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A Study of Truthfulness in Female Orthodontic Patients, from the Appraisal of Certain Autonomic Responses, to Questions Concerning Cooperation

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A STUDY OF TRUTHFULNESS IN FEMALE
ORTHODONTIC PATIENTS, FROM THE APPRAISAL
OF CERTAIN AUTONOMIC RESPONSES, TO QUESTIONS
CONCERNING COOPERATION.

BY

THOMAS P. CAVANAUGH, JR.

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

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LIFE

Thomas P. Cavanaugh was born in Chicago, Illinois on September 13, 1936. He was graduated from Mt. Carmel High School in Chicago, Illinois in June 1954.

He attended pre-dental training from 1954-1957 at Loyola University. He was accepted to Loyola University, School of Dentistry, September 1957 and received the Degree of Doctor of Dental Surgery in June 1961. He was accepted to the Graduate School and the Department of Orthodontics at Loyola University School of Dentistry, June 1961.

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INTRODUCTION

As progress in orthodontics moves forward the problem of patient cooperation has improved very little. In this investigation I will attempt to bring forward some of the problems relative to cooperation. This is very important since the level of patient cooperation is related to treatment time. The purpose of the investigation was to determine the level of patient truthfulness in regard to their cooperation in Orthodontic treatment. An analysis of the physiologic responses of the patient as recorded on the polygraph was used.

CHAPTER I

REVIEW OF RELATED LITERATURE

Anatomy and Physiology

The word polygraph is a Greek word meaning "Poly" - consisting of several, and "Graph" - a writer or instrument making records. We could then say that the polygraph is an instrument for making several different recordings.

The polygraph is a machine which records certain physiologic changes in the human body. These physiologic changes are controlled by the autonomic nervous system. To have a thorough knowledge of the polygraph technic, a basic understanding of the autonomic nervous system is necessary.

The somatic nerves make a direct connection between the central nervous system and their respective organs. These nerves are not interrupted, or relayed, in their transmission from central nervous system to the peripheral organs. In the autonomic nervous system there is a gap between the central nervous system and the vegetative or visceral organs.

This gap is the many different ganglia the visceral efferent fibers pass through to make connection between the central nervous system and visceral organ. These nerves do not actually pass through these ganglia but one preganglionic fiber may relay its impulse through numerous terminal branches (post-ganglionic fibers) to many neurons of the second group, each

of which sends an axon to a motor organ. This type of system eliminates multiple connections with the central nervous system of each separate motor unit.

The cells of origin of the sympathetic division are located in the lateral horns of the spinal cord (intermediolateral cell column). They extend from the 8th cervical or 1st thoracic to the 2nd or 3rd lumbar segments. The fibers arising from the spinal cord are medullated and are called preganglionic, those arising from cells of the ganglia are nonmedullated, and are called postganglionic. These cells of the ganglion are all motor in function with no afferent connections from the periphery.

The ganglion of the autonomic nervous system may be placed into three different groups according to their anatomical location. There are paravertebral (lateral), prevertebral (colateral), and terminal (peripheral).

By means of the lateral ganglia the sympathetic chain is formed on each side of the spinal cord. Many of the preganglionic fibers of the sympathetic system end in one of the twenty-two pairs of ganglia lying along the vertebral column. Most of the fibers end in the corresponding ganglion, but others do not make any synaptic connection and continue to a more distant ganglion. Thus many of these ganglia are connected by many intervening fibers forming the sympathetic chain.

The prevertebral ganglia lie a short distance from the

spinal column. They are the celiac, superior mesenteric, and inferior mesenteric ganglia.

The postganglionic fibers from both the lateral and colateral ganglia, supply many organs such as: dilators for the pupil; vasoconstrictors for the blood vessels of skin, stomach, intestines, kidneys, etc., secretory nerves for the sweat glands; cardiac accelerator fibers; motor fibers for the pyloric, ileocolic, and internal anal sphincter; inhibitory fibers for the muscles of the stomach, intestine, and bladder; and pilomotor nerves for erectors of the hairs.

The third type of ganglia known as the terminal ganglia are associated only with the parasympathetic nervous system. These terminal or peripheral ganglia are in very close association with the organ in which they innervate. Therefore, the preganglionic fibers are very long and the postganglionic fibers are relatively short.

The sacral nerves (preganglionic) form the pelvic nerve which terminate in the pelvic ganglion (terminal). The short postganglionic fibers supply the colon (lower part), rectum, internal anal sphincter, bladder, and blood vessels of the genital organs.

The cranial preganglionic fibers, from the midbrain, by way of the third cranial nerve end in the ciliary ganglion just posterior to the eye. The postganglionic fibers innervate the muscles of accommodation and the sphincter of the iris. The remaining cranial preganglionic fibers leave the medulla

oblongata by the seventh (facial), ninth (glossopharyngeal), and tenth (vagus) cranial nerves. Fibers of the seventh and ninth cranial nerves innervate terminal ganglia (submaxillary and otic ganglia) sending postganglionic fibers to the salivary glands. The preganglionic fibers of the tenth nerve are distributed to the heart (inhibitory), the various parts of the digestive canal, to the gall bladder, liver, pancreas, and kidneys. In the vagus nerve the preganglionic fibers are very long. Since the ganglion cells are in their respective organs, the postganglionic fibers are very short.

We exercise volitional control over skeletal muscles by means of the somatic system. We cannot voluntarily send impulses to the muscles and glands of the vegetative organs and the autonomic reflexes do not affect our consciousness. This is the reason the autonomic nervous system is spoken of as the involuntary nervous system. The two systems must not be thought of to be as two distinct or unrelated systems.

Activity of the cerebral cortex frequently has a powerful effect upon the vegetative organs. A mention of common experiences, or influence of emotions will have a noticeable reaction on cardiac, vascular, respiratory, and sweat gland functions.

All organs supplied by the autonomic nerves receive two innervations. These innervations are sympathetic and parasympathetic. These nerves work like the extensor and flexor

muscles of the arm. They are antagonistic only in the sense that they hold or exercise a mutual check on each other. This relationship should be looked upon as complimentary rather than antagonistic.

When norepinephrine is injected into the blood stream in small doses, effects are produced that are identical to those elicited by stimulation of the sympathetic division. Post-ganglionic fibers of this system typically liberate at their neuro-effector junctions, a substance that is similar to norepinephrine in its action. Fibers that produce this substance accordingly are known as adrenergic fibers. Another drug, acetylcholine, when administered in very small doses, produces effects similar to those following stimulation of the parasympathetic division. Most, if not all, postganglionic fibers of this system liberate acetylcholine at their terminals. The preganglionic fibers of both systems and some postganglionic fibers of the thoracolumbar system also liberate acetylcholine. Such fibers are designated cholinergic. The fibers to the sweat glands, for example, although having their origin in the thoracolumbar sympathetic ganglia, are cholinergic; the pilomotor fibers, whose origin is similar, are adrenergic. There is some evidence that adrenergic fibers are associated with the craniosacral autonomic innervation of certain organs.

The autonomic nervous system is not in complete control of the viseral organs. There is what is commonly known as a

psychosomatic reaction. The cortical activity accompanying the generation of an emotion may be pictured as stimulating the orbital frontal areas and thereby, directly or by way of the hypothalamus, affecting the visceral function as changes in blood pressure, sweat gland activity, and in the rhythm of respiration. The hypothalamus is the chief integrator for the functions of the visceral organs and integrative center for emotional reactions.

