bite	158	62	96
Deep bite	242	116	126
Total	400	178	222

Table 2 shows that ANB (3.32 ± 0.89) angle was greater in males while SN/Go-Gn (28.88 ± 3.93); Go angle (122.52 ± 5.01); FMA (24.47 ± 2.60); L1-NB (24.57 ± 6.33) & Y-axis (66.61 ± 3.37) were greater in females of **Class I deep bite group**

	Group	N	Mean ± SD	P value
SNA	Male	43	82.32 ± 4.02	0.068
	Female	42	80.88 ± 3.11	
SNB	Male	43	79.00 ± 3.97	0.218
	Female	42	78.04 ± 3.01	
ANB	Male	43	3.32 ± 0.89	0.018*
	Female	42	2.83 ± 0.98	
SN/Go-Gn	Male	43	24.30 ± 4.68	<0.001*
	Female	42	28.88 ± 3.93	
SN/PP	Male	43	8.06 ± 3.36	0.233
	Female	42	8.95 ± 3.40	
Go angle	Male	43	119.25 ± 5.54	0.006*
	Female	42	122.52 ± 5.01	
FMA	Male	43	21.11 ± 3.37	<0.001*
	Female	42	24.47 ± 2.60	
U1-L1	Male	43	127.32 ± 10.42	0.232
	Female	42	124.40 ± 11.91	
U1-NA	Male	43	27.79 ± 8.22	0.765
	Female	42	28.33 ± 8.43	
L1-NB	Male	43	21.74 ± 4.90	0.024*
	Female	42	24.57 ± 6.33	
Y- axis	Male	43	65.06 ± 3.22	0.033*
	Female	42	66.61 ± 3.37	

International Journal Dental and Medical Sciences Research
Volume 7, Issue 5, Sept – Oct 2025 pp 184-192 www.ijdmsrjournal.com ISSN: 2582-6018

Table 3 shows that U1-NA (28.71 ± 8.29) was greater in males while SN/Go-Gn (30.09 ± 5.43); Go angle (123.46 ± 5.17) & FMA (25.01 ± 3.04) were greater in females of **Class II/1 deep bite group**

	Group	N	Mean ± S.D	P value
SNA	Male	46	83.71 ± 4.44	0.670
	Female	54	83.35 ± 4.09	
SNB	Male	46	77.50 ± 4.59	0.325
	Female	54	76.64 ± 4.01	
ANB	Male	46	6.43 ± 1.40	0.318
	Female	54	6.70 ± 1.26	
SN/Go-Gn	Male	46	26.56 ± 4.12	<0.001*
	Female	54	30.09 ± 5.43	
SN/PP	Male	46	7.86 ± 3.03	0.311
	Female	54	8.55 ± 3.60	
Go angle	Male	46	121.32 ± 4.48	0.031*
	Female	54	123.46 ± 5.17	
FMA	Male	46	21.73 ± 2.94	<0.001*
	Female	54	25.01 ± 3.04	
U1-L1	Male	46	117.97 ±11.3	0.625
	Female	54	118.96 ± 8.72	
U1-NA	Male	46	28.71 ± 8.29	0.028*
	Female	54	25.37 ± 6.71	
L1-NB	Male	46	27.06 ± 7.08	0.106
	Female	54	29.01 ± 4.81	
Y- axis	Male	46	66.15 ± 4.25	0.051
	Female	54	67.75 ± 3.88	

Table 4shows statistically significant higher FMA (24.36 ± 2.77) in females of **Class II/2 deep bite group** compared to males.

