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The Relationship of the Bucco-Lingual Position of the Mandibular First Molar to Occlusion and Arch Stability

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THE RELATIONSHIP OF THE BUCCO-LINGUAL POSITION OF THE MANDIBULAR FIRST MOLAR TO OCCLUSION AND ARCH STABILITY

by

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The following manuscript was prepared as a partial fulfillment of the requirements for a graduate degree from Loma Linda University Graduate School under the discipline of the School of Dentistry.

While the format in general is governed by the criteria of a conventional Graduate School Thesis, it is in actuality a manuscript which readily is amenable for publication in a scientific journal.

The persons whose signatures appear below certify that they have read this paper and that in their opinions it is adequate, in scope and quality, as a paper for the degree of Master of Science.

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INTRODUCTION

The problem of holding teeth in an ideal esthetic and functional position has always faced the orthodontist. The success or failure of a treatment result is not evaluated by the appearance of the case immediately after the removal of the bands. A case is judged by its appearance and stability two, five, even ten years after treatment.

When the orthodontist is faced with the problem of a relapsing arch, he must re-evaluate his data and treatment, looking for possible pitfalls which he could avoid in treating subsequent cases.

Hellman (1944) has stated that much has been written about orthodontic failures, but very little has been done to prevent them. Consequently there is almost a complete ignorance of the specific factors which cause relapses.

The observation of Hellman may appear somewhat harsh and dogmatic, but from the amount and varied content of the literature on this subject it appears that the problem of retention is still very much with us today. To quote Oppenheim (1940), "Retention is the most difficult problem in orthodontia; in fact it is the problem."

Orthodontists have come to realize that retention is not a separate entity from orthodontic treatment but that it is an active part of treatment and therefore must be included in treatment planning.

The purpose of this study is (1) to determine if there is an ideal bucco-lingual relationship of the mandibular first molar over basal bone, (2) to correlate this position with arch stability of the mandibular anterior teeth and occlusion according to Angle's definition.

REVIEW OF THE LITERATURE

Over the years many philosophies of retention have developed. While our present day concepts do not adhere to any one specific theory, they do include a combination of several of the following philosophies.

The early pioneer, Kingsley, as far back as 1880, felt that the occlusion was the most potent factor in determining arch stability. While not disagreeing entirely with Kingsley, Rogers (1922) introduced a school of thought which stressed the importance of a proper functional muscle balance. This critical relationship between muscle and bone cannot be over estimated. When there is a struggle between the two, bone yields (Asling 1961). Brodie (1953), Graber (1953), Weinstein, et al. (1963) have corroborated this consideration.

Tweed (1944) gathered many followers by his insistance that the mandibular incisors must be over basal bone. Sved (1944), disagreeing with Tweed, maintained that as a rule neither the anterior nor the posterior teeth are placed directly over the ridges; furthermore, the first molar is directly over basal bone while the second and third molars are somewhat more lingually placed.

The question of what exactly is basal bone has yet to be fully answered. Since the term "basal bone" was first coined by Lundstrom in 1925 there have been varied attempts to define the term. His article, "Malocclusion of the teeth regarded as a problem in connection with the apical base," introduced a sharp disagreement to the generally accepted concept of functional development which held that if teeth were moved into new positions by artificial forces, bone would grow to support them in their new positions. He maintained that at the root ends of the teeth there was a zone that could not be influenced by artificial forces and that unless the coronal arch was harmonious in size with the apical base there was bound to be malocclusion of the teeth and that orthodontic treatment would fail. Later investigators have agreed with Lundstrom's observation, stressing the importance of a proper relationship between the teeth and basal bone in order to obtain a permanent result (Howes 1947, Huckaba 1964).

The major portion of the literature regarding tooth position and basal bone discussed findings observed through the use of lateral cephalograms. By this method the anterior-posterior relationships of the teeth were quite easily studied. Frontal films were also helpful but they have limitations from a depth viewpoint.

Downs (1940) approached the problem of the determination of apical base from a third view: the horizontal plane. Occlusal radiographs were taken of plaster models by directing the center of the beam perpendicular to the model base. An image of the details of the dental arches were thus obtained. This outline he assumed to be the apical base. The work of Howes (1947) was similar. He surveyed models opposite the apicies of the teeth. At this level he cut the models horizontally thus exposing what he considered the supporting bone. Among his conclusions are the following: 1. A normal occlusion must be supported by a normal apical base. 2. The supporting base can be surveyed and its relationship to tooth material can be established.

3. Mechanical therapy cannot alter the size of the apical base.

Until 1962, no studies had been directed at the apical base as an independent entity. Richardson (1962) developed a method which would permit longitudinal appraisal of the base of the maxillary denture. He also tested the correlations among the apical base, the alveolar arch, and tooth material. Occlusal radiographs were taken with the central ray perpendicular to the occlusal plane. Following the development of the film, the assumed outline of the apical base was traced. The plaster casts were x-rayed with the same technique and traced. When the two tracings were superimposed, they coincided almost exactly. The tracing from the radiograph was somewhat smaller because the x-ray represented the outline of the bone proper only. The difference between the two was taken as the area occupied by its soft tissue covering.

Another technique was developed that made it possible to delineate tooth changes of individual teeth to the apical base from mandibular records. Arch changes were studied by tracing the x-ray images of plaster models (Lude 1967).

The mandibular molars and cuspids are the keys in determining the alignment patterns for the remaining teeth. When these are not properly placed, a stable arch cannot be expected. There is a strong tendency for the first molar to resume its former axial inclination if it is tipped during treatment (Strang 1949, Brodie 1938).