One can now readily see the scientific basis for the polygraph. This technique by using physiologic responses from the sympathetic division of the autonomic nervous system as our basis for recording can now be understood. One can utilize the autonomic responses which induce physiologic changes in blood pressure, pulse characteristics, respiratory movements, and sweat gland activity which is the basis for the polygraph examination.

History of Deception

The Greek Erosiotratus in 300 B.C. was the first to use the pulse rate to detect deception. His first attempts were very sound and were based upon the same psychological and physiological principles as the modern day polygraph technique. Another very old method was the Chinese method of rice chewing. The man on trial was given a handful of rice to chew. If the man had something to fear there was a decrease in the amount of salivation and he could not swallow the rice. Therefore, the

man was guilty. As early as Boccaccio's time (1313-1373) the increase in pulsation and the advance of blood pressure was measured to detect deception.

During the time of Galileo (1581) a Roman Court Physician believed in the theory that emotions were produced from the inner actions of the body. He believed that if the heart worked faster or slower our emotions would vary. His theory was completely in reverse, but it did accelerate further work in that field.

1875-1895, A. Musso, an Italian Psychologist, conducted many experiments relating the effect of fear to blood pressure. At the same time C. Lambroso developed the hydrosphygmograph. A hand was immersed in a water filled tank and sealed. The pulsations of the blood caused a rising and lowering of the water and these recordings were made on a smoke drum. This device was used in many cases to aid the Italian police. 1904 Munsterberg used in court the blood pressure method to detect deception.

At the beginning of the twentieth century there were various methods being used. Some used heat measurements, blood vessel dilation and contraction, and the electrocardiograph. Marston in 1915 claimed that systolic pressure constituted an accurate method for detecting deception. Benussi in 1914 and Burt in 1921 recorded respiration of subjects while lying and concluded that an apparent change in the inspiration-

expiration ratio was a sign of deception.

Larson in 1921 used an Erlanger Sphygmomanometer in combination with a pneumograph. In 1932 Father Summers using an instrument of his own design for recording skin electrical variations, experimented with detection of deception. In 1925, Leonardi Keeler became interested in using records of pulse and respiration in detection of deception. Keeler designed and built his first machine to record pulse and respiration. In 1930 he came to Chicago to work in the Scientific Crime Detection Laboratory at Northwestern University. He entered private business in 1938 and founded lie detector laboratories and institutes for teaching his techniques.

The person being examined must have fear of the machine. They must be told or shown the possibilities and perfection the polygraph has in the detection of deception. As it has been said before, fear will only give a more pronounced reaction on the polygraph.

Mr. Harrelson of Keeler Polygraph Institute states:

"that the polygraph is a machine which detects physiological changes when there is deception and if the subject is questioned correctly and the right techniques are used, then it is all on the chart and therefore, conclusive. It is up to the examiner to interpret the charts and the only possibility of inclusiveness is on the part of the examiner who is not competent enough to interpret them correctly".

The polygraph is used in many businesses today. It is used for both pre-employment examinations and checking the honesty

of the presently employed. The polygraph is used very widely in criminal investigation and scientific research.

Use of the Polygraph in Dentistry

Law and Lewis (1958) did an investigation of certain autonomic responses of children to a specific dental stress. In their study four psychophysiological responses were recorded. They were galvanic skin reflex, face temperature, hand temperature, and heart rate. (Mittelman and Wolff reported that under stress there is decrease in hand temperature and increase in face temperature).

The only major problem which occurred was keeping the patient from making unnecessary movements. These movements would effect the galvanic skin reflex. The children were very cooperative and did not mind placement of attachments. The readings were taken during ordinary dental procedures to test individuals for states of anxiety or fear.

In summary Law and Lewis state:

"The use of the polygraph technic for measuring heart rate, face and hand temperature, and galvanic skin reflex, has been found to be a practicable method for the study of childrens' emotions under dental situations".

Yoshi Ando (1961) did an investigation of the psychological responses of patients in Orthodontic treatment. Using only the galvanic skin reflex, his investigations were taken during ordinary orthodontic procedures. He observed a greater physiologic response in the galvanic skin reflex on the part of male patients than on female patients.

CHAPTER II

METHODS AND MATERIALS

Selection of Patients:

Fifteen female patients were selected from the Orthodontic Department of Loyola University, School of Dentistry. They were all eleven to fifteen years old, and have been under orthodontic care for seven to ten months. These children were all wearing elastics, or elastics and headgear together.

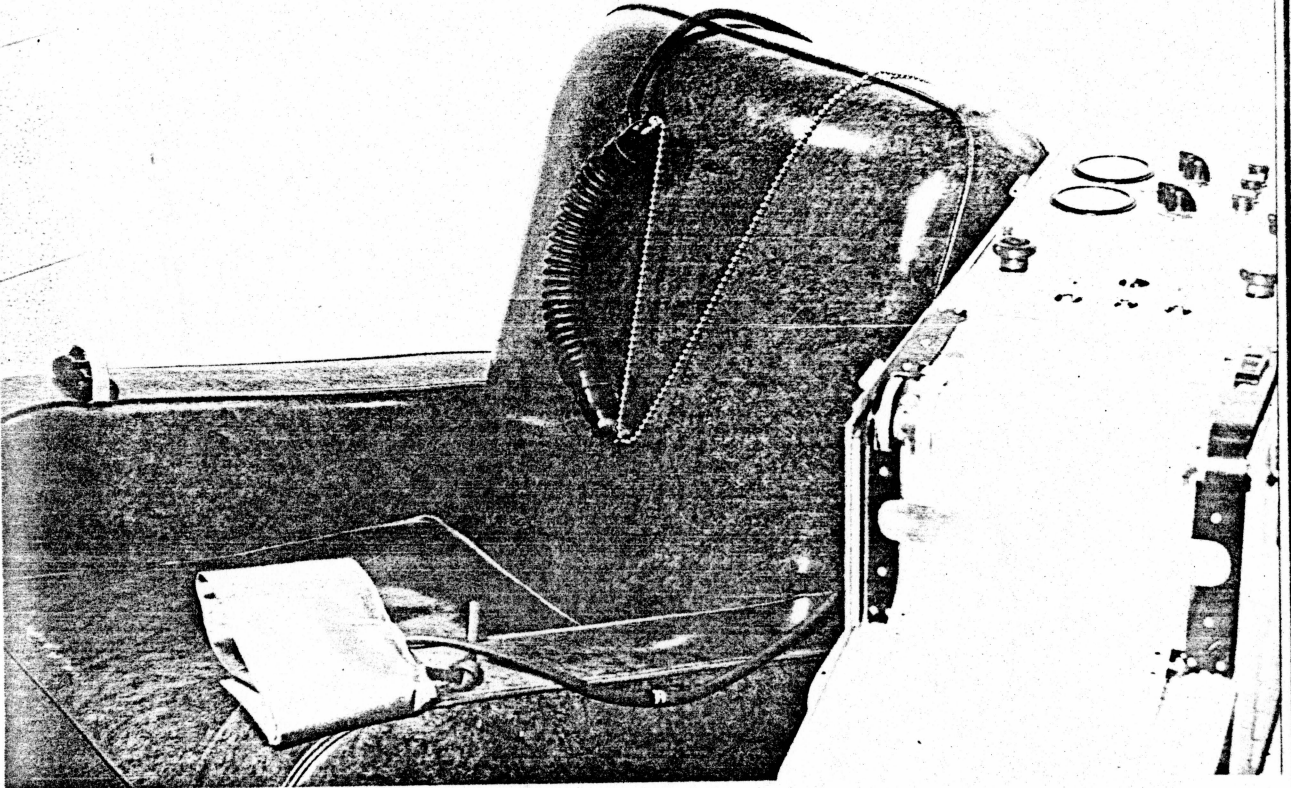
In the correction of the malocclusions of the fifteen selected children, a certain amount of cooperation is needed from each patient. Every patient has an orthodontic appliance adapted for her particular type of malocclusion. Every orthodontic appliance has a force system built into it. This is called an intrinsic force system. In many cases this is adequate, but in many other instances it must be aided by an extrinsic force system. This extrinsic force system is composed of two types: intraoral (elastics only) and extraoral (headgear). The extrinsic force system appliances are removable, and under complete control of the patient. This experiment is primarily concerned with how long these patients are actually wearing their appliances, and what level of cooperation we might expect from these patients. All the patients were instructed to wear their elastics twenty-four hours per day. In practice, however, the elastics are changed four times a

day and removed during meals. The headgear is worn after school and all night, at least fourteen hours per day.