	Group	N	Mean ± S.D	P value
SNA	Male	27	80.92 ± 3.94	0.085
	Female	30	82.60 ± 3.26	
SNB	Male	27	75.29 ± 3.76	0.225
	Female	30	76.50 ± 3.64	
ANB	Male	27	5.62 ± 1.00	0.174
	Female	30	6.10 ± 1.49	
SN/Go-Gn	Male	27	27.07 ± 4.92	0.392
	Female	30	28.16 ± 4.63	
SN/PP	Male	27	10.18 ± 2.77	0.327
	Female	30	9.40 ± 3.17	
Go angle	Male	27	119.66 ± 5.94	0.145
	Female	30	121.73 ± 4.57	
FMA	Male	27	21.62 ± 3.73	0.003*
	Female	30	24.36 ± 2.77	
U1-L1	Male	27	148.62 ± 12.22	0.498
	Female	30	150.90 ± 12.81	
U1-NA	Male	27	8.59 ± 7.90	0.892
	Female	30	8.86 ± 7.32	
L1-NB	Male	27	17.81 ± 7.53	0.372
	Female	30	16.03 ± 7.38	
Y- axis	Male	27	67.59 ± 3.57	0.240
	Female	30	66.43 ± 3.77	

Table 5 shows that L1-NB (4.92 ± 2.00) and maxillary index values (26.19 ± 8.14) were significantly higher in females while N-ANS (50.09 ± 3.44); PNS-SN (44.16 ± 3.13); ANS-SN (50.65 ± 3.44); S-Go (78.60 ± 6.43); Go-Gn (72.18 ± 5.50); Ar-Go (47.46 ± 4.91); L1-GoGn (36.20 ± 3.66); L6-GoGn (28.16 ± 3.49) were higher in males of **Class I deep bite group**

	Group	N	Mean ± S.D	P value
N-ANS	M	43	50.09 ± 3.44	0.006*
	F	42	48.23 ± 2.58	
ANS-Gn	M	43	57.20 ± 5.62	0.537
	F	42	56.52 ± 4.48	
PNS-SN	M	43	44.16 ± 3.13	<0.001*
	F	42	41.95 ± 2.40	
ANS-SN	M	43	50.65 ± 3.44	0.006*
	F	42	48.73 ± 2.80	
S-Go	M	43	78.60 ± 6.43	<0.001*
	F	42	71.73 ± 4.62	
Go-Gn	M	43	72.18 ± 5.50	0.027*
	F	42	69.69 ± 4.67	
Ar-Go	M	43	47.46 ± 4.91	<0.001*
	F	42	43.71 ± 4.09	
U1-NA	M	43	5.97 ± 3.09	0.285
	F	42	6.71 ± 3.22	
L1-NB	M	43	3.93 ± 2.05	0.026*
	F	42	4.92 ± 2.00	
U1-PP	M	43	26.53 ± 2.99	0.831
	F	42	26.66 ± 2.67	
U6-PP	M	43	21.76 ± 2.05	0.182
	F	42	21.16 ± 2.05	
L1-GoGn	M	43	36.20 ± 3.66	0.045*
	F	42	34.80 ± 2.54	
L6-GoGn	M	43	28.16 ± 3.49	0.014*
	F	42	26.47 ± 2.63	
Max. Index	M	43	21.99 ± 9.13	0.028*
	F	42	26.19 ± 8.14	
Mand. Index	M	43	29.16 ± 8.09	0.135
	F	42	32.13 ± 9.97	

Table 6 shows that Maxillary index values (29.33 ± 10.64) were significantly higher in females while N-ANS (49.17 ± 3.59); ANS-Gn (57.93 ± 3.49); PNS-SN (43.45 ± 2.81); ANS-SN (49.76 ± 3.42); S-Go (76.19 ± 5.61); Go-Gn (70.71 ± 3.99); Ar-Go (46.13 ± 4.01); U1-NA (5.47 ± 2.56); U6-PP (21.47 ± 1.95); L1-GoGn (37.86 ± 2.67) ; L6-GoGn (28.30 ± 2.49) were higher in males of **Class II/1 deep bite group**

	Group	N	Mean ± S.D	P value
N-ANS	M	46	49.17 ± 3.59	0.001*
	F	54	47.05 ± 2.65	
ANS-Gn	M	46	57.93 ± 3.49	0.001*
	F	54	55.11 ± 4.59	
PNS-SN	M	46	43.45 ± 2.81	<0.001*
	F	54	41.03 ± 2.29	
ANS-SN	M	46	49.76 ± 3.42	0.002*
	F	54	47.74 ± 2.82	
S-Go	M	46	76.19 ± 5.61	<0.001*
	F	54	68.96 ± 4.60	
Go-Gn	M	46	70.71 ± 3.99	<0.001*