Dempster, Adams, and Duddles (1963) did a qualitative and quantitative study of the arrangement of the roots of the teeth in eleven skulls with typical dentitions. The direction and amount of root slanting were measured and treated statistically. They found that the mandibular first molars inclined toward the lingual and the root position, next to the lower bicuspids, showed the least amount of angular variation. A drawback to the study of Dempster, et al. (1963), is that the skulls used were of Indian origin. A comparable group of skulls with caries-free teeth representing our present day American population could be obtained.

METHODS AND MATERIALS

Sampling

Group A

Patients in this group were treated at the orthodontic clinic of Loma Linda University. The following criteria for selection was used:

1. At least four years post retention.
2. Availability of records, especially beginning and ending study models.
3. Presence of six-year molars.
4. Absence of restorations which would alter the basic morphology of the above tooth, i.e., full or three-fourth crown.

Of the eighty patients meeting the above requirements only thirteen were available for this study. Of these thirteen cases, five were males and eight were females with ages varying from nineteen to twenty-five years.

Group B and C

Samples for these groups were selected from the sixty-six students in the sophomore class of dentistry at Loma Linda University. These samples were all males with ages ranging from twenty-two to thirty-four years. The selection criteria was the following:

1. Presence of six-year molars.
2. Absence of restorations which would alter the basic morphology of the above tooth, i.e., full or three-fourth crown.

Those students which had no previous orthodontic treatment composed group B. The orthodontically treated students composed group C. The B group was further divided by their molar classification (Angle's). Table 1 contains the sample sizes of groups B and C.

Table 1

Sophomore Dental Student Sample

Group B (non-treated)			
Class	I	27	
Class	II	13	
Class	III	0	
Total			40
Group C (treated)			9
Total student sample			49

Radiographic Technique and Measurements

Mandibular occlusal radiographs were obtained on all sixty-two cases. The following technique varies somewhat from the more conventional one as used by Downs (1940). The technique used in this study allows the central ray to parallel the long axis of a majority of the teeth rather than only those teeth in the posterior segment of the arch (Figure 1).

With the patient's head tilted far back a Kodak Ultra Speed occlusal film was placed on the occlusal surface and the patient was instructed to bite together. Care was taken not to have the patient bite too hard for this could distort the film. The tip of the x-ray tube (long cone) was placed approximately four inches from the tip of the chin. The central ray was directed at right angles to the film but tilted so that the ray was also parallel to the long axis of the cuspid (Figures 2 and 3). Should the cuspid be in an abnormal angulation the long axis of the first premolar is used.

This technique can be duplicated quite accurately as is seen by the superimposed radiographic tracings in Figure 4. These radiographs were taken about one-half hour apart.

A Ritter radiographic machine was used utilizing 75 kVp and 10 mA. Exposure time was 1.5 seconds. Development technique and time was equal to intra-oral radiographs.

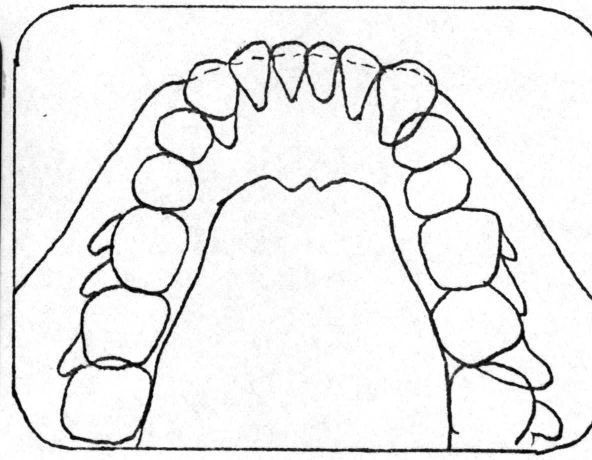
All the following measurements were made with a pinpoint divider and a Boley gauge and then rounded to the nearest one-half of a millimeter.

Intermolar width measurements were taken between the first molars at the indentation of the lingual groove. In the case of two grooves the most anterior one was always measured. The position of the lingual surface of the molar in relation to the medial border of the mandible was also measured (Figure 5). An overlap of the tooth to the lingual surface of the mandible was recorded as a negative (-) value.

Plaster Model Measurements

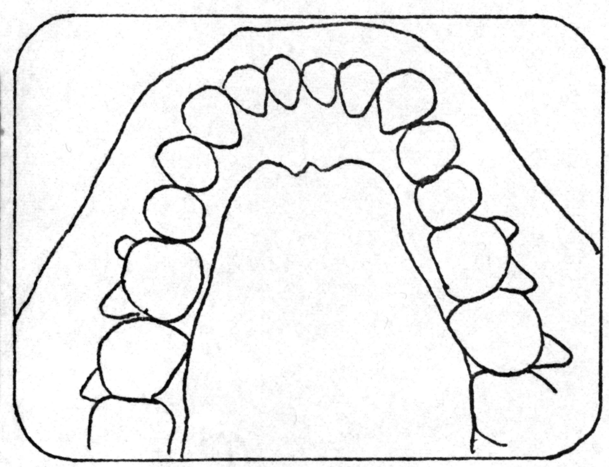
From alginate impressions, plaster models were made for all sixty-two cases. Intermolar width measurements were made between the most convex portion of the mandibular first molar at the area of the lingual groove. Anterior arch length discrepancy (anterior crowding) was determined by subtracting the total width of the anterior teeth from the total width of the space available in the arch.

1 a.



1 b.

2 a.



2 b.

Figure 1.

A comparison of occlusal radiographs and tracings using the conventional and modified techniques. 1. a & b. Radiograph and tracing illustrating the conventional technique. 2. a & b. Radiograph and tracing illustrating the modified technique used in this study. Note the anterior distortion of the incisors in tracing 1 a.