Examination Room and Polygraph

To conduct a most reliable polygraph examination, a room which is almost completely free of extraneous noises is necessary. The room used was especially constructed for this purpose with walls to attenuate noises originating on the outside and surfaces to reduce the reverberation time for noises originating inside the room. Lighting was somewhat subdued, coming from flush ceiling fixtures. A ventilation fan in the ceiling moved air through the room. There were no objects within the field of view of the patient to distract her.

The examination room is equipped with two chairs, a table and a polygraph unit to be described later. (Fig. 1). The chair selected for the patient must have large arm rests. This enables the patient to rest his arms and hands and it keeps them in view of the examiner at all times. The table, polygraph unit, and examiner's chair are arranged in such a manner, as to allow the examiner to have unobstructed view of the patient. The polygraph unit must be at a proper level to enable the examiner to write on its examination chart with ease and to have access to the controls of polygraph, while the exam is in progress. The patient is placed so that she cannot watch the polygraph unit, but close enough that a conversation may be carried out in a moderate tone of voice. The Keeler Polygraph



EXAMINATION ROOM

AND

POLYGRAPH

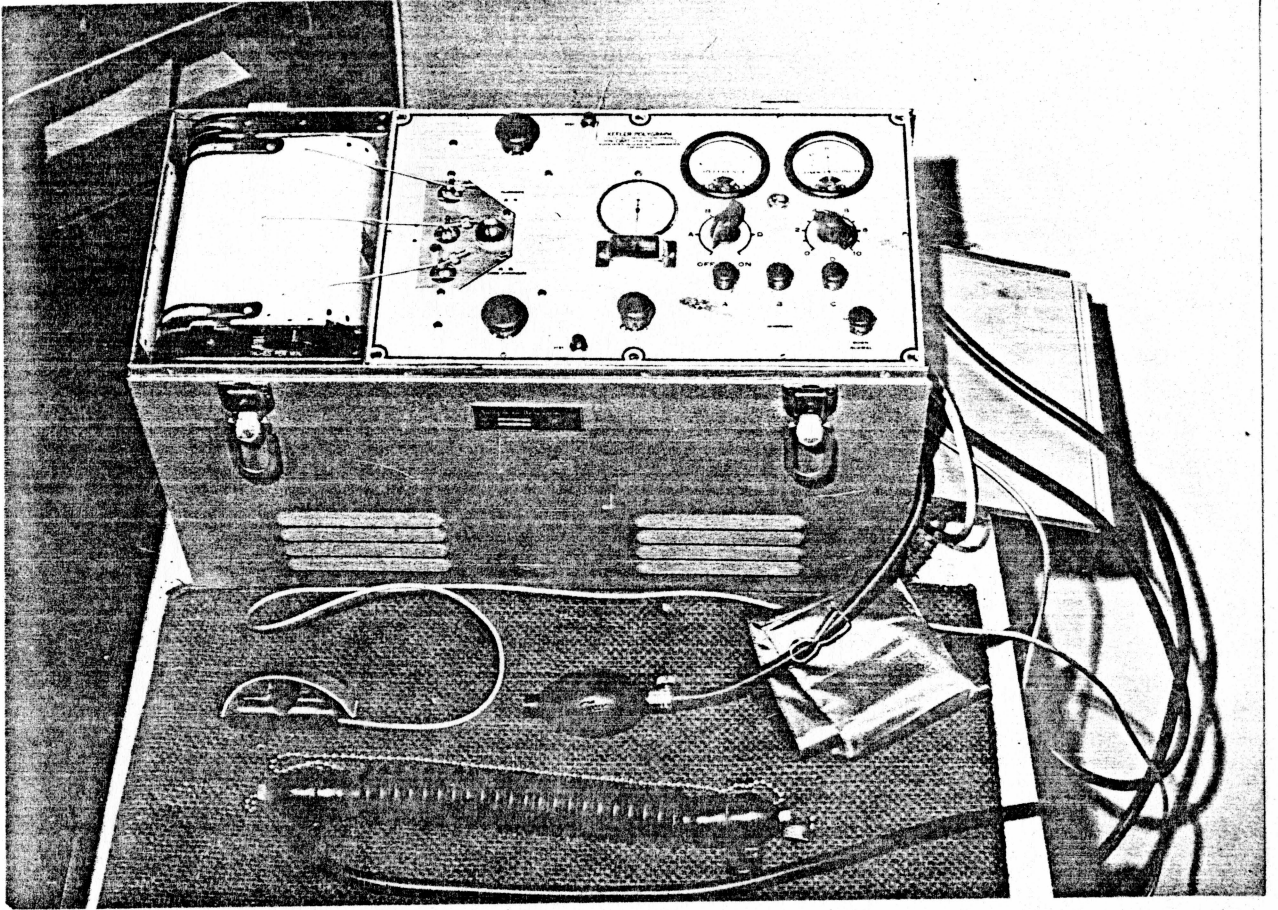
(Figure 1.)

is an extremely sensitive instrument, components of which, are designed to record physiological changes accompanying the psychological reactions of the individual being questioned. (Fig. 2). The Model 302 is equipped with a kymograph mechanism which drives a strip chart forward under the pens at a uniform rate. It also contains a cardiophygmograph unit for recording amplitude and frequency of heart action of the person being questioned, and a pneumograph unit for recording amplitude and pattern of respiration. The Model 302 also has a galvanograph unit to record changes in skin-resistivity of the person being interrogated. Accessories necessary to operation of the machine consist of a blood pressure cuff assembly (Fig. 3) and connecting hose for attachment to the cardiosphygmograph, a blood pressure pump bulb and connecting hose with special spring type pressure clamp, a pneumograph chest assembly (Fig. 4) with its connecting hose for attachments to the pneumograph recording unit, a hand electrode (Fig. 5) with attaching cable for connection with the galvanograph and a line cord for connecting the unit to the 115 volt, AC power source.

The mechanism is completely self-contained in a metal case with hinged top and ends (Fig. 6). The hinged top is equipped with slip-hinges for easy removal and may also be locked by means of the two trunk-type locks located on the case and lid.