International Journal Dental and Medical Sciences Research
Volume 7, Issue 5, Sept – Oct 2025 pp 184-192 www.ijdmsrjournal.com ISSN: 2582-6018

	F	54	66.35 ± 3.81	
Ar-Go	M	46	46.13 ± 4.01	<0.001*
	F	54	40.74 ± 3.66	
U1-NA	M	46	5.47 ± 2.56	0.050*
	F	54	4.46 ± 2.53	
L1-NB	M	46	5.93 ± 2.36	0.232
	F	54	6.48 ± 2.17	
U1-PP	M	46	26.73 ± 1.98	0.305
	F	54	26.20 ± 3.00	
U6-PP	M	46	21.47 ± 1.95	0.007*
	F	54	20.31 ± 2.24	
L1-GoGn	M	46	37.86 ± 2.67	<0.001*
	F	54	35.38 ± 2.25	
L6-GoGn	M	46	28.30 ± 2.49	<0.001*
	F	54	26.35 ± 1.77	
Maxillary Index	M	46	25.06 ± 10.22	0.044*
	F	54	29.33 ± 10.64	
Mandibular Index	M	46	34.23 ± 8.50	0.830
	F	54	34.61 ± 9.08	

Table 7shows that Maxillary index values (29.26 ± 7.97) were significantly higher in females while N-ANS (50.74 ± 3.22); ANS-Gn (56.29 ± 4.23); ANS-SN (51.18 ± 2.97); S-Go (75.59 ± 5.37); Ar-Go (45.51 ± 4.65); U6-PP (21.48 ± 1.71); L1-GoGn (35.25 ± 2.22); L6-GoGn (27.25 ± 1.95) were higher in males of **Class II/2 deep bite group**

	Group	N	Mean ± S.D	P value
N-ANS	M	27	50.74 ± 3.22	0.015*
	F	30	48.80 ± 2.61	
ANS-Gn	M	27	56.29 ± 4.23	0.016*
	F	30	53.63 ± 3.81	
PNS-SN	M	27	43.18 ± 2.88	0.249
	F	30	42.30 ± 2.84	
ANS-SN	M	27	51.18 ± 2.97	0.011*
	F	30	49.20 ± 2.74	
S-Go	M	27	75.59 ± 5.37	<0.001*
	F	30	70.23 ± 3.54	
Go-Gn	M	27	70.62 ± 5.23	0.102
	F	30	68.73 ± 3.24	
Ar-Go	M	27	45.51 ± 4.65	<0.001*
	F	30	41.46 ± 3.50	
U1-NA	M	27	-1.44 ± 2.25	0.208
	F	30	-2.23 ± 2.40	
L1-NB	M	27	1.96 ± 2.12	0.691
	F	30	1.73 ± 2.21	
U1-PP	M	27	26.81 ± 2.54	0.160
	F	30	25.86 ± 2.47	
U6-PP	M	27	21.48 ± 1.71	0.003*
	F	30	20.03 ± 1.77	
L1-GoGn	M	27	35.25 ± 2.22	<0.001*
	F	30	33.33 ± 1.64	
L6-GoGn	M	27	27.25 ± 1.95	<0.001*
	F	30	25.06 ± 1.79	
Maxillary Index	M	27	24.92 ± 8.20	0.048*

	F	30	29.26 ± 7.97	
Mandibular Index	M	27	29.62 ± 7.45	0.075
	F	30	33.39 ± 8.16	

V. DISCUSSION

This study found that 242 out of 400 participants had deep bite, indicating a high prevalence among ethnic Himachali adults in the Upper Sirmaur region. The sagittal position of the maxilla (SNA) did not differ significantly between deep bite and control groups. However, individuals in the Class II/1 group had a more forwardly positioned maxilla. In skeletal Class II cases, the mandible (SNB) was found to be retrognathic. According to Uzuner et al., [19] this Class II morphology likely results from the position of the mandible rather than its size, as the mandibular corpus length (Go-Gn) was consistent across Class II subtypes

The study classified cases based on sagittal intermaxillary relationships, revealing significant differences in ANB angles between Class I and Class II groups, with Class II/1 showing the highest values. This indicates that skeletal structure plays an important role and should be considered when analyzing Class II/2 malocclusion.

