A Study to Determine If There Is a Relationship between Treatment Success and Patient Attitudes

Gene L. Dongieux

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A STUDY TO DETERMINE IF THERE IS A RELATIONSHIP
BETWEEN TREATMENT SUCCESS
AND PATIENT ATTITUDES

by

GENE L. DONGIERUX

A Thesis Submitted to the Faculty of the Graduate School
of Loyola University in Partial Fulfillment of
the Requirements for the Degree of
Master of Science

JUNE
1965
LIFE

Gene L. Dongieux was born in Yazoo City, Mississippi, on December 6, 1932. He was graduated from St. Clara Academy in June, 1950.

He took his predental studies at the University of Mississippi in Oxford, and was graduated in June, 1954.

From 1954 to 1959, he served as a pilot in the United States Air Force.

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# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Page</th>
</tr>
</thead>
</table>
| I       | INTRODUCTION. ........................................... 1  
A. Introductory Remarks. ................................. 1  
B. Statement of the Problem. ............................. 3 |
| II      | REVIEW OF THE LITERATURE. ............................... 5  
A. Review of Psychological Dental Literature .......... 5  
B. Review of Dental Treatment Literature ............... 13 |
| III     | METHODS AND MATERIALS ................................. 17  
A. Selection of Subjects ................................ 17  
B. Construction of a "Tool" to Evaluate Treatment Progress.......................... 17  
C. Evaluation of Orthodontic Treatment Success ........ 20  
1. Collection of Treatment Evaluation Data .......... 20  
2. Scoring of Treatment Evaluation Cards ............. 22  
D. Initial Attitude Assessment .......................... 24  
E. Six-Month Attitude Assessments ....................... 25 |
| IV      | FINDINGS. ................................................ 26  
A. Treatment Evaluation ................................ 28  
B. Attitude Changes During Treatment ................... 32  
C. Correlation of Patient Attitude with Treatment Success  ......... 36 |
| V       | DISCUSSION. .............................................. 42 |
| VI      | SUMMARY AND CONCLUSIONS ............................... 48  
A. Summary ................................................. 48  
B. Conclusions ............................................. 49 |
<p>| VII     | BIBLIOGRAPHY. ........................................... 51 |
| VIII    | APPENDICES                                       |</p>
<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Standard Deviations of Treatment Outcome Ratings.</td>
<td>30</td>
</tr>
<tr>
<td>2</td>
<td>Frequency Distribution of Mean Treatment Outcome.</td>
<td>31</td>
</tr>
<tr>
<td>Table</td>
<td>Description</td>
<td>Page</td>
</tr>
<tr>
<td>-------</td>
<td>-----------------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>I</td>
<td>Means and Standard Deviations of Attitude Scores of Patients Lost and Patients Retained and &quot;t&quot; Ratios</td>
<td>27</td>
</tr>
<tr>
<td>II</td>
<td>Means and Standard Deviations of Treatment Evaluations for all Subjects.</td>
<td>29</td>
</tr>
<tr>
<td>III</td>
<td>Attitude Change in Boys</td>
<td>34</td>
</tr>
<tr>
<td>IV</td>
<td>Attitude Change in Girls</td>
<td>35</td>
</tr>
<tr>
<td>V</td>
<td>Attitude Changes, Boys vs. Girls</td>
<td>37</td>
</tr>
<tr>
<td>VI</td>
<td>Relationship between Criterion of Treatment Success of Boys, and Various Predictors</td>
<td>38</td>
</tr>
<tr>
<td>VII</td>
<td>Relationship between Criterion of Treatment Success of Girls, and Various Predictors</td>
<td>40</td>
</tr>
</tbody>
</table>
CHAPTER I

INTRODUCTION AND STATEMENT OF THE PROBLEM

A. Introductory Remarks:

One of the intriguing and yet unanswered questions is what motivates one child to want orthodontics, another child passively to accept it, while still another rejects its benefits by failing to cooperate.

Motivation consists of many ingredients, yet if we narrow the term motivation to its narrowest definable parameters, it means to "impel or incite".

What mechanisms incite or impel one child to accept orthodontic treatment and eagerly cooperate in the fullest measure, and what blocks the same mechanisms in another, denying that child the benefits of orthodontics?

This question of motivation is pondered by psychologist, psychiatrist, educators, employers, and the bewildered parents of growing children.

Experimental psychologists have developed various methods to create and assess motivation in experimental animals. Some of these methods have lent themselves not only to the assessment, but even to the creation of motiva-
tion in humans. The orthodontist is primarily interested in any tangible method that is available to him to achieve and maintain the elusive quality known as "motivation".

Why this interest in motivation of orthodontic patients? What purpose does it serve? Both of these questions can be answered simply with the statement, "Where from 50 per cent to 60 per cent of treatment is dependent on the responsibility of the patient, motivation must be high if the objectives of treatment are to be fully achieved." Frequently the term motivation is loosely translated into orthodontic clinical jargon implying cooperation. The term cooperation, loosely defined, is for mutual profit or benefit. We may assume from this loose definition that cooperation is a two-way highway; motivation, on the other hand, is intrinsic, coming from the patient alone, wishing to keep this highway opened by individual efforts.

Studies dealing with the intrinsic quality "motivation" are very few in dentistry and even less so in orthodontics. Intrigued by the fact that some orthodontic patients being treated in the Loyola University Orthodontic Clinic finish with rapid dispatch while others with apparently similar
malocclusions go on for several years without ever really reaching a desirable result, Gannon (1964) undertook a study of motivational factors that seemed to be influencing patient cooperation. This included an attempt to isolate relevant factors and the construction of an instrument for the measurement of these factors. His findings will be discussed in the portion of this thesis dealing with the "Literature". The results reported in this thesis are a continuation of Gannon's study. More specifically, however, this thesis will deal with an attempt to determine whether there is a correlation between treatment success and patient attitude.

B. Statement of the Problem:

The purpose of this research was to compare the relationship of attitudes of orthodontic patients before and during treatment, and to see whether there is a correlation between treatment success and either initial attitude scores or attitude changes.

This involved the administration of an attitude scale (see Appendix I) to sixty orthodontic patients after six months of active treatment. These patients had been tested
with the identical scale before the initiation of treatment. In addition to this procedure, it was necessary to construct an orthodontic progress instrument that could be used to evaluate treatment of these same patients (see Appendix II). To insure a comprehensive evaluation using this clinical tool, the following areas were described on each patient's treatment evaluation card: (1) description of the original malocclusion, (2) treatment objectives to be accomplished during orthodontic treatment, (3) description of the occlusion following six months of treatment, and (4) orthodontic force systems employed during six months of treatment.