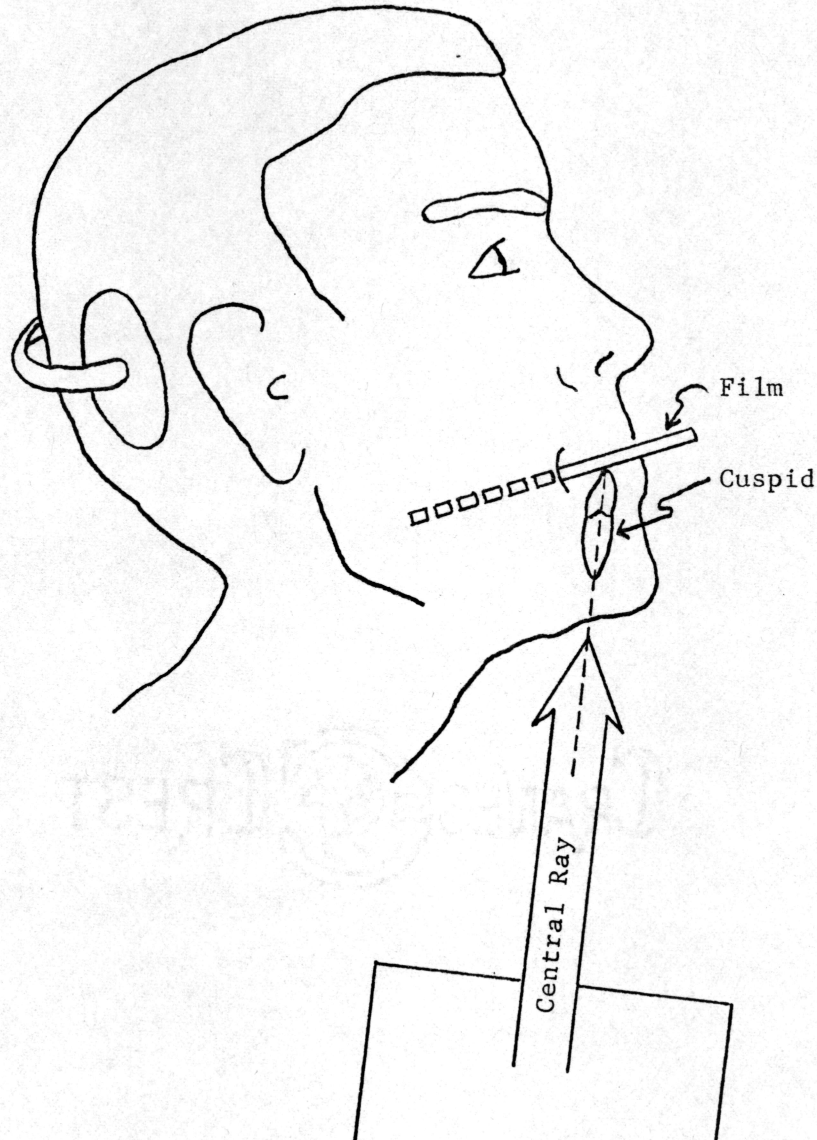


Figure 2.

A lateral view of the modified occlusal radiographic technique showing the central ray passing parallel through the long axis of the mandibular cuspid. Notice the head position.

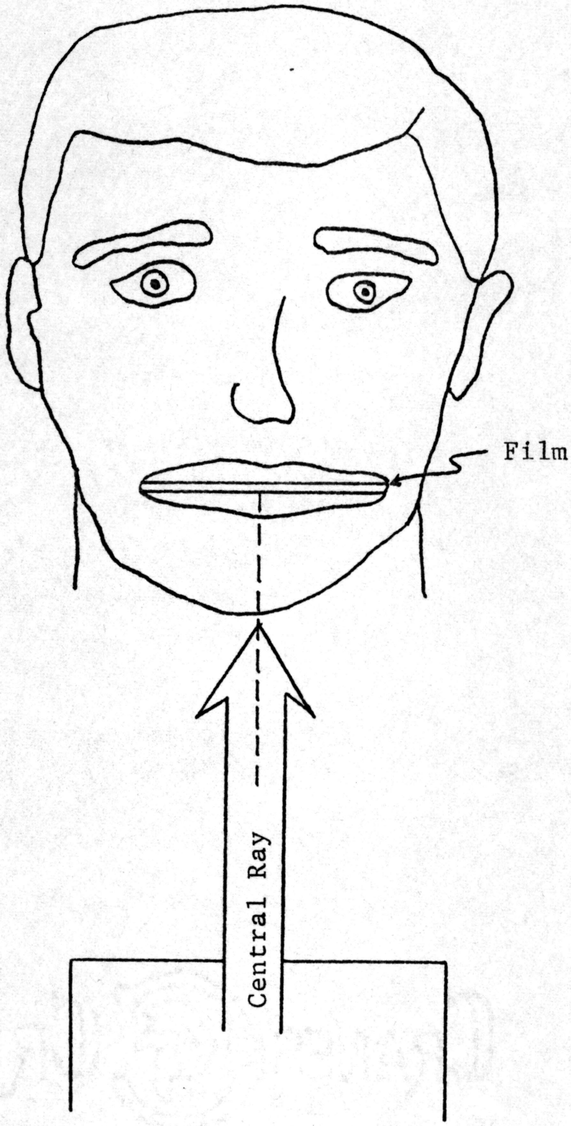
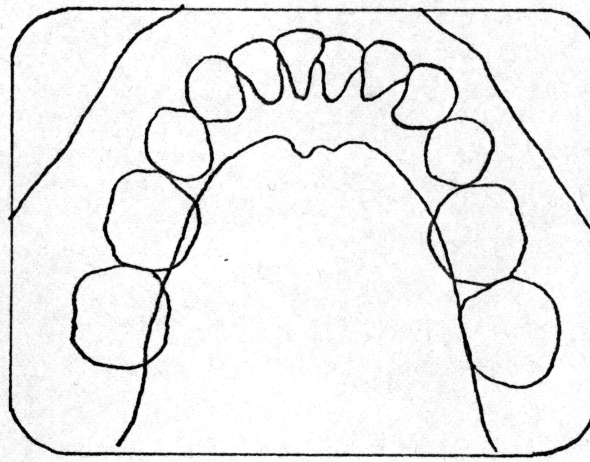
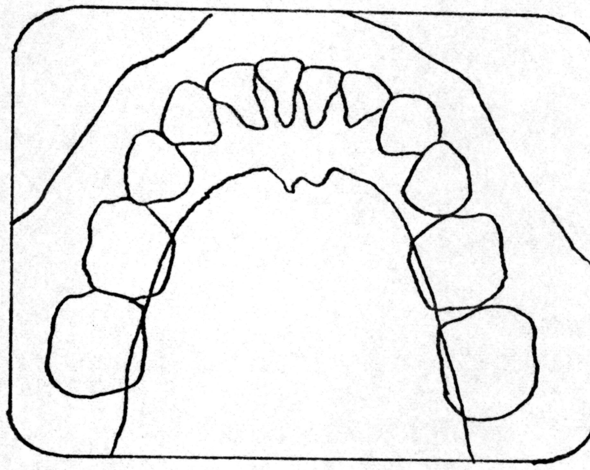