It is widely accepted that deep bite is linked to a reduced total and lower anterior facial height (ANS-Gn). [10,11,12,13] Similar to findings by Beckmann et al. [14], Fattahi et al. [5], and Trouten et al. [7], the deep bite group in this study demonstrated a notably shorter lower anterior facial height when compared to the normal bite group. This contradicts the results of Al-Zubaidi & Obaidi [15], who found no difference between these groups. A key trait often associated with Class II/2 malocclusion is a reduced lower anterior facial height, a trend supported in the current study. Conversely, the Class II/1 group exhibited values similar to the control group.

The study also revealed a significantly increased upper anterior facial height in the deep bite group compared to the normal bite group, aligning with findings from Fattahi et al. [5] and Nanda [16]. Despite this, overall facial height remained stable, likely due to compensatory increase in upper anterior facial height offsetting the reduced lower height.

Analysis of SN/PP angle showed no significant difference between deep bite and normal bite groups, reinforcing previous findings by Fattahi et al. [5] and suggesting no rotation in palatal plane. However, other researchers (e.g., Sreedhar, Trouten [7], Ceylan [17], and El-Dawlatly [18]) noted a more downward-inclined palatal plane in deep bite cases. In this study, palatal plane angle was larger in Class II/2 than in Class II/1, yet both skeletal deep bite groups had similar angles, consistent with Uzuner et al. [19], indicating that palatal plane inclination is not markedly altered in deep bite cases.

The gonial angle was significantly smaller in deep bite individuals compared to those with normal occlusion. This contrasts with Uzuner et al.'s [19] findings but is consistent with reports by El-Dawlatly [18], Brezniak [20], Ceylan [17], and Renfroe [21], who observed an acute gonial angle in deep bite patients.

A smaller Sn/Go-Gn angle in deep bite group suggests forward & upward mandibular growth, supporting Fattahi et al.'s [5] view that a horizontal growth pattern contributes to deep bite formation. The reduction in lower anterior facial height further implies counterclockwise mandibular rotation. No significant difference in ramus length (Ar-Go) was observed, echoing the results of Ceylan and Eroz.[17]

There is ongoing debate in literature regarding the correlation between increased overbite and posterior facial height (S-Go). In line with Uzuner FD et al. [19], the current study found no major influence of posterior vertical morphology on deep bite development, though S-Go values were significantly higher in Class I deep bite subjects compared to the other deep bite groups. Furthermore, the Class II/1 group demonstrated reduced ramus height (Ar-Go), consistent with findings by Uzuner et al. [19]

The study found significant differences in dentoalveolar morphology between deep bite and normal bite groups. Deep bite cases had a larger interincisal angle, while normal bite individuals showed more incisor proclination. In Class I deep bite, mandibular incisors were upright and maxillary incisors were proclined and protrusive. Class II/1 cases had proclined and protrusive incisors with a smaller interincisal angle, likely due to overjet compensation. Class II/2 cases showed retruded incisors and a larger interincisal angle.

These findings align with prior research demonstrating a deep overbite, an obtuse interincisal angle, and prominent retroclination of maxillary incisors in Class II/2, possibly as a skeletal compensation. Retroclination may also result from lip pressure. Unstable contact between incisors may explain the retroclination of lower incisors, with mandibular retrusion potentially occurring in response to maxillary incisor inclination. This study's results support findings by Bratu [11] and Hitchcock [13], who reported retruded lower incisors, though others (Pancherz, Godiawala [12]) observed normal inclinations, possibly due to varying reference frameworks.