These sixty treatment evaluation cards were studied by ten qualified orthodontists and the progress was rated as follows: (1) Very Good Treatment Progress, (2) Above Average Treatment Progress, (3) Average Treatment Progress, (4) Below Average Treatment Progress, and (5) Very Poor Treatment Progress.
CHAPTER II

REVIEW OF THE LITERATURE

In order to give this review some meaningful continuity, it was necessary to divide it into two discrete categories. The first will include the psychological literature pertinent to the field of dentistry. This will describe what has been done relative to attitude assessment in dental areas. The second area will cover the dental literature pertinent to the development of a suitable treatment evaluation tool.

A. Review of Psychological Dental Literature:

Rogers (1921) states that one of the first duties of an orthodontist is to learn the mental attitudes of the child because, when attitudes were found to be unfavorable, treatment success could not be attained. He was one of the first to indicate that cooperation and motivation were directly related to attitude.

Wile (1929) made it known that the function of the orthodontist is to straighten personalities as well as teeth. He goes on to say that the orthodontist should create a morale that will establish positive patient attitudes and, if this is accomplished, the treatment should be successful.
Maller (1929) discussed the applications of psychologic disciplines to orthodontics. He observed that there was no simple rule for the manipulation of children, but that each temperament should be observed individually.

Walker (1941) indicated that the adverse effects of maloccluding teeth on personality development should be more readily recognized as having a prominent place in the study of orthodontics. Some of the more common characteristics noticed in patients with disfiguring dental anomalies were discovered. The most common trait found was that encountered when a child believed himself to be inferior to other children; i.e., an inferiority complex. Other traits found in order of their frequency were defense reactions, timidity, selfishness, jealousy and supersensitiveness.

Burstone (1946) stated that "modern medicine has come to the realization that the human body cannot be treated in terms of a mere sum of its different parts, but rather be dealt with in terms of the psychophysiologic aspects of the organism as a whole." He mentions that every effort must be made to understand the relationship between psychic and somatic processes in dental health and disease.
Glaser (1946) pointed out that psychic and functional training is by no means to be considered a substitute for the various mechanical therapies, but rather an aid to them. Ryan (1946) points out, accordingly, that the patient and his disease can never be evaluated with intelligence unless we think of the person as the sum of his generic, familial, and environmental background. Furthermore, he states that existing patient dental attitudes are largely determined by previous dental experiences. In his book, *Psychobiologic Foundations in Dentistry*, he described the principles of psychosomatic medicine and the clinical aspects of psychobiology.

Root (1949), in his article entitled "Face Value", showed a relationship between facial esthetics and personality development in children. He indicated that dental deformities caused manifestations of inferiority, self-consciousness, and shame. He found these problems to be evident because the child was unable to satisfy the two fundamental drives of personality development: self-expression and conformance with accepted social standards.

Ash, in 1950, pointed out that the orthodontist and the plastic surgeon have the opportunity to treat the psyche
somatistically -- to remove emotional tensions and undesirable attitudes by improving facial appearance. In 1951, he developed an outline for the psychosomatic evaluation of the orthodontic patient. This outline was used as a guide in questioning and observing orthodontic patients to determine their emotional stability. The outline covered the following five areas: consciousness of esthetic defects, habitual motor activity, involuntary behavior disorders, social attitudes, and scholastic status.

January (1951) wrote on psychosomatics in patient management. He indicated that the patient management problem will be solved when the orthodontist understands and employs the psychological principles of human motivation and control.

Only eight scientifically oriented studies have been done on patient attitude toward dental operations. Shoben and Borland (1954) carried out research of a preliminary and exploratory nature to test patient attitudes to psychological stimuli associated with dentistry. Thirty persons were used to test three hypotheses: (a) pain tolerance, (b) traumatic experience, and (c) parental attitudes and
family background. Each subject was given an intensive two-hour interview designed to obtain information relevant to the areas indicated in the hypotheses. They concluded that the acceptance of dental treatment procedures by the child was largely determined by previous dental experiences of the parent. This indicated that the parents were the guiding force in the molding of the child's dental attitude.

The second scientific study on patient attitude toward dental procedures was carried out by the American Dental Association (1952). This study was designed to determine what motivates patients to seek out or reject dental care. One hundred and twenty-six people were interviewed to study their attitudes toward dentistry. It was found that the higher social classes presented the most favorable attitudes toward dental procedures even though dentistry was known to be a serious, demanding, uninteresting, and repetitive experience. Attitudes toward orthodontic care were also explored in this study. Again, those of higher social status were more aware of the cosmetic benefits derived from orthodontics and were more prone to desire orthodontic attention.
The third scientifically designed dental study was done by Friedson and Feldman (1958) on a sample of two thousand individuals. The investigation was designed to determine what factors influenced the attitudes of the public toward dental treatment. It was found that fear was the one most important factor for patient rejection of dental care. The other reasons were economic deficiencies and inconvenience.

Gablum and Kegeles (unpublished 1959) investigated the "feeling tones" of thirty-five orthodontic patients during treatment and the effect these feelings had on treatment. Each patient was questioned relative to desire and general attitude toward orthodontic care. The three orthodontists treating these patients were then questioned concerning treatment progress or terminal treatment success. A positive correlation was found between patient desire for orthodontic care and cooperation.

Kegeles (1961) did a study to determine why people seek dental care. He found that men desired dental care less than women. He also found that people forty years of age and older, and the lower social classes were less apt
to seek out dental care. Individuals falling in the age

bracket of six to forty, and those in the higher social and
economic structure demonstrated more favorable attitudes
toward dental treatment.

The first psychological test to measure attitudes of

children toward dentistry was formulated by Nelson and

Lester (1962). The technique used was sentence completion,
multiple choice questions, and word association. The

attitudes of three hundred and sixty children were measured.
The findings of Nelson and Lester concurred with those of
the American Dental Association study in that a positive
correlation was found between dental attitudes and socio­
economic groups. Again it was concluded that the lower
educational and economic class groups place less value on
dental care than those experiencing greater economic and
social security.

In 1963, Kegeles interviewed four hundred and thirty
adult employees of a corporation to determine their atti­
tudes toward dental care. The interview was the free
answer variety, requiring forty-five to ninety minutes to
complete. Factors contributing to great desire and acceptance
of dental care included higher income, advanced education, and a job status requiring higher responsibilities.

Gannon (1964) explored the question of what motivational factors are relevant to patient cooperation. Having decided what factors are relevant, he formulated an attitude scale and administered it to seventy-five orthodontic patients who were about to begin treatment. His questionnaire was divided into three subscales. Section 1 contained thirty-two items pertaining to the strength of desire for orthodontic treatment. Section 2 contained twenty-eight items measuring willingness to tolerate social deterrents which might be incurred while wearing orthodontic appliances. Section 3 contained twenty items measuring the degree of discomfort anticipated during orthodontic treatment. He found that all of his subjects possessed a desire for orthodontic treatment but were indefinite about tolerating or accepting the social impediments and pain connected with treatment. This research revealed that the principle gain from orthodontic treatment in the eyes of the patient was that of improved appearance. The chief contribution of this research was the construction of an instrument that
makes it possible to empirically study the relationship between selected motivational factors and treatment.