Figure 3.

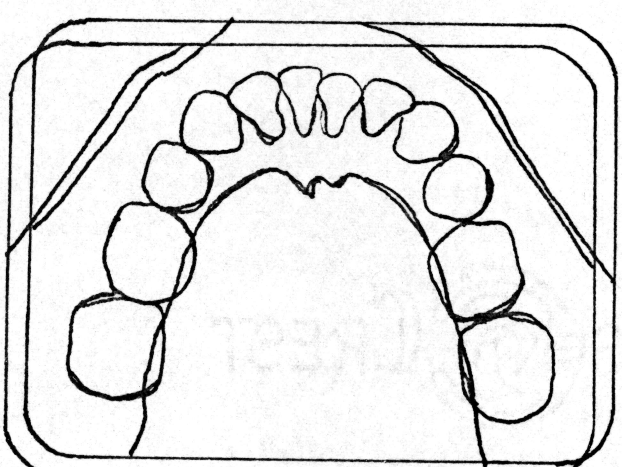
A frontal view of the modified occlusal radiographic technique showing the central ray passing the film perpendicular to the occlusal table.



1.



2.



3.

Figure 4.

Superimposed tracings illustrating a high degree of duplication. Tracings 1. and 2. were taken one-half hour apart. 3. Superimposed tracings.

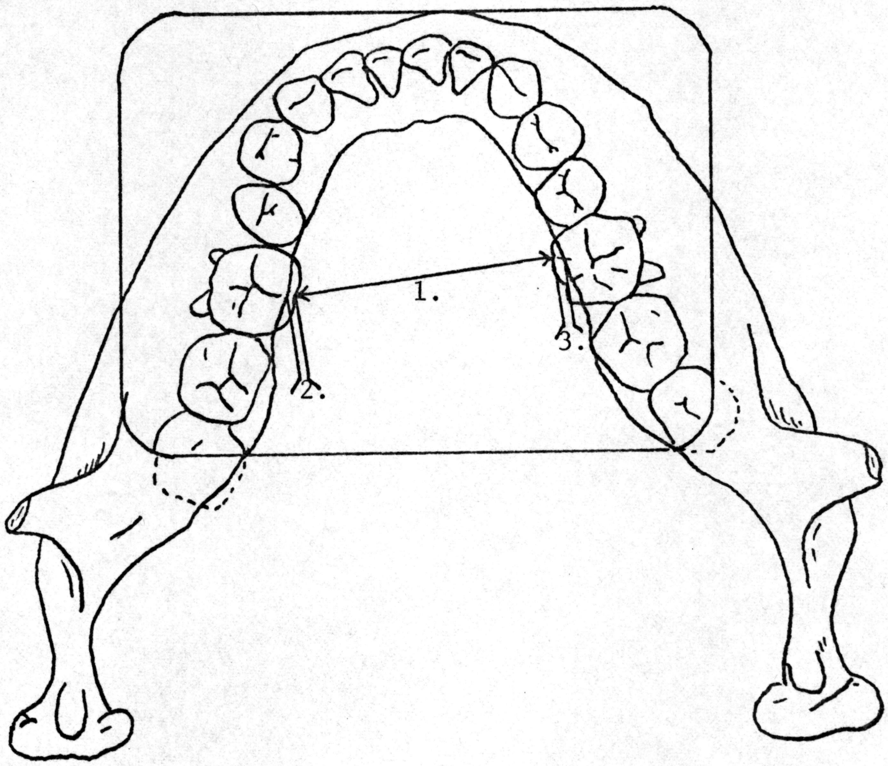


Figure 5.

An actual size tracing from the radiograph of student No. 41 superimposed on a mandible. 1. Intermolar width measurement between the lingual grooves of the mandibular first molar teeth. Note that in the case of two lingual grooves, the most anterior one is used. 2. The measurement of the amount of overlap of the tooth relative to the left lingual border of the mandible. 3. The same measurement as No. 2 but on the right side.