According to El Dawlatly et al. [18], the most influential dental factors in deep bite were a pronounced Curve of Spee and excessive eruption of maxillary incisors. In this study, Class II/1 individuals showed greater extrusion of mandibular incisors than other deep bite groups. This increase in extrusion may be attributed to skeletal deviations and inadequate incisal contact in these cases.

The vertical positions of incisors remained within the normal range for all groups, contradicting the assumption that extrusion might accompany severe retroclination in Class II/2, as suggested by Sangcharearn et al. [22] Thus, the primary contributors to deep bite in Class II/2 appear to be incisor retroinclination and reduced lower facial height.

Both mandibular and maxillary molar heights were significantly reduced in deep bite groups compared to controls. These results are consistent with Fattahi et al. [5], who observed short mandibular molars in nearly 30% of deep bite cases. Lower molar heights were especially evident in Class I and Class II/2 groups, supporting findings by Mete L. Bjork and Skieller proposed that stable incisor contact affects mandibular rotation and dentoalveolar height. If contact is stable, anterior rotation occurs with molar eruption compensating for it. In unstable contact scenarios, this compensation fails, leading to intruded molars and skeletal deep bite, especially evident in Class II/1, where significantly lower maxillary molar heights were found.

The study found higher dentoalveolar ratios in deep bite individuals, suggesting that increased incisor height, especially in the mandible, is a major contributing factor. This highlights mandibular incisor extrusion as a key cause of deep bite. Clinically, the findings support mandibular incisor intrusion as a more effective treatment approach than molar extrusion, aligning with Kale et al.'s recommendation of using a utility arch for correction in non-growing patients

This study had some limitations like it relied on 2D cephalograms, which limit the accurate representation of 3D craniofacial structures. All tracings were done by a single operator, so inter-operator variability was not assessed. The analysis focused only on dentoskeletal features, excluding soft tissue factors like lip pressure and lip positioning, which may influence overbite and incisor inclination. Future research should include larger sample sizes, use advanced 3D imaging techniques like CBCT for more precise assessment, and consider soft tissue influences to better understand the development of deep bite.

VI. CONCLUSION

The study's findings show that deep bite is prevalent in Himachali adults of Upper Sirmaur region and it may manifest in various craniofacial patterns without exhibiting a distinctive craniofacial morphology. The degree of overbite was unaffected by sagittal positions of either jaw. Increased overbite appears to be mostly caused by dental morphology.

Reduced lower anterior facial height, retrusive mandibular incisors, higher interincisal degree were observed in Class I deep bite group. While the mandibular molars and incisors in both jaws were positioned vertically normally, maxillary molars were intrusive.

The Class II/1 group had a retrognathic mandible, protrusive mandibular incisors, extrusive maxillary and mandibular incisors, increased lower anterior facial height and mandibular plane angle, decreased interincisal degree.

Reduced lower anterior facial height, an increased interincisal angle, retrusive incisors in both jaws were seen in the Class II/2 group.

The study found that there are differences between males and females in a number of skeletal and dental parameters, and that no single factor causes development of a deep bite, indicating that the etiology is multifactorial.

Conflict of Interest - The authors declare no conflicts of interest.

REFERENCES

[1]. Daskalogiannakis J, Ammann A. Glossary of orthodontic terms. Quintessence Books Chicago; 2000.
[2]. Sreedhar C, Baratam S. Deep overbite-A review. Ann Essence Dent. 2009 Jul;1(1):8- 25
[3]. Pollard D, Akyalcin S, Wiltshire WA, Wellington JR. Relapse of orthodontically corrected deep-bites in accordance with growth pattern. Am J Orthod Dentofacial Orthop 2012; 141:477-83.
[4]. Shioya S, Arai K. Dentoskeletal morphology of adult Class II division 1 and 2 severe deep overbite malocclusions. Orthodontic Waves. 2017 Jun 1;76(2):97-104.