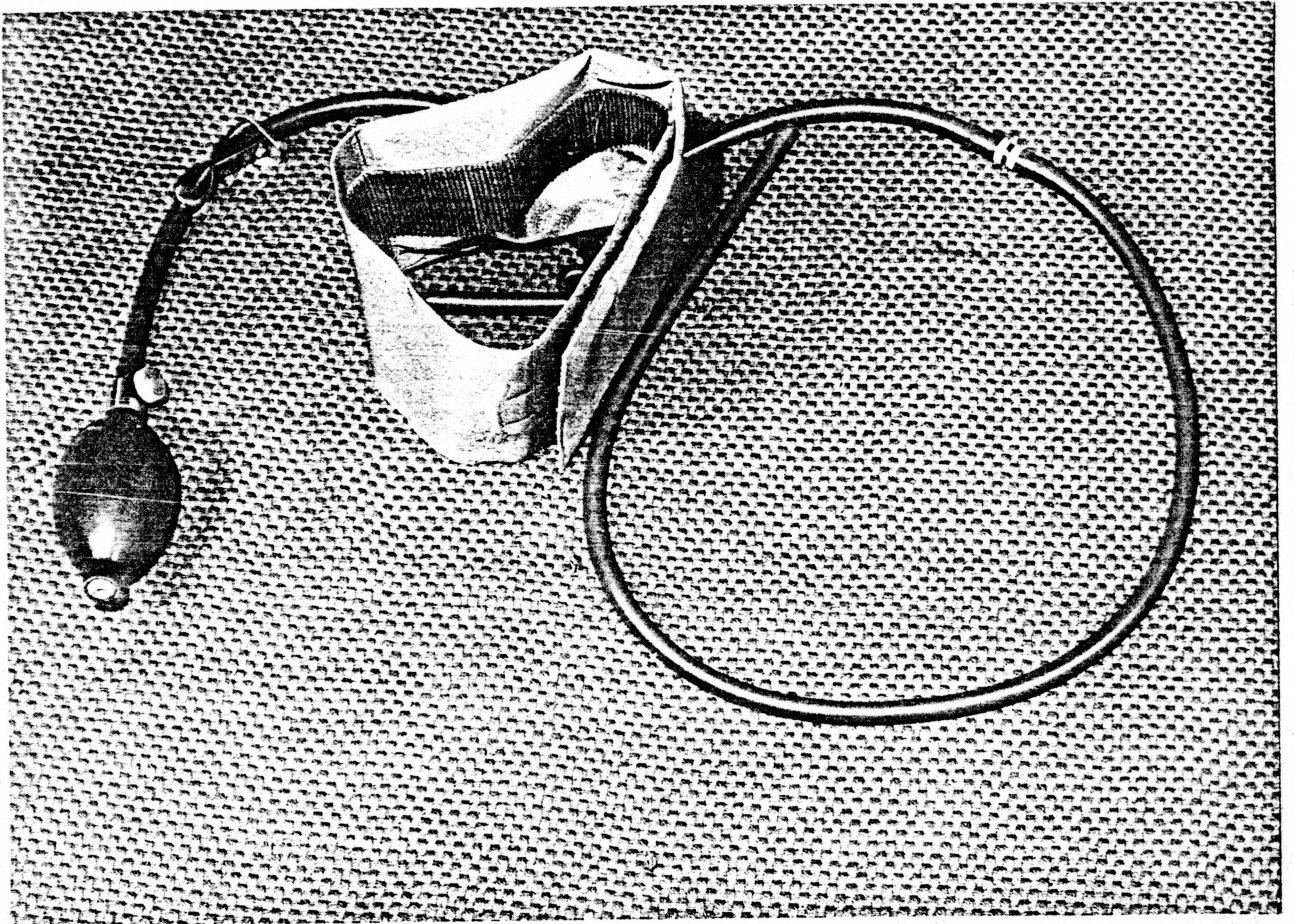
Procedure

When the average individual attempts a deception, he



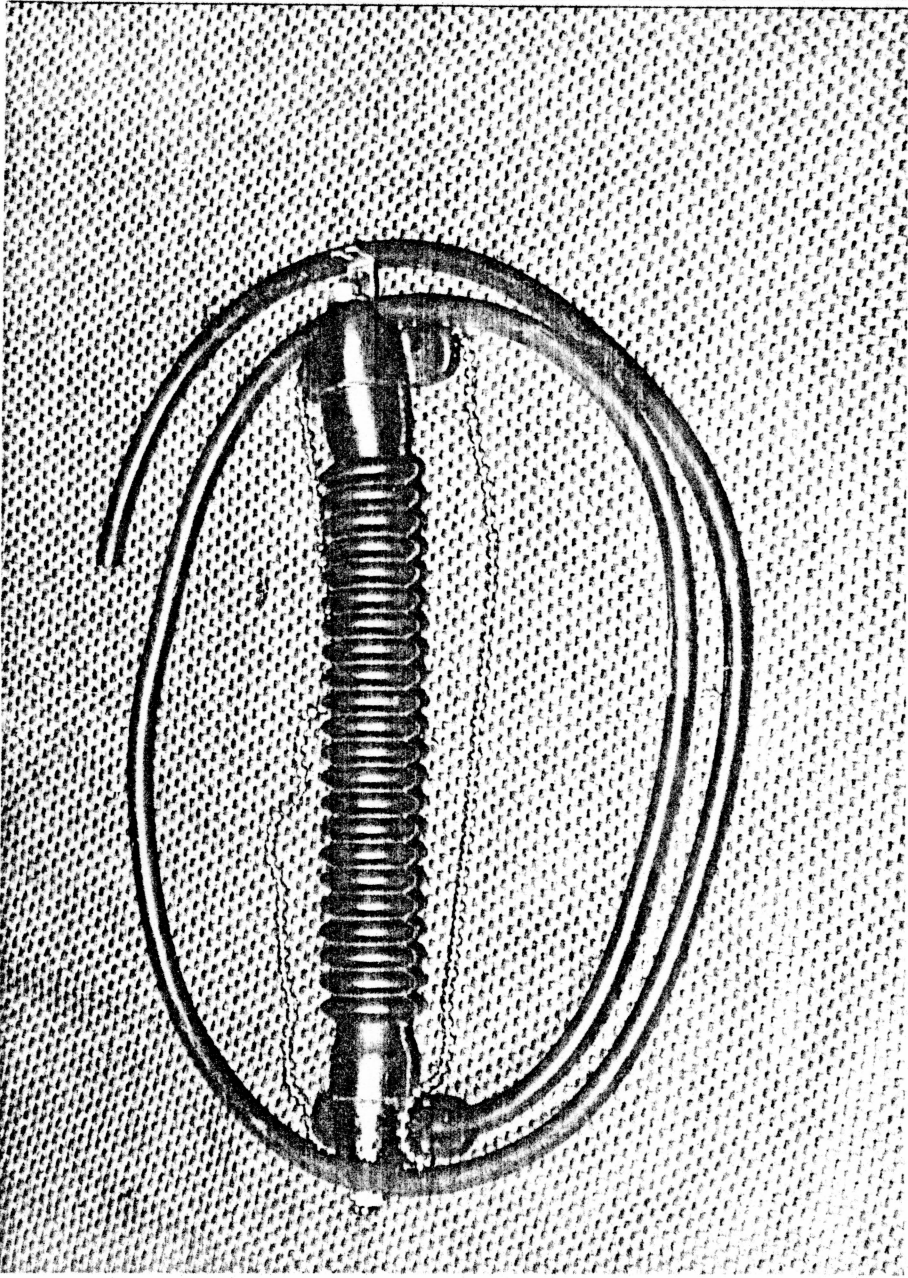
POLYGRAPH

(Figure 2.)