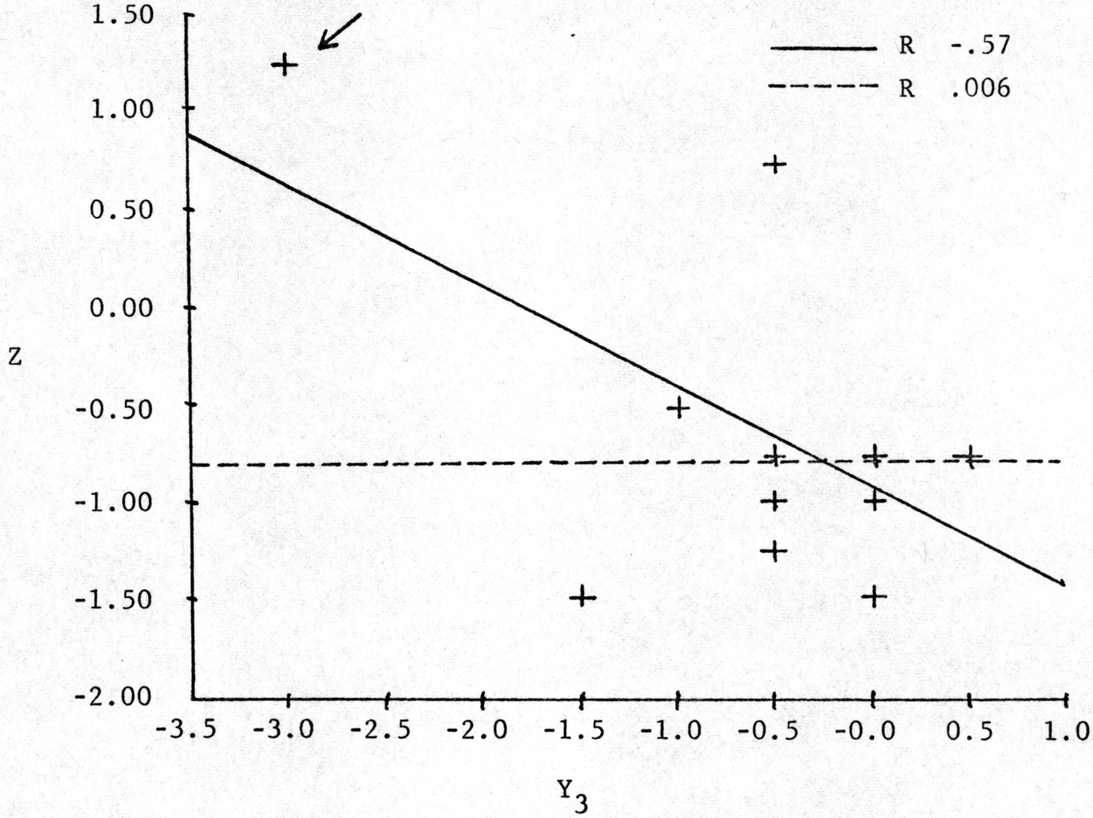


Figure 6.

A scatter diagram plotting the molar overlap-anterior crowding variable. The solid line represents the slope (R -.57) of the Y_3-Z variable of all the clinic patients tested. Notice the change of the slope (broken line) when case No. 3 (arrow) is deleted. See text for explanation of of case deletion.

DATA AND RESULTS

On evaluation of the radiographs a discrepancy became evident. The bucco-lingual position of the first molar, relative to the lingual border of the mandible, was not equal on both sides. Further study showed that many times this was the result of an improper x-ray tube position. From the frontal view the central ray should enter at right angles to the occlusal table (Figure 3). A slight variation from this angle may decrease the amount of overlap on one side and increase it on the other. The intermolar distance (X4) was found to be the same even with the slight tube head variation. The mean of the right and left overlap (Z) was used when correlated to the amount of anterior crowding (Y).

The data from the patients treated in the orthodontic clinic appear in Appendix 1. The same measurements were made on the beginning, ending, and post retention models. The post retention time was recorded in months.

The measurements of the students who had received orthodontic treatment were the same as the clinically treated patients except that the beginning and ending models were not available (Appendix 2).

From the non-treated students, the measurements were the same as the treated students with the addition of Angle's molar classification (Appendix 3). Post retention records were not applicable. The unilateral class II patients were deleted in one of the correlation analysis to determine whether the bilateral class II showed any significant differences.

When spacing was found in the anterior teeth a positive value was recorded. A negative (-) value denotes arch crowding.

A key to the different variables and measurements is listed in Table 2.

TABLE 2

Summary of Variables and Their Abbreviations

Intermolar Width - IM
- X_1 - beginning (models)
- X_2 - finish (models)
- X_3 - final or post retention (models)
- X_4 - occlusal radiograph

Anterior Crowding - AC
- Y_1 - beginning
- Y_2 - finish
- Y_3 - final or post retention

Molar Overlap - MO
- Z

The means and one standard deviation for the various groups are found in Table 3. All the variables do not apply to every data group and are signified by non applicable (n.a.). The linear correlations were tabulated between variables found in Table 4. The results from t-test applications are found in Table 5. The means were tested with assumed equal variances. Scatter diagrams were plotted from the Y_3 - Z variable of clinic patients to clarify the abnormal correlations (Figure 6).

TABLE 3

Means and one standard deviation of variables measured. Intermolar width; beginning model (X_1), finish model (X_2), final or post retention (X_3), occlusal radiograph (X_4). Anterior crowding; beginning (Y_1), finish (Y_2), final or post retention (Y_3). Molar overlap (Z). All variables are not applicable to all data groups (n.a.)