B. Review of Dental Treatment Literature:

The second area of this review will cover the dental literature pertinent to the development of a suitable treatment evaluation tool. It will be seen that there are no scientifically objective methods of treatment evaluation described in the literature and still the elements of an almost objective evaluation may be found in a careful study of several pertinent references. As will be seen in the section on "Methods and Materials", the "tool" for evaluation was designed from the most useful elements found in the references that will be reviewed.

Angle (1920), in his text Malocclusion of the Teeth, presented case histories describing Class I, Class II, and Class III malocclusions that he had treated to completion. He devoted particular attention to the etiology causing each malocclusion and the mechanical devices used in correction. He did, however, evaluate his own treatment success by comparing pretreatment and posttreatment photographs of plaster casts and patient profiles. The element
of comparison is useful in the construction of an evaluating "tool". A verbal commentary was also provided to supplement the photographic comparisons. This commentary also appeared applicable and helpful in this research.

Another method of describing orthodontic results, not so common, was the procedure wherein linear measurements were made directly from plaster casts and patients, before, during, and following treatment. Steadman (1961) recorded intermolar and intercuspid distances of thirty-one orthodontic cases before treatment, at the completion of treatment, and one year after termination of retention. These measurements were made with a Boley micrometer (vernier caliper) and recorded. The objective use of linear measurements on casts and patients was regarded as a valuable element in treatment evaluation.

Roentgenographic cephalometrics are used to describe and appraise craniomaxillo-dentofacial changes, whether they result from orthodontic treatment or growth. Of all the methods found in the dental literature to describe and assess orthodontic results, cephalometrics is one of the more scientifically accurate systems.
Downs (1948) introduced a method of recording the skeletal and denture pattern observed in cephalometric roentgenograms. He did this by defining a number of cephalometric landmarks and angular norms. Proper selection of these landmarks and precise comparisons of successive lateral head plates enabled him to follow the progress of the patient and to evaluate the success of the therapy. The use and appraisal of lateral head X-rays was regarded as a good approach to scientifically objective evaluation.

Verbal descriptions derived from examining photographs, linear measurements taken from pretreatment and posttreatment casts, and cephalometry have been employed to describe and evaluate treatment. In recent years, these tools have not been applied as separate entities but have been linked together to facilitate a more thorough treatment evaluation.

Jarabak and Fizzell (1963) offered the latest and most complete description of treated orthodontic cases. A well-coordinated combination of aids was used to describe each treatment from beginning to completion viz: pretreatment and posttreatment photographs; pictures of the plaster casts
before and after treatment; pretreatment and posttreatment intra-oral roentgenograms; cephalometric tracings before and after treatment; and a Loyola University Cephalometric Analysis performed before and after treatment. A comprehensive word description combined these aids in such a way that the reader could easily evaluate the progress of each treated case presented. This reference combined the elements noted in previous references but stressed the importance of the treatment plan and the verbal description. Accordingly, these latter elements are well taken for use in the development of an objective treatment evaluation "tool".
For ease of explanation, this chapter will be divided into five discrete areas. These are selection of the subjects, construction of a "tool" to evaluate orthodontic treatment success, evaluation of orthodontic treatment success, initial attitude assessment, and attitude assessment following six months of orthodontic therapy.

A. Selection of Subjects:

Sixty orthodontic patients, twenty-seven males and thirty-three females, were selected from the orthodontic department at Loyola University. These patients were chosen because the attitude scale developed by Dr. Gannon in 1964 had been administered to them just prior to the initiation of their active orthodontic treatment. The availability of these subjects made a study of attitude changes possible along with a comparison of attitudes with treatment success.

B. Construction of a "Tool" to Evaluate Treatment Progress:

The "tool" for treatment evaluation was a case summary form especially developed for this study (see Appendix II).
The first section described the malocclusion before treatment initiation. The initial description was in terms of the following data gathered from the pretreatment plaster models: Molar Relationship -- the relationship of the maxillary first molar to the mandibular first molar, whether it be mesioclusion, distoclusion or neutroclusion; Overbite -- the extent in millimeters to which the maxillary anterior teeth overlapped their mandibular antagonist; Overjet -- the extent in millimeters of antero-posterior overlap of the maxillary anterior teeth over the mandibular teeth in centric occlusion; Crossbite -- the areas where the mandibular teeth were displaced laterally and occluded lateral to their maxillary antagonist; Discrepancy--the amount of space deficiency in millimeters needed to align the mandibular teeth, due to broken contacts and rotations of teeth.

Cephalometric information was used to describe the following terms: SNA -- the relationship in degrees between the maxillary denture base and cranial anatomy; SNB -- the relationship in degrees between mandibular denture base and cranial anatomy; ANB -- the relationship in degrees of
the two denture bases to each other; IMPA -- the angular relationship of the mandibular central incisors to the lower border of the mandible; \( l \) to \( SN \) -- the angular relationship of the upper central incisors to the floor of the anterior cranial base; GoGnSN -- the angular relationship between the lower border of the mandible and the floor of the anterior cranial base; Esthetic Plane -- the linear measurement which gives the relationship of the upper and lower lip to a straight line connecting the tip of the nose and the tip of the chin.

The following clinical information was given in the initial description of the malocclusion: Extraction or Non Extraction -- this indicated whether the treatment plan called for the removal of dental units for the resolution of the malocclusion; Teeth Extracted -- this indicated the exact teeth removed, if the removal of dental units was necessary; Treatment Objectives -- this described the step-by-step procedure necessary to correct the malocclusion.

Section two of the evaluating instrument described the status of the occlusion of each patient following six months of active orthodontic treatment. To allow for an
accurate comparison, the identical clinical and cephalometric measurements just described were presented showing how the measurements had changed during six months of therapy. In addition to this information, the space remaining in each extraction site after six months, where applicable, was offered in section two.

Section three of the instrument provided a resume of the appliance therapy used during the six-month treatment period. This resume included wire size and shape, elastic configurations, and headgear therapy where applicable.

The fourth and last section of the evaluating "tool" was reserved for remarks that might supplement the description of each patient's treatment progress. This section was provided to allow the clinician gathering the data to offer any additional information not provided in the first three sections.

C. Evaluation of Orthodontic Treatment Success:

1. Collection of Treatment Evaluation Data

The data necessary to complete each treatment evaluation card were collected from five separate sources. These were pretreatment plaster models of the teeth, pretreatment
and six-month progress lateral cephalograms, a diagnosis and treatment plan for each subject, a clinical examination of each patient following six months of treatment, and pre-treatment and progress intra-oral photographs.