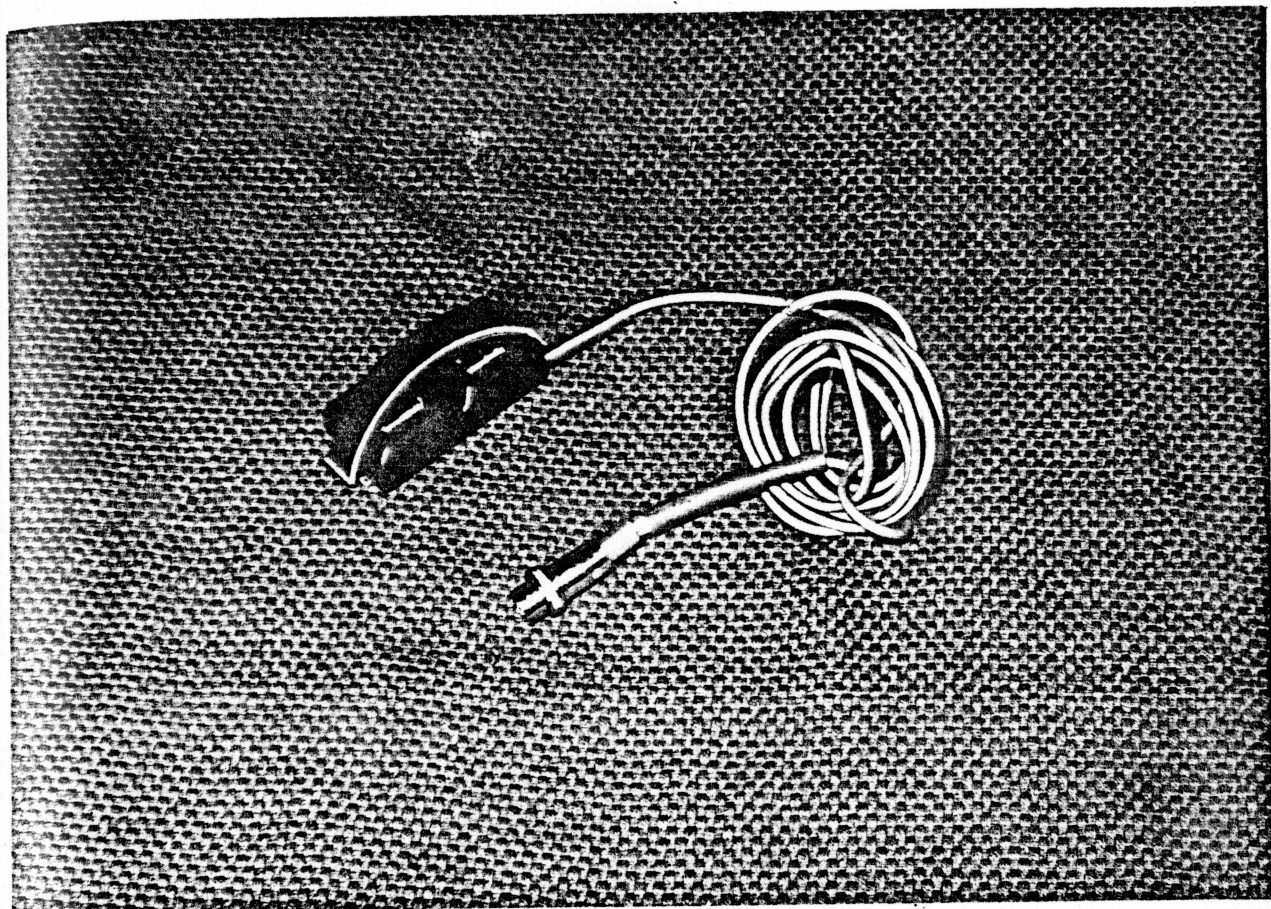
BLOOD PRESSURE CUFF ASSEMBLY

(Figure 3.)



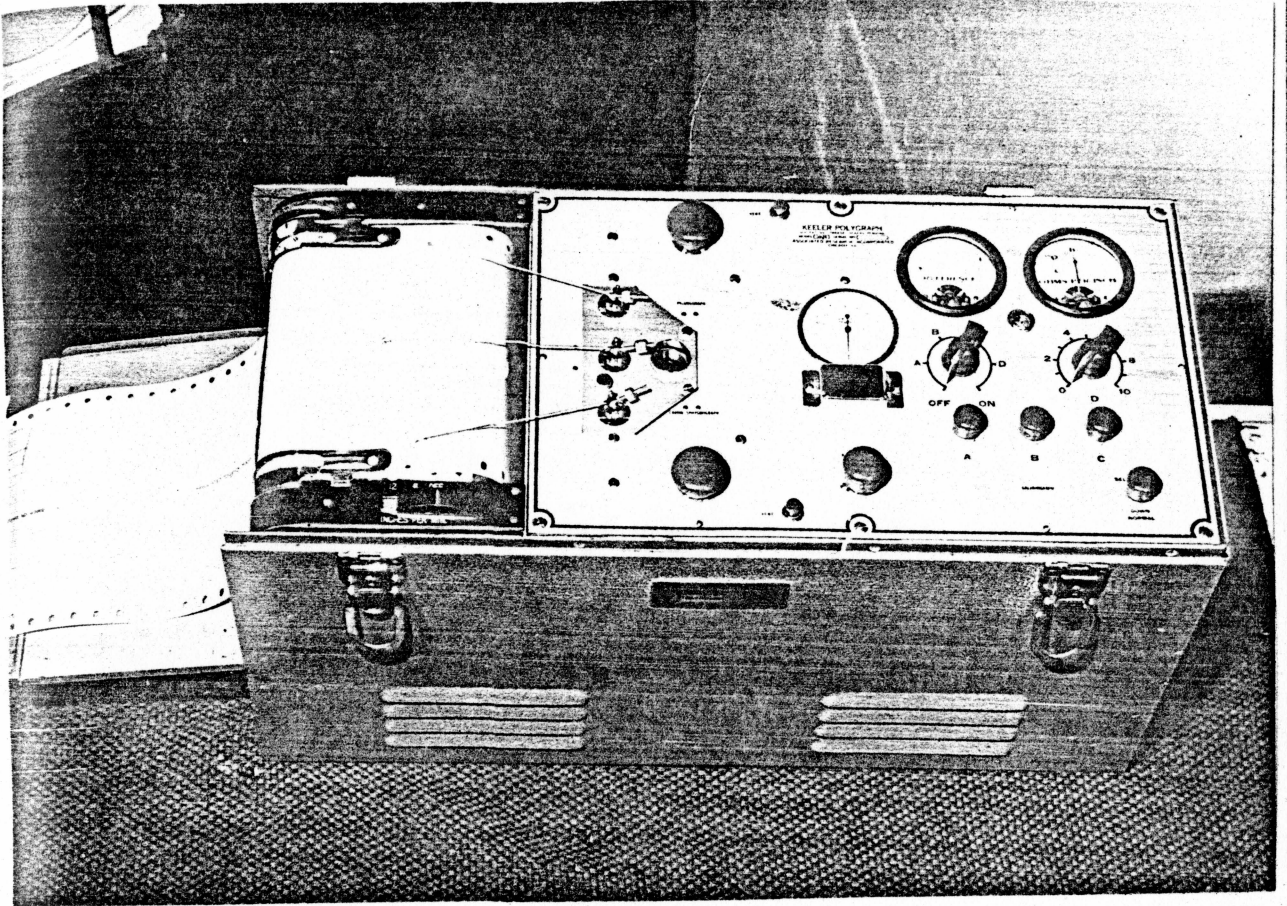
PNEUMOGRAPH ASSEMBLY

(Figure 4.)



HAND ELECTRODE

(Figure 5.)