Data Group	Sample Size	X_1	X_2	X_3	X_4	Y_1	Y_2	Y_3	Z
Group A: Clinic Patients	13	33.0 ±3.0	33.3 ±3.2	33.4 ±2.9	34.0 ±2.9	-2.7 ±3.3	0.0 ±0.0	-0.7 ±0.9	-0.6 ±0.8
Group B: All Non Tx. Students	40	n.a.	n.a.	33.3 ±2.7	33.7 ±2.7	n.a.	n.a.	-1.0 ±1.3	0.1 ±1.1
Group B: Non Tx. Class I	27	n.a.	n.a.	33.6 ±2.5	34.1 ±2.3	n.a.	n.a.	-1.1 ±1.2	0.1 ±1.1
Group B: Non Tx. Class II*	13	n.a.	n.a.	32.7 ±3.1	32.7 ±3.2	n.a.	n.a.	-0.9 ±1.3	0.0 ±1.0
Group B: Non Tx. Class II**	9	n.a.	n.a.	32.9 ±3.4	32.8 ±3.5	n.a.	n.a.	-1.1 ±1.5	-0.2 ±1.0
Group C: Treated Students	9	n.a.	n.a.	30.8 ±2.5	31.2 ±2.8	n.a.	n.a.	-1.3 ±1.2	-0.6 ±1.0

* unilateral and bilateral
** bilateral only

TABLE 4

Significance levels for correlations derived from intravariable comparisons. Levels above p=.05 were not considered significant and are denoted by n.s. (non-significant). Refer to Table 2 for variable definitions.

Variable Comparisons	Group A: Clinic Patients		Group B: Non Treated Students — All		Class I		Class II*		Class II**		Group C: Treated Students	
	R	P	R	P	R	P	R	P	R	P	R	P
X_3 vs. Y_3	-.31	n.s.	.14	n.s.	.08	n.s.	.28	n.s.	.41	n.s.	.05	n.s.
X_3 vs. X_4	.97	p<0005	.98	p<.0005	.98	p<.0005	.99	p<.0005	.99	p<.0005	.97	p<.0005
X_3 vs. Z	-.15	n.s.	.27	n.s.	.03	n.s.	.27	n.s.	.78	p<.01	.57	n.s.
Y_3 vs. Z	-.57[a]	p<.05	.22	n.s.	.06	n.s.	.57	p<.05	.73	p<.02	.23	n.s.
X_1 vs. X_2	.88	p<.001										
X_1 vs. X_3	.80	p<.001										
X_2 vs. X_3	.94	p<0005										
Y_1 vs. Y_3	.10	n.s.										
Y_2 vs. Y_3	***											
Y_1 vs. Z	-.30	n.s.										

* unilateral and bilateral Class II
** bilateral Class II only
*** not able to correlate due to 0.0 value
a see text for possible explanation of abnormal correlation

TABLE 5

Significance levels derived from intragroup comparisons. Levels above p=.05 were not considered. Refer to Table 2 for variable definitions. t - test; to test equal means with variances assumed to be equal.

Data Groups	X_3 Intermolar Width	Y_3 Anterior Crowding	Z Molar Overlap
Clinic Patients vs. All Non Treated Students	n.s.	n.s.	$p<.05$
Clinic Patients vs. Treated Students	$p<.05$	n.s.	$p<.05$
Treated Students vs. All Non Treated Students	$p<.05$	n.s.	$p<.05$
Non Treated Students Class I vs. Non Treated Students Class II*	n.s.	n.s.	n.s.

*unilateral and bilateral

DISCUSSION

Sample Size

The sample size of the clinic patients was small because of the difficulty in locating these patients. The majority (84 per cent) had either moved or would not consent to the additional radiographs and impressions.

The sophomore dental students are not a representative group because of the high percentage of orthodontic treatment among them (18 per cent). The students were therefore divided into the treated and non-treated groups.

Radiographic Accuracy

The intermolar width (IM) of the occlusal radiographs was found to be highly correlated (.97-.99) to that of the plaster models. The $p<.0005$ level of significance implies that this is not a chance phenomenum. All the X_3-X_4 variables in Table 4 show this high correlation. The mean intermolar width of the radiographs was 0.4 mm larger than that of the plaster models. One explanation for this discrepancy is the magnifying effect of the central ray because of the close target distance. For practical purposes, measurements of the models and radiographs may be interchanged.

Intermolar Width

The intermolar widths of Group A were expanded 0.3 mm during treatment. Rather than relapse during post retention, the intermolar width increased 0.1 mm. These small amounts of change may be due to growth as well as measurement errors and small sample size.

The treated students (Group C) exhibited the smallest intermolar width (30.8 mm). This may occur due to the forward movement of the molars as anchorage is lost in extraction cases. The molars would now occupy a position in the more narrow portion of the arch. When compared with the intermolar width of the non-treated students, this value is statistically different ($p<.05$).

Apart from Group C and Group B, Class II (to be discussed later), there are no statistical differences in the intermolar widths.

Anterior Crowding

All groups show approximately 1 mm of anterior crowding. There appear to be no statistical differences of this variable in intragroup comparisons. The clinic treated cases, with a mean anterior crowding of 2.7 mm, showed a relapse of 0.7 mm.

Molar Overlap (Bucco-lingual position)

In the non-treated students the molars occupy a position directly over the basal bone (-0.1 ± 1.1 mm). This appears to confirm the work of Sved (1944).

The treated groups, A and C, show an increased overlap of 0.6 mm. A larger sample segregated into extraction and non-extraction cases may show whether the loss of anchorage in the extraction cases is exhibited by a tipping effect.

All intergroup comparisons except the Class I - Class II variable, result in a significance in the 95 per cent level.

Variable Comparisons

Apart from the radiographic-model variables (X_3 - X_4), no other groups showed a consistant significance.

The anterior crowding - molar overlap variable (Y_3 - Z) in the clinic patients exhibited a negative correlation (-.57). As the only negative correlation in this intravariable group, it appeared that it was due to the small sample size and/or unknown factors. A scatter diagram of this variable resulted in an interesting observation (Figure 6). The variable intersect of one patient (case No. 3) appeared to be abnormally plotted. Further investigation revealed that this female patient exhibited a latent Class III tendency. The patient stated that she grew two inches during her last two years of high school.