From the pretreatment plaster models, the following data were gathered: molar relationship before treatment, pretreatment overbite and overjet relationships, crossbite relationship before treatment, and discrepancy due to an accentuated curve of Spee, broken contacts and rotations, found in the mandibular arch.

From the pretreatment lateral head film, all of the beginning cephalometric data previously described were gathered. The esthetic plane was also made available with this diagnostic aid.

The progress cephalometric data were gathered by tracing and recording angles from a cephalogram taken six months after initiation of treatment.

Information relative to treatment objectives and specific force systems to be utilized during treatment was gathered from the write-up of the diagnosis and treatment plan on each of the subjects.
The status of the molar relationship, overbite, overjet, crossbite, discrepancy, and curve of spee after six months of treatment was determined by a thorough clinical examination of each patient. These measurements, along with the remaining space to be closed in the extraction sites, were determined and recorded. The pretreatment and progress intra-oral photographs were used primarily to offer information for the remarks section, but they were also used to verify nearly every observation previously described.

2. Scoring of Treatment Evaluation Cards

The sixty treatment evaluation cards were studied by ten qualified orthodontists who were to judge the relative treatment success of each subject. Each orthodontist was instructed to accomplish this by using a procedure of successive sorting. For the initial rating, the evaluator was instructed to place each card into one of three categories: (1) above average treatment success for six months of therapy; (2) average treatment success for six months of therapy; or (3) below average treatment success for six months of therapy. For the second discrimination, the
evaluator was instructed to go one step further and sort the cards placed in the above average category into above average and very good categories. He was similarly asked to sort the cards in the below average category into below average and very poor categories. Upon completion of this procedure, the sixty cards were divided into the following five categories: very good treatment success for six months of therapy; above average treatment success for six months of therapy; average treatment success for six months of therapy; below average treatment success for six months of therapy; and very poor treatment success for six months of therapy. A score of five was given the patient whose treatment results were rated as very good for six months, four for above average, three for average, two for below average, and one for very poor success for six months of therapy.

After all ten qualified orthodontists completed their examination of the sample, the scores were tallied and the patient with the highest score was assumed to have experienced the greatest amount of treatment success. The patient with the lowest total score, conversely, was rated as one experiencing very little treatment success.
D. Initial Attitude Assessment:

The attitude scale constructed by Gannon in 1964 was administered by him to each subject individually and privately previous to orthodontic treatment. This method of administration was chosen because of the age groups of the patients and the difficulty of getting good patient rapport. He administered the questionnaire in a conference room at Loyola's Dental School and the patients were informed that these questions were part of an orthodontic research project. The patients were advised that the purpose was to discover their feelings about orthodontics and they were assured that their responses would be kept confidential.

Having administered the questionnaire to all subjects, the next procedure was to score the items in the three subscales. Responses were weighted so that the individual selecting the most favorable category would receive the highest score and, in the same manner, the individual selecting the least favorable category would receive the lowest
score. A score of five was assigned to the most favorable answer to each question, and a score of one to the least desirable. Totals were compiled so that each subject received three total scores. The total scores were in the following areas: strength of desire for orthodontic treatment, willingness to tolerate social impediments, and the willingness to tolerate the discomforts commensurate with orthodontic treatment.

E. Six-Month Attitude Assessments:

To assure a meaningful comparison of attitude scores, the attitude scale was administered to the identical patients used by Gannon, under the same conditions, and the exact scoring procedure was also employed. Since all patients had been under treatment for six months, it was unnecessary to familiarize each child with orthodontic treatment procedures and appliances. The subjects were instructed to take as much time as they needed to complete the questionnaire and the usual time required was thirty minutes. The patients appeared familiar with all terms and very few questions arose during the testing.
CHAPTER IV

FINDINGS

The findings are divided into three sections. The first section contains the results of treatment evaluation. The second section contains the attitude changes during six months of treatment and the third section contains the correlations between treatment outcome and patient attitudes. Treatment outcome is compared with attitudes before therapy and attitude changes during therapy.

Before proceeding, it should be noted that 15 of the subjects used by Gannon in his original assessments of pretreatment attitude were not available for this research. The parents of these prospective patients withdrew their applications for treatment. They stated that orthodontic therapy was either too expensive or too demanding of their time or both. It is interesting to note, however, that these prospective patients generally had poor attitudes towards treatment (see Table I and Appendix III).

These patients were found to have very little desire to begin treatment and they were unwilling to tolerate the
Table I

Means and Standard Deviations of Attitude Scores of Patients Retained and Patients Lost and "t" Ratios

<table>
<thead>
<tr>
<th>Subscales</th>
<th>Patients Retained M₁</th>
<th>Patients Lost M₂</th>
<th>&quot;t&quot;</th>
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<tr>
<td>Desire before</td>
<td>91.36 9.36</td>
<td>79.40 10.37</td>
<td>3.92*</td>
</tr>
<tr>
<td>Social impediment before</td>
<td>64.17 11.73</td>
<td>47.73 11.36</td>
<td>4.78*</td>
</tr>
<tr>
<td>Discomfort before</td>
<td>37.05 5.03</td>
<td>31.73 5.30</td>
<td>3.37*</td>
</tr>
</tbody>
</table>

N₁ = 54, N₂ = 15, (Since the judges could not agree on six of the subjects, they were deleted from this table.)

* .01 confidence level
social impediments and discomforts anticipated during orthodontic therapy. By applying the "t" test of significant differences, it was found that the scores of these fifteen patients were significantly lower than the scores of the patients who remained for treatment.

3. Treatment Evaluation:

Before determining the effects any pretreatment attitude might have on treatment outcome, it was first necessary to establish how well the treatment of each subject had progressed. The method described in Chapter III (Methods and Materials), was used to determine treatment success. A concise treatment summary of each of the 60 cases was placed in a five-point treatment progress scale by each of the 10 judges. The means and standard deviations of the ratings given to each patient are presented in Table II, and Figures 1 and 2. The mean of the expert judgments is used as the best single index of treatment progress for each case. The standard deviation of the ratings for each case is an index of the amount of disagreement among the judges. If all the judges were to give exactly the same rating to a particular patient, the standard deviation would
Table II

Means and Standard Deviations of Treatment Evaluations for all Subjects

<table>
<thead>
<tr>
<th>Patient Number</th>
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<th>Standard Deviation</th>
<th>Patient Number</th>
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FIGURE 1
STANDARD DEVIATIONS OF TREATMENT OUTCOME RATINGS

N = 60
FIGURE 2

FREQUENCY DISTRIBUTION OF MEAN TREATMENT OUTCOME

N = 60
be zero. As the ratings depart from perfect agreement, the standard deviation increases. The greater the disagreement, the larger the standard deviation.