POLYGRAPH
(Figure 6.)

experiences a combination of psychological reactions which are manifested in physiological changes. These changes in specified physiological phenomena are recorded and later compared with the normal behavior of these same phenomena when no deception is being attempted.

The patient is interviewed for approximately fifteen to twenty minutes. During this time, the patient's history is reviewed. With this review of the history we have two objectives in mind; first, as aid in establishing irrelevant questions; secondly, to give us some time to observe the patient and psychologically set the atmosphere for a polygraph examination.

All the questions to be used during the examination are thoroughly explained to the patient. Each patient is informed that these questions will be asked of them again, with the polygraph in operation and that this machine will tell me if they have been cooperating. After the test procedure is thus explained, the polygraph accessories are attached to the patient.

First, the pneumograph chest assembly for recording respiration is connected to the patient (Fig. 4.)

This assembly consists of a large rubber expansion tube. It is an air-tight tube that is connected by a long rubber hose to a highly sensitive tambour unit which responds to pressure changes. Any movement of the bellows in the tambour unit is registered on the polygraph chart by the recording pen.

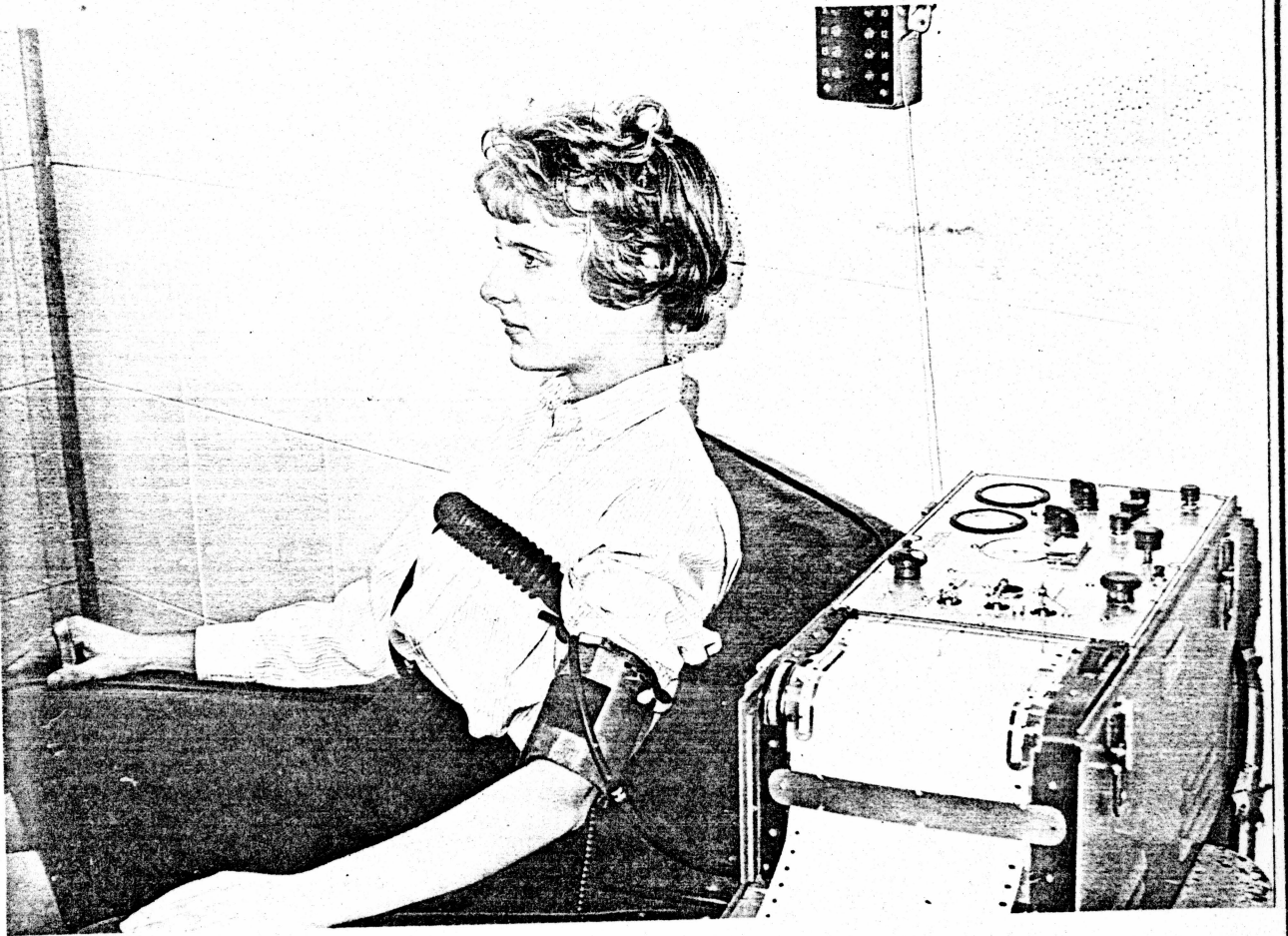
The chest assembly (Fig. 7.) is centered across the chest,

and approximately one-half inch of expanded tension applied, before connecting the bead chain to hook on the opposite side of the pneumograph tube. The vent which protects tambour unit during attachment since high compression and depression may damage unit is opened, the pneumograph pen is centered on the chart, and we are ready to proceed to step two.

Secondly, the galvanograph unit is connected (Fig. 7). The galvanograph tracing measures the skin resistivity. Fear, anger, and excitement will effect skin resistance. The recording galvanometer is a system used to amplify these changes. It will record with considerable amplitude the very slightest change in skin resistivity.

The hand electrodes are put into direct contact with the palm of the right hand. These hand electrodes are made of two flat pieces of metal mounted on an insulating base and held in contact with skin by a spring-like device similar to a watch band. Electrode conducting paste is placed on each electrode to insure positive skin contact. Finally the galvanometer pen is centered on the chart.

The cardiosphygmograph unit is attached to the patient. This is actually a blood pressure cuff assembly (Fig. 7). It is attached lastly since some discomfort may result from its use. It is placed on the left arm over the brachial artery. The cuff assembly is then inflated and the cardio pen is centered. This recording pen is driven by a tambour unit similar to that



POLYGRAPH CONNECTED

TO

PATIENT

(Figure 7.)

of the pneumograph pen. The pen pressure is either increased or decreased to give an equally sharp tracing at the top and bottom peaks of the blood pressure curve. Final adjustment of pressure cuff is necessary to place the dicrotic notch on the lower third of the downward stroke of the pressure curve. The size of the pressure wave is adjusted by the resonance control knob. With the pens centered and all systems functioning, the examination is about to proceed. On each examination chart the patient's name, test type, date and blood pressure are recorded. This is to insure having each record complete and identifiable.

If the patient does not wear a headgear, there will be only one series of questions which will pertain to elastics. It will last two to three minutes and will be followed by a duplicate examination in four weeks. If the patient is going to be examined on elastics and headgear, there will be two examinations in the same test period. The first dealing with elastics will last two to three minutes, followed by a fifteen minute rest period. Then the second series of questions dealing with headgear lasting two to three minutes. The entire procedure was repeated in four weeks.

The questions are arranged in such a fashion as to prevent overlapping of physiological reactions on the tracing paper. The irrelevant questions are placed throughout the examination to keep constant control through the examination and to

prevent overlapping. The questions are asked fifteen to twenty seconds apart. They do not have double meanings, and are asked clearly with a constant monotone voice.

The patient is advised before the examination begins to answer by "yes" or "no" only, they are told not to shake their head, and avoid all movements. Their complete cooperation is necessary otherwise the entire procedure would have to be repeated. When the examination is over they are told to remain still and the cuff pressure will be released in a few seconds.