A second regression line, with case No. 3 deleted, resulted in a significant correlation change (.006 vs. -.57). This result was similar to the correlation of the other intragroup variables.

Characteristics of the Class II Mandibular Arch

After evaluating Table 4 it became evident that the data from the bilateral Class II students was unique. Whereas all the other groups showed only one variable comparison as significant (X_3 - X_4), the bilateral Class II group showed three. When comparing the intermolar width (X_3) with molar overhang (Z), no significant correlation was observed in the Class I student. The Class II student, though, showed a positive correlation of .78 ($p<.01$). There was also a correlation between the amount of molar overlap (Z) and anterior crowding (Y_3). A significant positive correlation was found in no other group.

One can speculate that the above characteristics were the results of several factors. A common finding of the Class II occlusion was that of mesially rotated maxillary molars. As the maxillary molar occluded with the mandibular molar, the working cusp rode up on the mesial marginal ridge of the lower molar thus also resulting in a mesial rotation of that tooth. This tooth was thus positioned more lingually and anteriorly. The more anterior position could decrease the leeway space to the degree of anterior crowding.

Asahino (1971) and other clinicians have observed that to avoid a possible unstable arch, it may be necessary to refrain from using Class II elastics in the Class II non-extraction case. Following the establishment of a Class I relationship through growth and extraoral traction, the mandibular first molar is restored to its ideal position with the application of Class III elastics.

Clinical Applications of Occlusal Radiographs

In view of the findings of this study there are several areas of application helpful to the clinical orthodontist.

The outline and width of the basal bone are readily seen in the radiograph thus helping one to evaluate the position of each tooth in the arch. The lateral and periapical views do not give one an indication of the amount of root torque necessary for proper tooth alignment, while the occlusal view aids one during torquing by displaying both the clinical crown and root position in relation to the other teeth in the arch.

During treatment planning the cortical plate must be considered. Many orthodontists have experienced delayed movement when the tooth came in contact with the cortical plate. The amount of cancellous bone available for tooth movement may be more readily evaluated with an occlusal view.

Impacted teeth can be a problem for the orthodontist when it is impossible to establish whether the tooth is lying in a lingual or labial position. Asahino (1971) has found the occlusal radiograph very helpful to the oral surgeon in establishing the exact location of impacted third molars.

With the increasing need of auxilliary personnel in the profession, many preformed appliances are being used. To save chair time, the occlusal radiograph could serve as a template of each patient's arch form. Individualized preformed arch wires can thus be fabricated from the patient's template thereby removing much of the guesswork encountered by the inexperienced clinician.

SUMMARY AND CONCLUSIONS

1. Occlusal radiographs and plaster models were obtained from 62 patients. Of the 22 orthodontically treated, 13 were patients at Loma Linda University. The remainder (49) were sophomore dental students. Beginning and final study models were also obtained from the clinic treated patients. The data from this group was further classified: non-treated Class I students, non-treated Class II students, and non-treated bilaterally Class II students.

2. Intermolar width, anterior crowding, and molar overlap measurements were recorded to establish the relationship of the buccolingual position of the mandibular first molar to anterior crowding and molar relationship.

3. The radiographic technique described reduced the amount of root distortion and placed the long axis of the teeth over the basal bone.

4. A very high correlation between the models and the radiographs was noted. For measuring purposes the two may be interchanged, i.e., arch form.

5. In the non-treated Class I students the position of the mandibular first molar was directly over basal bone.

6. A tipping effect and a decreased intermolar width was noted in the treated students and patients. A loss of anchorage in the extraction cases may be responsible for this result.

7. There appeared to be no significant correlation between anterior crowding and intermolar width.

8. Except for bilateral Class II's there appeared to be no significant correlation between anterior crowding, intermolar width, and molar overlap.

9. There was no significant correlation of molar overlap between Class I's and Class II's.

10. The untreated bilateral Class II case was unique in that it showed a high p value (significance) when intermolar width, as well as anterior crowding, is correlated with molar overhang.

11. The occlusal radiograph can be helpful during treatment planning and active treatment itself, _e.g._, arch form, locating impactions, fabricating individualized arch wires, and determining root angulation.

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APPENDIX I

CLINIC TREATED PATIENTS

GROUP A

Results of measurements obtained from patients treated at the Loma Linda Orthodontic Clinic. Refer to Table 2 in text for key to lettered variables. All values are in millimeters.

Case Number	Molar Overlap Right	Left	Mean	Intermolar Width X_1	X_2	X_3	X_4	Anterior Crowding Y_1	Y_2	Y_3
1	-1.5	0.0	-0.75	31.0	29.5	30.0	32.0	-6.5	0.0	-0.5
2	-1.0	-2.0	-1.50	36.5	36.5	37.0	37.5	-3.0	0.0	-1.5
3	0.5	2.0	1.25	34.0	36.5	36.5	36.5	-1.5	0.0	-3.0
4	-0.5	0.0	-0.25	28.0	29.0	32.0	32.5	-1.5	0.0	-3.0
5	0.0	1.5	0.75	30.5	*	31.0	30.5	-9.0	*	-0.5
6	-1.0	0.0	-0.50	33.5	33.5	33.0	34.0	-1.0	0.0	-1.0
7	-1.0	-1.5	-1.25	40.0	38.5	39.0	40.0	2.0	0.0	-0.5
8	0.0	-1.5	-0.75	34.5	31.0	31.5	32.0	1.0	0.0	0.5
9	-0.5	-0.5	-0.50	30.0	30.0	29.5	30.0	*	*	-1.0
10	-1.5	-0.5	-1.00	31.5	*	34.0	34.5	0.0	*	0.0
11	-1.0	-2.0	-1.50	33.5	34.0	33.0	34.0	-1.5	0.0	0.0
12	-1.0	-1.0	-1.00	32.0	32.5	32.0	33.0	-6.5	0.0	-0.5
13	-1.0	-0.5	-0.75	33.5	35.0	36.0	36.0	-1.0	0.0	0.0