Obviously, one can be more certain about the degree of treatment progress in those cases where the judges agree, than one can be in those cases where the judges disagree. However, disagreement, as used here, is a matter of degree and there are no absolute standards. For the purposes of this study, the solution consists of simply eliminating the patients about whom the judges disagreed the most. If the standard deviation of the ratings was 1.00 or greater, the subject was eliminated from the study. Since the judges could not agree on six patients, these patients were not used when treatment success was correlated with patient attitudes.

B. Attitude Changes During Treatment:

Gannon (1964) developed a psychological tool with which he measured certain attitudes which seemed to be relevant in selecting patients who would cooperate. If the patient cooperates, treatment should be successful, as orthodontic technology at present is at a high level.
The four attitudes which Gannon thought might have some pretreatment indication as to the success or failure of treatment were as follows: (1) desire for orthodontic treatment, (2) willingness to tolerate social impediments during treatment, (3) willingness to tolerate discomforts associated with treatment, and (4) total patient attitude. Item four was a summation of items one, two, and three.

The analysis in this particular section is to determine which, if any, of these attitudes changed during treatment.

After subjecting the patients in the sample to identical measurements, the four attitudes before treatment and after six months of treatment were compared. Statistical assessments of the changes were carried out and are shown in Tables III and IV.

From these data may be drawn the fact that patients were accepting treatment more favorably as time passed. By this is meant, the four attitudes improved as treatment progressed. The desire to receive the benefits of treatment increased in both boys and girls. The willingness of these patients to tolerate those discomforts and those social impediments, which at the beginning of treatment seemed to loom high, also increased.
### Table III

**Attitude Change in Boys (N=26)**

<table>
<thead>
<tr>
<th>Attitude</th>
<th>Mean</th>
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<th>Standard Error</th>
<th>&quot;t&quot; value</th>
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<tbody>
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<td>Total Change</td>
<td>10.87</td>
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<td>4.81</td>
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</table>

* significant at .05 level (one-tailed test)
### Table IV

**Attitude Change in Girls (N=28)**

<table>
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<tr>
<th>Attitude</th>
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<th>Standard Error</th>
<th>&quot;t&quot; value</th>
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<td>8.44</td>
<td>1.62</td>
<td>1.98*</td>
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<tr>
<td>Total Change</td>
<td>13.68</td>
<td>25.31</td>
<td>4.87</td>
<td>2.80*</td>
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</table>

* significant at .05 level (one-tailed test)
A test for significant differences was run to determine how the attitude changes of boys compared with those of girls. Table V shows that the attitudes of both boys and girls changed in a favorable direction and to a similar degree. No significant difference was found between the attitude changes of the two sexes.

C. Correlation of Patient Attitude with Treatment Success:

Is there a correlation between patient attitude changes and treatment success? This is a very challenging question. Another equally challenging question is one which asks: "Do the attitudes before treatment in any way influence treatment progress and outcome?"

The data in Table VI contains the various attitude factors that apply to boys and show some very valuable information. None of the attitudes shown in Table VI was found to be directly related to treatment progress. Thus, to ask the various psychological questions used in the questionnaire developed by Gannon will serve no real purpose in predicting treatment outcome of boys. Are there factors outside of this test which might favorably affect the orthodontic treatment? Successful predictors for
<table>
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<th>Girls</th>
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<tr>
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<td>Mean</td>
<td>Standard Deviation</td>
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<td>Discomfort before</td>
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*significant at .05 level (one-tailed test)
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<th>A (intercept)</th>
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<td>.02</td>
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<td>.02</td>
<td>2.11</td>
<td>1.11</td>
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<tr>
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<td>.00</td>
<td>.00</td>
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<td>.32</td>
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<tr>
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<td>.04</td>
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<tr>
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<td>.00</td>
<td>.00</td>
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<td>.28</td>
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<td>.01</td>
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<td>.00</td>
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<td>.32</td>
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</tbody>
</table>

* significant at .05 level
treatment outcome of boys were not uncovered by using Gannon's questionnaire but must exist and should be investigated.

Table VII deals with the correlation between attitudes and treatment success in girls. Studying this table, one thing stands out in bold relief. That is that the attitude changes toward orthodontics, brought about by the operator during treatment, are much more important in controlling treatment outcome than are pretreatment attitudes toward orthodontics.

Total changes in attitude toward orthodontics were found to account for 33 per cent of the variance in treatment outcome. To further explain, perfect prediction would consist of accounting for all (100%) of the factors that control treatment outcome. In this case, because only one of the important controlling factors is being considered, the prediction value is 33 per cent. Other controlling factors, to be sure, could contribute to predicting the remaining 67 per cent of treatment success. One of these controlling factors may be the attitude of the orthodontist toward the patient; others may deal with
Table VII

Relationship between Criterion of Treatment Success of Girls and Various Predictors (N=28)

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<td>.06</td>
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<td>3.33*</td>
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<td>.02</td>
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<td>3.58*</td>
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* significant at .05 level
the seriousness of the malocclusion and various treatment obstacles. Still another may be the general health of the patient. The predictive values of these other controlling factors were not investigated in this study.

Table VII also indicates that one pretreatment attitude in girls was found to affect treatment success. It was observed that a pretreatment willingness to tolerate discomfort can predict 12 per cent of the variance in treatment success or failure. Here again, other controlling factors are responsible for the remaining 88 per cent of pretreatment predictability.

Summarizing the findings in Tables III through VII, it can now be said, without reservation, that whatever the preexisting attitudes may be toward orthodontics prior to treatment, these will not be indicators of treatment success in boys. In girls, pretreatment willingness to tolerate discomfort was the only effective predictor of treatment success. What is obviously a factor of much greater significance is the change in attitude during treatment. Should this change be in the favorable direction, treatment will tend to be successful, and if attitude deteriorates, treatment will tend to fail.
CHAPTER V

DISCUSSION

It is known that patient cooperation is one of the major controlling factors of treatment success or failure. It has always been suspected, yet never proved, that patient cooperation depends primarily on the attitude of the patient toward treatment. Gannon (1964) developed a psychological instrument for measuring those factors in attitude that seemed to him to be most relevant to patient cooperation. These factors are: desire for treatment, willingness to tolerate social inconvenience, willingness to withstand orthodontic discomforts, and total patient attitude.

The purpose of this research was to determine: (1) what changes in patient attitude take place during orthodontic treatment, (2) if treatment success can be predicted on the basis of pretreatment attitude, and (3) whether changes in patient attitude during treatment affect treatment outcome.

Before one can test controlling factors of treatment success, there must be standards established as to what is
or is not adequate treatment. It was decided that a standard method of communications had to be developed and for this research the method of communication was a treatment summary card. On this card were entered certain pertinent facts dealing with the status of the patient's occlusion, his diagnosis, and his treatment plan.