Explanation of Chart and Questions:

The chart (Fig. 8) is self-explanatory, and is used as a helpful aid in keeping a record and data on each of the patients. It is also useful in configuration of irrelevant questions. The questions were established after very careful planning. It was necessary that they be to the point. The tests were set up in such a manner as to meet the qualifications for deception on that particular patient.

LOYOLA UNIVERSITY - ORTHODONTIC DEPARTMENT

Date _____

Patient's Name _____ Age ____ School _____

Address _____ Sex _____ Sisters _____ Test 1. 2.

Dr. Jarabak _____ Birth: Brothers _____ Type A. C.

Dr. Carter _____ Place _____ B. D.

Date _____

Doctor's Name _____

Treatment: Begin _____

Finish _____

Questions: <u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>
3) Y. N.	11) Y. N.	17) Y. N.	20) Y. N.
4) Y. N.	12) Y. N.	18) Y. N.	21) Y. N.
6) Y. N.	14) Y. N.	19) Y. N.	14) Y. N.
7) Y. N.	15) Y. N.	8) Y. N.	15) Y. N.
8) Y. N.	16) Y. N.		16) Y. N.

Explanations:

Elastics

HISTORY CHART

(Figure 8.)

TEST A

- (1) Is your first name _____?
- (2) Do you drink water?
- (3) Have you been faithful about wearing your elastics?
- (4) Other than to change or to eat have you removed your elastics?
- (5) Are you _____ years old?
- (6) Have you always worn your elastics the required time?
- (7) Have you always worn your elastics _____ hours per day?
- (8) Are you purposely trying to withhold any information from me about wearing your elastics?

TEST B

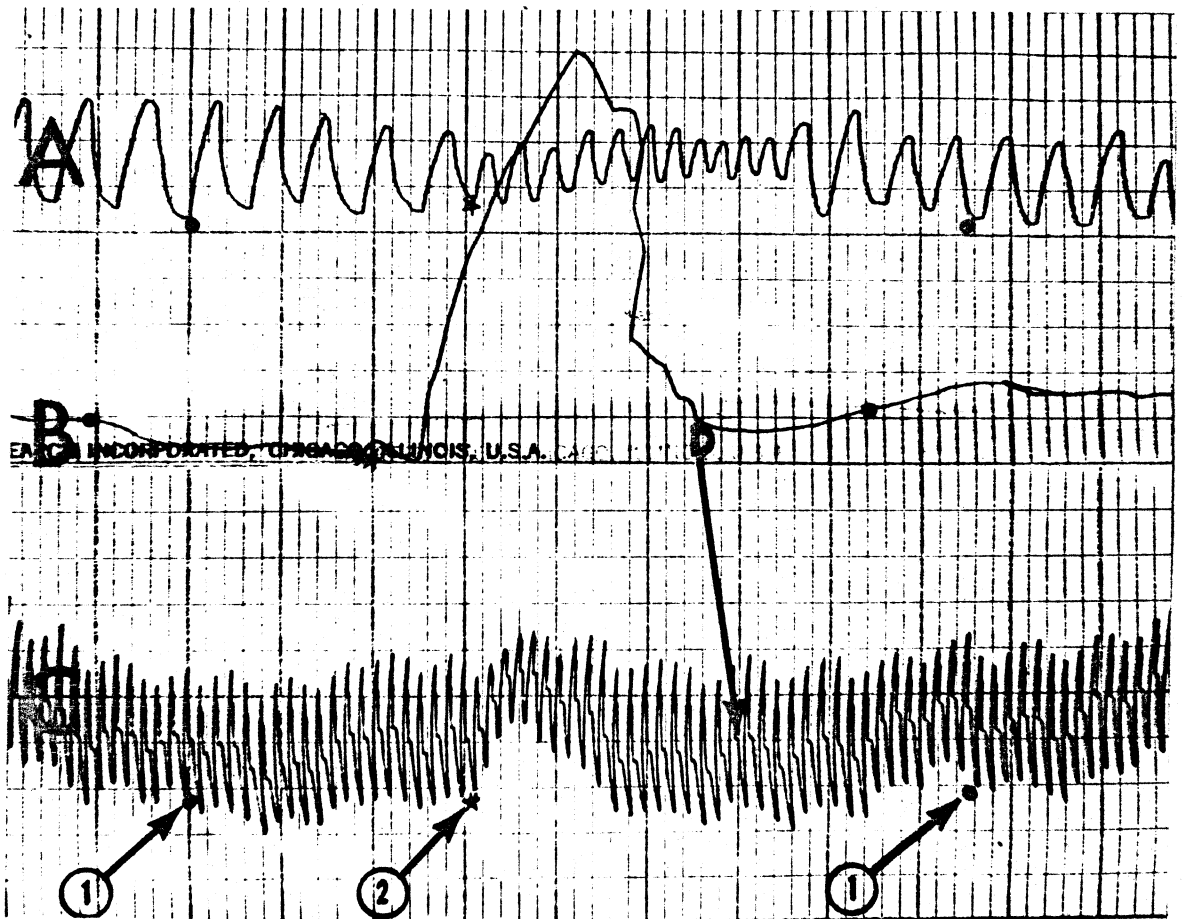
- (9) Do you go to school?
- (10) Are you in the _____ grade?
- (11) Have you been faithful about wearing your headgear?
- (12) Have you always worn your headgear the required time?
- (13) Were you born in _____?
- (14) Have you always worn your headgear _____ hours per day?
- (15) Is your Orthodontist Dr. _____?
- (16) Do you like Dr. Jarabak?

TEST C

- (1) Is your first name _____?
- (2) Do you drink water?
- (17) Have you been less faithful about wearing your elastics than you told me?
- (5) Are you _____ years old?
- (19) Have you worn your elastics at least _____ hours per day?
- (8) Are you purposely trying to withhold any information from me about wearing your elastics?

TEST D

- (9) Do you go to school?
- (10) Are you in the _____ grade?
- (20) Have you been faithful about wearing your headgear as much as you have told me?
- (21) Have you kept your headgear off more than you told me about?
- (13) Were you born in _____?
- (14) Have you always worn your headgear _____ hours a day?
- (15) Is your Orthodontist Dr. _____?
- (16) Do you like Dr. Jarabak?



POLYGRAPH CHART

- A - Pneumograph tracing
- B - Galvanograph tracing
- C - Cardiograph tracing
- D - Dicrotic Notch

- 1.) Black Dot (•) - represents verbal stimulus of irrelevant question on all three tracings.
- 2.) Star (*) - represents verbal stimulus of relevant question on all three tracings.