[5]. Hamidreza Fattahi, Hamidreza Pakshir, Neda Afzali Baghdadabadi, Shervin Shahian Jahromi; Skeletal and Dentoalveolar Features in Patients with Deep Overbite Malocclusion; November 2014; Vol. 11, No. 6; Journal of Dentistry, Tehran University of Medical Sciences

[6]. Schudy FF. The rotation of the mandible resulting from growth: Its implications in orthodontic treatment. Angle Orthod 1965;35: 36-50.

[7]. Trouten JC, Enlow DH, Rabine M, Phelps AE, Swedlow D. Morphologic factors in open bite and deep bite. Angle Orthod 1983 Jul;53(3):192-211.

[8]. Keeling SD, Riolo ML, Martin RE, Ten Have TR. A multivariate approach to analyzing the relation between occlusion and craniofacial morphology. Am J Orthod Dentofacial Orthop 1989; 95:297-305.

[9]. Claro CA, Abrao J, Reis SA. Association between overbite and craniofacial growth pattern. Braz Oral Res 2010; 24:425-32.

[10]. Karlsen AT. Cranio-facial characteristics in children with Angle Class II-2 malocclusion combined with extreme deep-bite. Angle Orthod 1994; 64:123-30.

[11]. Bratu DC, Balan RA, Szuhanek CA, Pop SI, Bratu EA, Pop G. Craniofacial morphology in patients with Angle Class II Division 2 malocclusion. Rom J Morphology Embryology 2014; 55:909-13.

[12]. Godiawala RN, Joshi MR. A cephalometric comparison between Class II division 2 malocclusions and normal occlusion. Angle Orthod 1974; 44:262-7.

[13]. Hitchcock HP. A cephalometric distinction of Class II Division 2 malocclusion. Am J Orthod 1976; 69:447-54.

[14]. Beckmann SH, Kuitert RB, Prahl-Andersen B, Segner D, The RP, Tuinzing DB. Alveolar and skeletal dimensions associated with lower face height. Am J Orthod Dentofacial Orthop. 1998 May;113(5):498-506.

[15]. Al-Zubaidi SA, Obaidi HA. The variation of the lower anterior facial heights and its component parameters among the three overbite relationships (cephalometric study). Al Rafidain Dent J. 2006 Jul;6(2):106-13

[16]. Nanda SK. Patterns of vertical growth in the face. Am J Orthod 1998; 93:103-16.

[17]. Ceylan I, Eroz U. The effects of overbite on the maxillary and mandibular morphology. Angle Orthod. 2001 Apr;71(2):110-5.

[18]. El-Dawlatly MM, Fayed MM, Mostafa YA. Deep overbite malocclusion: analysis of the underlying components. Am J Orthod Dentofacial Orthop. 2012 Oct;142(4):473-80.

[19]. Uzuner FD, Aslan BI, Dinçer M. Dentoskeletal morphology in adults with Class I, Class II Division 1, or Class II Division 2 malocclusion with increased overbite. American Journal of Orthodontics and Dentofacial Orthopedics. 2019 Aug 1;156(2):248-56.

[20]. Brezniak N, Arad A, Heller M, Dinbar A, Dinte A, Wasserstein A. Pathognomonic cephalometric characteristics of Angle Class II Division 2 malocclusion. Angle Orthod 2002; 72:251-7.

[21]. Renfroe EM. A study of the facial patterns associated with Class I, Class II Division 1, and Class II Division 2 malocclusions. Angle Orthod 1948; 18:12-5.

[22]. Sangcharearn Y, HO C. Effect of incisors angulation on overjet and overbite in class II camouflage treatment. Angle Orthod 2007;77(6):1011–8.

[23]. Shetti, Shraddha Subhash; Chougule, Kishor Adinath. Panorama of Prevalence of Malocclusion, Treatment Needs, Specific Occlusal Traits & Gender Distribution in Patients Seeking Orthodontic Treatment in Kolhapur Population - A Prospective Cross-sectional Study. Journal of Indian Association of Public Health Dentistry 11(4): p 34-41, Oct–Dec 2013.