Admittedly, the statements concerning diagnosis and treatment planning were subjective and would depend in the final analysis upon the individual operator. This card (see Appendix II) served as a standardized means of communication between the treating orthodontist and the ten orthodontists who were asked to judge treatment progress. The judges were not asked whether they would agree with the diagnosis and treatment but, in view of the plan of the treating orthodontist, was the case progressing satisfactorily.

When these judgments were made, it was apparent that the standardized method for clear communication did indeed serve its purpose. There was good agreement among judges relative to what cases were succeeding and what cases were failing. Thus, a communicating instrument was developed and was demonstrated to be quite reliable.
Certain things can be accepted from the findings in Chapter IV. It was shown that nearly all the measured factors in patient attitude became more favorable during treatment. The attitudes of both boys and girls changed in a favorable direction and to a similar degree.

With regard to prediction of treatment outcome, the most important finding is that attitude manipulation during treatment, rather than the pretreatment attitudes of girls, is the most important factor to be considered.

In the case of boys, neither pretreatment attitudes nor attitude changes were related to treatment success. In girls, pretreatment willingness to tolerate discomfort was found to be related to treatment success. Of more importance, however, is the fact that all of the attitude changes induced during treatment are related to treatment success. The reason why similar attitude changes in boys and girls have different effects on treatment is not presently known.

Root (1949) found that children needed to satisfy two fundamental drives for normal personality development. These were self-expression and conformance with accepted standards.
From the latter observation, a reason for the difference in boys' and girls' treatment predictability suggests itself. It may be that girls tend to accept the wearing of orthodontic appliances by their friends whereas boys may ridicule and embarrass other boys who wear orthodontic appliances. Even though a boy may have a sincere desire to complete treatment, he may fail to cooperate because of the reactions of his friends. He is subconsciously rebelling to the ridicule of his associates.

If what Root states can be accepted as fact, we might also speculate that girls, being more mature socially, are more aware of their appearances than are boys of the same chronological age. Presently, the age consideration for the selection of orthodontic patients is based on dental age, and dental age corresponds more closely to chronological age than it does to social age, especially in boys. What has not been answered and what must be our important concern is whether girls and boys of the same social developmental age would act alike or differently. Thus, chronological or dental age is hardly a fair test for attitudes because we would expect the orthodontic
cooperation to be more closely related to social age or age of maturity.

Hence, the difference that was found between the effects of attitude changes of boys and girls on treatment outcome could be attributed to the difference in their social ages. From a motivational viewpoint, it might be better to begin orthodontic treatment with boys at a somewhat later chronological age, with the idea of treating them at a more desirable level of maturity. One important factor must be considered, however, and that is that time extensions may present physiologic limitations which tend to make treatment more difficult.

Although much has been learned about attitudes of children toward orthodontic treatment and about the effects attitudes have on treatment outcome, it is obvious that further work needs to be done before solid conclusions are drawn.

Investigations should be undertaken to determine what specific happenings during treatment change the attitude of patients favorably or unfavorably toward orthodontics. The fact that a favorable change in the attitude of girls
is related to treatment success, but a similarly favorable change in the attitude of boys is not related to treatment success, needs further exploration. Motivational factors, other than those explored by Gannon, may control treatment success of boys, or it may be that simply waiting until boys achieve greater social maturity would result in better cooperation. It would require extensive exploration in the area of depth motivation to uncover the real cause of why girls were found to be more predictable than boys.
A. Summary:

The dental literature has repeatedly pointed out a need for a clearer understanding of why some orthodontic patients finish treatment with rapid dispatch while others with apparently similar malocclusions go on for several years without ever really reaching a desirable result. The difference is clearly in the area of patient cooperation and not due to technical problems. Intrigued by these facts, Gannon (1964) developed a method for the assessment of those patient attitudes that seemed to him to be relevant to patient cooperation. These are: desire for treatment, willingness to tolerate social inconveniences, willingness to withstand orthodontic discomforts, and total patient attitude.

The purpose of this study was to determine whether these attitudes change during treatment, and whether pre-treatment attitudes or attitude changes affect treatment success.

The treatment progress was determined by ten qualified
orthodontists. One phase of this research was to devise a very concise treatment summary card which could be used by these ten orthodontists in evaluating treatment success of each subject.

Pretreatment attitude scores were made available by Gannon and six-month attitude scores were obtained by administering his attitude scale to the very same subjects.

B. Conclusions:

1. The prospective patients who decided against treatment before orthodontics was initiated were those demonstrating the least favorable pretreatment attitudes concerning its benefits.

2. The attitudes of both boys and girls changed significantly in a favorable direction during orthodontic treatment.

3. There were no pretreatment attitude scores found to be significant in predicting future treatment success of boys.

4. Willingness to tolerate discomforts was the only pretreatment attitude that was found to be significantly related to treatment outcome of girls.
(5) All of the attitude change scores in girls were found to be significantly related to treatment outcome. Total attitude change in the favorable direction was found to account for thirty-three per cent of the difference in success as against failure. This means that one-third of the success of treatment depends on the attitude changes that take place during treatment.


Campisi, R. S. A study of truthfulness in male orthodontic patients from the appraisal of certain autonomic responses to questions concerning cooperation. Unpublished Masters Thesis. Loyola University, 1963.


Towell, R. B. The possible psychological effect upon the adolescent patient as a result of poor esthetics due to failure to diagnose and to treat satisfactorily fractured, malformed, malpositioned or missing anterior teeth. The Journal of the Mississippi Dental Association, 15:9-11, 1959.


Appendix I

ORTHODONTIC ATTITUDE SCALE

Please read all questions and circle only one answer which you think best applies to each question. If you do not understand any questions, please ask them to be explained. Thank you.

SECTION I

1. How important do you think "straight" or "even" teeth are for a pleasing appearance?
   a) Very important   d) Unimportant
   b) Important        e) Very unimportant
   c) Undecided

2. How much do you want your teeth straightened?
   a) Want very much    d) Do not want
   b) Want              e) Strongly do not want
   c) Undecided

3. How much do you think you need your teeth straightened?
   a) Need very much    d) Do not need
   b) Need              e) Strongly do not need
   c) Undecided

4. How anxious are you to begin orthodontic treatment?
   a) Very anxious     d) Not very anxious
   b) Anxious          e) Strongly not very anxious
   c) Undecided

5. How important do you think it is to have your teeth straightened?
   a) Very important   d) Unimportant
   b) Important        e) Very unimportant
   c) Undecided
6. How much of your allowance (spending money) would you be willing to give up to help pay for your orthodontic treatment?
   a) All of the entire amount
   b) More than half of the entire amount
   c) Undecided
   d) Less than half of the entire amount
   e) None of the entire amount

7. Would you be willing to give up participating in sports and play because you have to wear your headgear?
   a) Very willing
   b) Willing
   c) Undecided
   d) Unwilling
   e) Very unwilling