*Data not available

APPENDIX II

NON-TREATED DENTAL STUDENTS

GROUP B

Case Number	Molar Overlap - Z Left	Right	Mean	Intermolar Width X_3	X_4	AC Y_3	Molar Classification Left	Right
1	0.0	-1.5	-0.75	30.5	31.0	0.5	1	1
2	0.5	0.0	0.25	36.0	36.0	0.0	1	1
3	-1.0	-1.5	-1.25	36.0	36.0	-1.5	1	1
5	0.0	1.0	0.50	35.5	35.5	-0.5	1	1
6	1.0	2.0	1.50	29.0	30.5	-0.5	1	1
7	-3.0	-2.0	-2.50	26.0	26.0	-4.0	2	2
8	0.0	0.5	0.25	33.5	34.0	2.5	1	1
9	1.5	3.0	2.25	34.0	34.0	0.0	1	1
10	0.0	1.5	0.75	35.5	35.0	-3.0	1	1
11	0.0	-0.5	-0.25	35.0	35.0	-3.0	2	2
12	1.0	2.5	1.75	37.0	38.0	0.0	1	1
13	0.0	-0.5	-0.25	34.0	34.0	-1.0	1	1
14	0.0	-0.5	-0.25	34.0	34.0	0.0	2	2
15	0.0	0.0	0.00	33.5	33.5	-2.0	2	2
16	0.0	0.5	0.25	30.5	30.0	0.0	2	2
17	1.0	0.5	0.75	33.5	33.0	0.0	1	2
18	1.5	1.5	1.50	31.0	31.5	-0.5	1	1
19	1.0	2.0	1.50	37.5	37.5	0.0	2	2
20	0.0	2.5	1.25	37.0	37.5	-1.5	1	1
21	0.5	2.5	1.50	35.5	36.0	-1.0	1	2
22	0.0	0.0	0.00	33.0	33.0	0.0	2	2
23	0.0	2.5	1.25	34.5	35.0	-2.0	1	1
24	-1.0	0.5	-0.25	36.0	36.0	-1.0	1	1
25	-1.0	0.5	-0.25	30.5	30.5	0.0	2	2
26	-0.5	0.0	-0.25	32.0	32.5	-3.0	1	1
27	-2.0	-0.5	-1.25	38.0	38.5	0.0	1	1
28	-1.0	0.0	-0.50	35.5	36.0	-1.0	2	2
29	-0.5	0.0	-0.25	36.5	37.0	-1.5	1	1
31	-1.0	0.0	-0.50	34.0	35.0	-1.5	1	1
32	-0.5	-1.5	-1.00	30.5	30.5	0.0	1	2
33	-0.5	1.5	0.50	30.0	31.0	-1.5	1	1
34	-1.0	2.0	0.50	29.5	29.5	-0.5	1	2
35	1.0	1.5	1.25	33.5	33.5	-2.0	1	1
36	0.0	1.0	0.50	31.0	31.5	-3.5	1	1
37	0.0	1.5	0.75	35.0	35.0	-3.0	1	1
38	-2.0	-1.5	-1.75	28.5	29.0	-1.5	1	1
39	-1.0	1.0	0.00	33.5	34.5	-1.5	1	1
40	-1.0	0.0	-0.50	33.5	34.5	-1.5	1	1
41	-1.5	-1.5	-1.50	33.0	33.5	-0.5	1	1
42	-1.5	-1.5	-1.50	33.0	33.5	-3.5	1	1

APPENDIX III

OROTHODONTICALLY TREATED DENTAL STUDENTS

GROUP C

Case Number	Molar Overlap Z Left	Right	Mean	Intermolar Width X_3	X_4	Anterior Crowding Y_3
43	-1.0	-0.5	-0.75	29.5	29.5	-0.5
45	-0.5	-1.0	-0.75	31.0	31.5	-0.5
46	-1.0	-1.5	-1.25	28.0	29.0	-3.0
47	-2.0	-2.0	-2.00	30.0	30.5	-2.5
48	1.0	0.5	0.75	31.0	30.0	0.0
49	0.5	2.0	1.25	33.0	33.5	-2.5
50	0.0	-0.5	-0.25	33.0	34.5	0.0
51	-1.0	0.0	-0.50	35.0	35.5	-2.0
52	-2.0	-1.0	-1.50	27.0	27.0	-1.0

LOMA LINDA UNIVERSITY

Graduate School

THE RELATIONSHIP OF THE BUCCO-LINGUAL POSITION OF THE MANDIBULAR FIRST MOLAR TO OCCLUSION AND ARCH STABILITY

by

Lothar M. Guttschuss

An Abstract of a Paper in Partial Fulfillment

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in the Field of Orthodontics

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ABSTRACT

Forty non-treated and twenty-two orthodontically treated cases were selected to determine the relationship of the bucco-lingual position of the mandibular first molar to occlusion and arch stability.

Plaster models and occlusal radiographs were obtained from all the cases. Anterior crowding, intermolar width, molar classification, and molar overhang relative to the basal bone were determined. The modified technique for occlusal radiographs used was found to result in radiographs which were more versatile and accurate when interchanged with the model measurements. Clinical applications of this technique include the determination of root angulations, location of impactions, and the fabrication of individualized preformed arch wires.

Only in the Class I non-treated cases was the molar found directly over basal bone. There was no direct correlation of molar overhang and anterior crowding or intermolar width except in the untreated bilateral Class II cases which exhibited a correlation at the 0.02 significance level. The treatment plan must therefore be carefully evaluated on this type of patient.