8. How often would you be willing to brush your teeth in order to keep them clean while undergoing orthodontic treatment?
   a) 4 or more times a day
   b) 2 times a day
   c) Undecided
   d) Only once a day
   e) Only when I feel like it

9. How willing would you be to wear your elastics and headgear eighteen months or two years in order to have your teeth straightened?
   a) Very willing
   b) Willing
   c) Undecided
   d) Unwilling
   e) Very unwilling

10. How willing would you be to wear your elastics (rubber bands) twenty-four hours a day (except while eating)?
   a) Very willing
   b) Willing
   c) Undecided
   d) Unwilling
   e) Very unwilling

11. How willing would you be to wear your headgear (neck strap) from the time school is out until school begins the next day, during the course of your entire treatment?
   a) Very willing
   b) Willing
   c) Undecided
   d) Unwilling
   e) Very unwilling
12. During the course of your entire treatment, how willing would you be to wear your headgear (forehead strap) from the time school is out until school begins the next day?  
   a) Very willing  
   b) Willing  
   c) Undecided  
   d) Unwilling  
   e) Very unwilling

13. Will you be willing to carry a toothbrush with you at all times in order to maintain proper cleanliness of your teeth?  
   a) Definitely no  
   b) Probably no  
   c) Undecided  
   d) Probably yes  
   e) Definitely yes

14. How willing would you be to give up two afternoons a month of school time in order to have your teeth straightened?  
   a) Very willing  
   b) Willing  
   c) Undecided  
   d) Unwilling  
   e) Very unwilling

15. How fortunate do you think you are to have the opportunity to have your teeth straightened?  
   a) Very fortunate  
   b) Fortunate  
   c) Undecided  
   d) Unfortunate  
   e) Very unfortunate

16. How essential do you think it is to keep your orthodontic appointments while undergoing treatment?  
   a) Very essential  
   b) Essential  
   c) Undecided  
   d) Unessential  
   e) Very unessential

17. How happy will you be to have straight teeth?  
   a) Very happy  
   b) Happy  
   c) Undecided  
   d) Unhappy  
   e) Very unhappy

18. How much will you like coming to the dental school for your appointments?  
   a) Like very much  
   b) Like  
   c) Undecided  
   d) Dislike  
   e) Dislike very much
19. How willing will you be to give up gum and candy in order to have your teeth straightened?
   a) Very willing    d) Unwilling
   b) Willing        e) Very unwilling
   c) Undecided

20. How willing will you be to tolerate speech difficulties caused by wearing rubber bands, headgears, and bands on your teeth?
   a) Very willing    d) Unwilling
   b) Willing        e) Very unwilling
   c) Undecided

21. How willing will you be to suffer the discomfort (pain) of wearing your rubber bands?
   a) Very willing    d) Unwilling
   b) Willing        e) Very unwilling
   c) Undecided

22. How willing will you be to suffer the discomfort (pain) of wearing either the forehead strap or neck strap?
   a) Very willing    d) Unwilling
   b) Willing        e) Very unwilling
   c) Undecided

SECTION II

23. How self-conscious are you about the way your teeth look now?
   a) Very self-conscious    d) Unself-conscious
   b) Self-conscious         e) Very unself-conscious
   c) Undecided

24. How embarrassed will you be about your appearance while you're wearing braces?
   a) Very embarrassed    d) Not embarrassed
   b) Embarrassed         e) Very not embarrassed
   c) Undecided
25. How much do you think wearing braces will affect your social activities (parties, dating, sports, outdoor activities, indoor activities, etc.)?
   a) Affect very much    d) Not affect
   b) Affect            e) Very not affect
   c) Undecided

26. How willing will you be to tolerate the appearance of your braces while at parties, dating, etc.?
   a) Very willing    d) Unwilling
   b) Willing           e) Very unwilling
   c) Undecided

27. How willing will you be to give up some after-school activities in order to have your teeth straightened?
   a) Very willing    d) Unwilling
   b) Willing           e) Very unwilling
   c) Undecided

28. How embarrassed will you be to wear your headgear (neck strap) while you are in school?
   a) Very embarrassed    d) Not embarrassed
   b) Embarrassed        e) Very not embarrassed
   c) Undecided

29. How embarrassed will you be to wear your headgear (neck strap) in front of friends in both your home and theirs?
   a) Very embarrassed    d) Not embarrassed
   b) Embarrassed        e) Very not embarrassed
   c) Undecided

30. How embarrassed will you be to wear your headgear (forehead strap) while you are in school?
   a) Very embarrassed    d) Not embarrassed
   b) Embarrassed        e) Very not embarrassed
   c) Undecided

31. How embarrassed will you be to wear your headgear (forehead strap) in front of friends in both your home and theirs?
   a) Very embarrassed    d) Not embarrassed
   b) Embarrassed        e) Very not embarrassed
   c) Undecided
32. How distracting do you think your headgear will be to you while you are studying?
   a) Very distracting  d) Not distracting
   b) Distracting       e) Very not distracting
   c) Undecided

33. How distracting do you think your elastics will be to you while you are studying?
   a) Very distracting  d) Not distracting
   b) Distracting       e) Very not distracting
   c) Undecided

34. Will wearing your elastics in class distract you?
   a) Definitely yes  d) Probably no
   b) Probably yes    e) Definitely no
   c) Undecided

35. Do you think the headgear is unsightly or ugly?
   a) Definitely yes  d) Probably no
   b) Probably yes    e) Definitely no
   c) Undecided

36. Do you think your friends will think your headgear is unsightly?
   a) Definitely yes  d) Probably no
   b) Probably yes    e) Definitely no
   c) Undecided

37. Do you think that your friends will think that your braces detract from your appearance?
   a) Definitely yes  d) Probably no
   b) Probably yes    e) Definitely no
   c) Undecided

38. Will you be self-conscious about the appearance of your braces?
   a) Definitely yes  d) Probably no
   b) Probably yes    e) Definitely no
   c) Undecided
39. Do you think your school grades will suffer by your being absent from school in order to have your teeth straightened?
   a) Definitely yes  
   b) Probably yes  
   c) Undecided  
   d) Probably no  
   e) Definitely no

40. Do you think the appearance of your friends who wear braces has been unfavorably changed?
   a) Definitely yes  
   b) Probably yes  
   c) Undecided  
   d) Probably no  
   e) Definitely no

41. Do you think the personality of your friends who wear braces has been unfavorably changed?
   a) Definitely yes  
   b) Probably yes  
   c) Undecided  
   d) Probably no  
   e) Definitely no

42. How willing will you be to tolerate speech difficulties caused by wearing rubber bands, headgears, and bands on your teeth?
   a) Very willing  
   b) Willing  
   c) Undecided  
   d) Unwilling  
   e) Very unwilling

SECTION III

43. Do you think wearing the rubber bands will cause pain?
   a) Definitely yes  
   b) Probably yes  
   c) Undecided  
   d) Probably no  
   e) Definitely no

44. How pleasant do you think it will be to wear your forehead strap or neck strap while sleeping?
   a) Very pleasant  
   b) Pleasant  
   c) Undecided  
   d) Unpleasant  
   e) Very unpleasant
45. Will you continue to wear your headgear (forehead strap or neck strap) even though it may cause a great amount of pain?
   a) Definitely yes       d) Probably no
   b) Probably yes          e) Definitely no
   c) Undecided

46. How much do you think the bands and wires will irritate your cheeks, tongue, and lips?
   a) Very much       d) Not very much
   b) Slightly          e) Not at all
   c) Undecided

47. How painful do you think it will be to undergo orthodontic treatment?
   a) Very painful       d) Not painful
   b) Painful           e) Very not painful
   c) Undecided

48. Do you think that your teeth can be straightened without any pain?
   a) Definitely yes       d) Probably no
   b) Probably yes         e) Definitely no
   c) Undecided

49. How worried are you about having your teeth straightened?
   a) Very worried       d) Unworried
   b) Worried          e) Very unworried
   c) Undecided

50. Do you fear the thought of having your teeth straightened?
   a) Definitely yes       d) Probably no
   b) Probably yes        e) Definitely no
   c) Undecided

51. How comfortable do you think it will be to wear your elastics while sleeping?
   a) Very comfortable       d) Uncomfortable
   b) Comfortable        e) Very uncomfortable
   c) Undecided
52. How comfortable do you think it will be to wear your head-gear (forehead or neck strap) while sleeping?
   a) Very comfortable
   b) Comfortable
   c) Undecided
   d) Uncomfortable
   e) Very uncomfortable

53. How willing will you be to suffer the discomfort (pain) of wearing your rubber bands?
   a) Very willing
   b) Willing
   c) Undecided
   d) Unwilling
   e) Very unwilling

54. How willing will you be to suffer the discomfort (pain) of wearing either the forehead strap or neck strap?
   a) Very willing
   b) Willing
   c) Undecided
   d) Unwilling
   e) Very unwilling

SECTION IV

55. Do you think you will have fewer cavities because your teeth are straightened?
   a) Definitely yes
   b) Probably yes
   c) Undecided
   d) Probably no
   e) Definitely no

56. Do you think it will be easier to brush your teeth and keep them clean if they are straightened?
   a) Definitely yes
   b) Probably yes
   c) Undecided
   d) Probably no
   e) Definitely no

57. Do you think it will be easier to chew food if your teeth are straightened?
   a) Definitely yes
   b) Probably yes
   c) Undecided
   d) Probably no
   e) Definitely no

58. Do you think it will be easier to breathe if your teeth are straightened?
   a) Definitely yes
   b) Probably yes
   c) Undecided
   d) Probably no
   e) Definitely no
59. Do you think it will be easier to speak more clearly if you have your teeth straightened?
   a) Definitely yes  
   b) Probably yes  
   c) Undecided  
   d) Probably no  
   e) Definitely no

60. How important do you think straight teeth are for a pleasing appearance?
   a) Very important  
   b) Important  
   c) Undecided  
   d) Unimportant  
   e) Very unimportant

61. How much improved do you think your teeth would look if they were straightened?
   a) Extremely improved  
   b) Improved  
   c) Undecided  
   d) Unimproved  
   e) Extremely unimproved

62. Do you think having your teeth straightened will change the appearance of your face?
   a) Definitely yes  
   b) Probably yes  
   c) Undecided  
   d) Probably no  
   e) Definitely no

63. How pleasant do you think your smile is presently?
   a) Very pleasant  
   b) Pleasant  
   c) Undecided  
   d) Unpleasant  
   e) Very unpleasant

64. How satisfied are you with the appearance of your teeth presently?
   a) Very satisfied  
   b) Satisfied  
   c) Undecided  
   d) Unsatisfied  
   e) Very unsatisfied

65. Which of the following statements applies?
   a) I dislike the appearance of my teeth and wish them to be straightened.
   b) I dislike the appearance of my teeth but do not want them to be straightened.
   c) I like the appearance of my teeth and do not want them straightened.
d) I like the appearance of my teeth and still want them to be straightened.

66. Does your father think that you need to have your teeth straightened?
   a) Definitely yes
   b) Probably yes
   c) Undecided
   d) Probably no
   e) Definitely no

67. Does your mother think that you need to have your teeth straightened?
   a) Definitely yes
   b) Probably yes
   c) Undecided
   d) Probably no
   e) Definitely no

68. Do you think that you need to have your teeth straightened?
   a) Definitely yes
   b) Probably yes
   c) Undecided
   d) Probably no
   e) Definitely no

69. How important was your dentist's influence on your decision to have your teeth straightened?
   a) Very important
   b) Important
   c) Undecided
   d) Unimportant
   e) Very unimportant

70. How important was your friends' influence on your decision to have your teeth straightened?
   a) Very important
   b) Important
   c) Undecided
   d) Unimportant
   e) Very unimportant

71. How important was your parents' influence on your decision to have your teeth straightened?
   a) Very important
   b) Important
   c) Undecided
   d) Unimportant
   e) Very unimportant

72. Was the decision to have your teeth straightened yours and yours alone?
   a) Definitely yes
   b) Probably yes
   c) Undecided
   d) Probably no
   e) Definitely no
73. Was your own desire the main influence for having your teeth straightened?
   a) Definitely yes  
   b) Probably yes  
   c) Undecided  
   d) Probably no  
   e) Definitely no

74. Do you want only your front teeth (the teeth that show) straightened?
   a) Definitely yes  
   b) Probably yes  
   c) Undecided  
   d) Probably no  
   e) Definitely no

75. Do you want both the front and the back teeth straightened?
   a) Definitely yes  
   b) Probably yes  
   c) Undecided  
   d) Probably no  
   e) Definitely no
# Appendix II

## TREATMENT EVALUATION INSTRUMENT

Patient's Name ____________________________________  

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Mechanics to Date:    

Remarks: 

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67
### Appendix III

**ATTITUDE SCORES OF PATIENTS LOST FROM SAMPLE**

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## Appendix IV

### ATTITUDE SCORES OF PATIENTS RETAINED

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APPROVAL SHEET

The thesis submitted by Dr. Gene L. Dongieux has been read and approved by members of the Departments of Anatomy and Oral Biology.

The final copies have been examined by the director of the thesis and the signature which appears below verifies the fact that any necessary changes have been incorporated, and that the thesis is now given final approval with reference to content, form, and mechanical accuracy.

The thesis is therefore accepted in partial fulfillment of the requirements for the Degree of Master of Science.

Date

Signature of Adviser