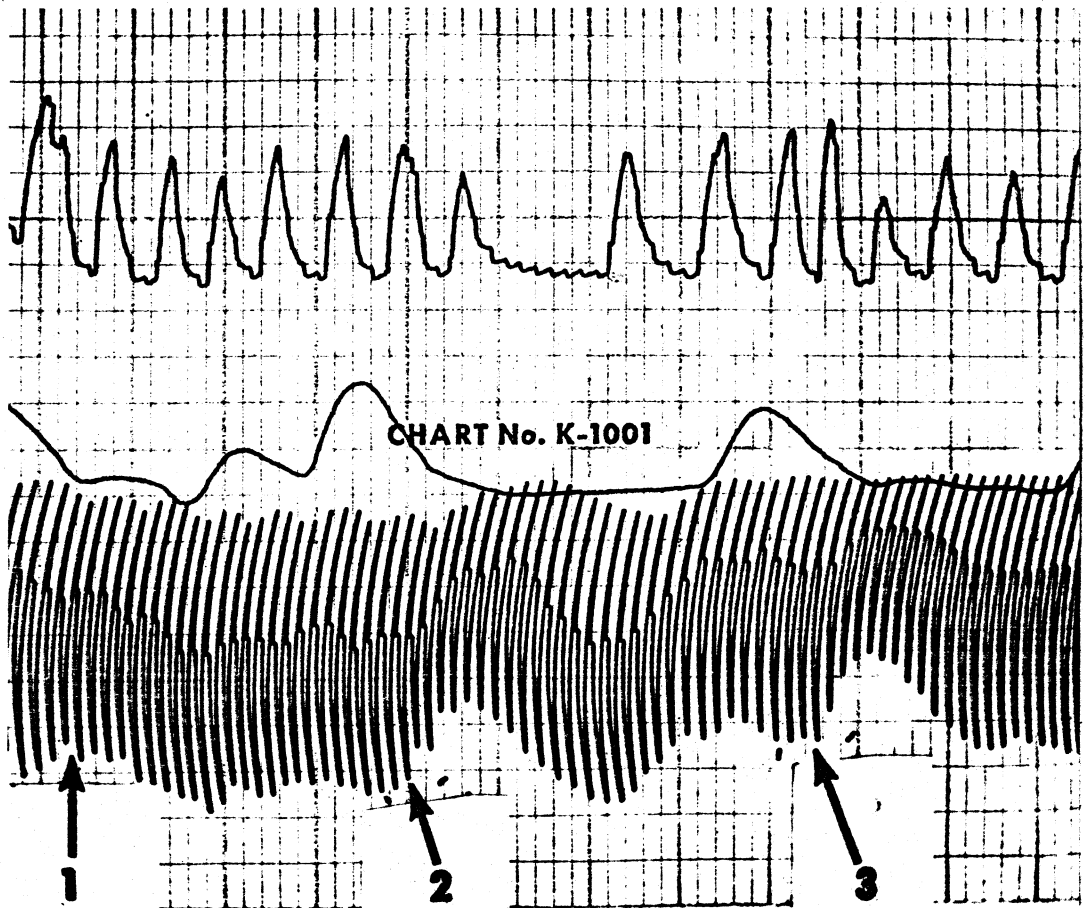
(Figure 9.)

If the patient is to be questioned on the elastics alone, then Test A or Test C will be used. Added to these tests will be the last two questions of Tests B and D (Test questions 15-16). Should the patient be questioned on elastics and headgear, then Tests A and B or C and D will be used. There will be a fifteen minute rest between tests. To determine which test is to be used, a careful pre-test interview is necessary. If the patient admits to being unfaithful in the wearing of her elastics, then Test A will no longer be adequate for this patient. Test C will now be given. This is easily understood when you compare the two different tests.

The same procedure is applied when the patient is to be examined on the elastics and headgear. If the patient admits to being unfaithful the test questions A and B will not be used. Test C and D will then be properly adapted to this patient. At completion of the test period, the patients were informed that a duplicate examination would be given in four weeks.

Chart Interpretation:

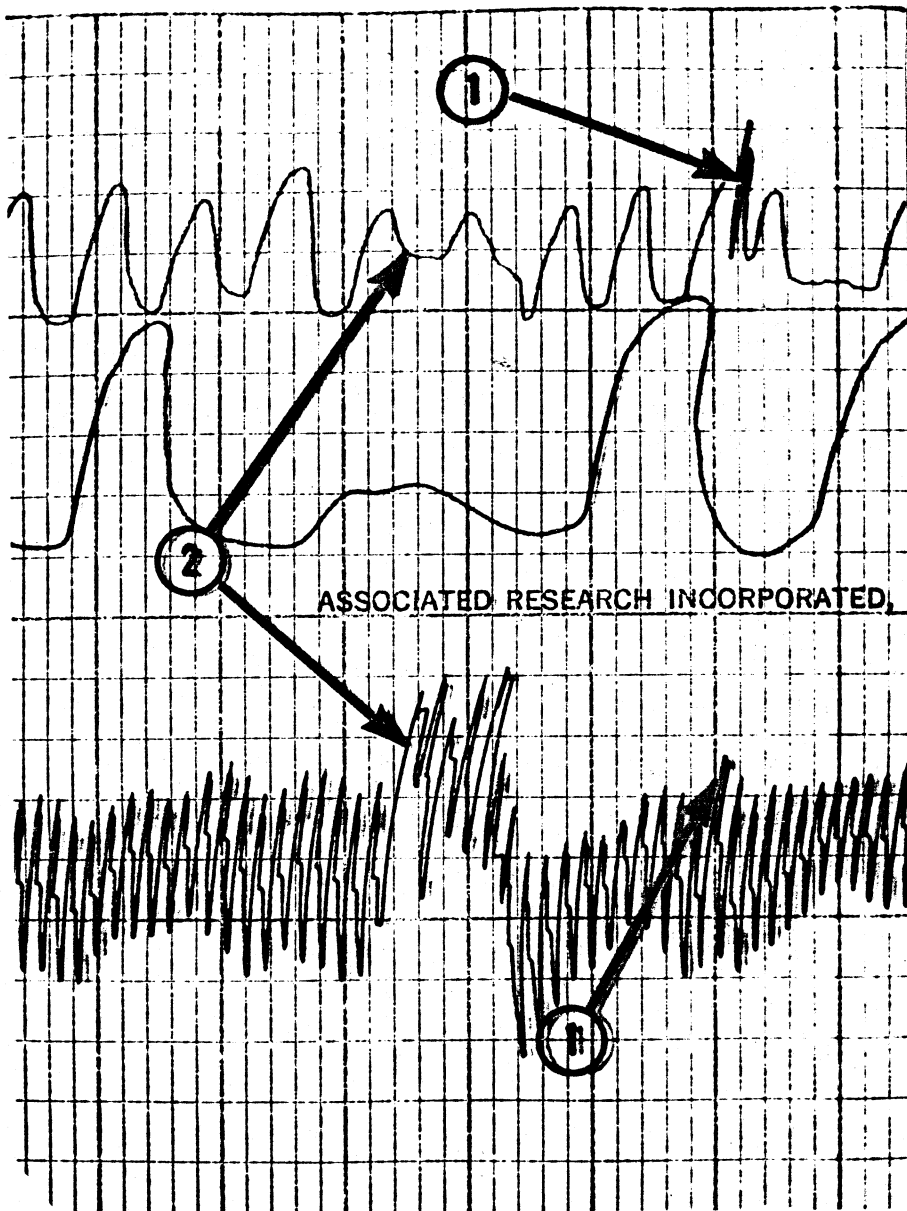
In the analysis of the physiologic responses as recorded on the polygraph, the tracings of the pneumograph, galvanograph, and the cardiograph were evaluated (Fig.9). If there is deception the tracings of that patient will vary from her normal. In a properly conducted examination there will be simultaneous deviations from the normal on all three recording



POLYGRAPH CHART

- 1.) Irrelevant Question asked here
- 2.) Relevant Question asked here
- 3.) Relevant Question asked here

(Figure 10)



POLYGRAPH CHART

- 1) Patient Cough
- 2) Patient Movement

(Figure 11.)

patterns of that individual. The following is an explanation of how deception may be indicated in the pneumograph, galvanograph, and cardiograph tracing patterns.

A. Pneumograph Tracing

1. A change in rate from the patient's normal respiratory pattern (Fig. 9-2).
2. A change in the amplitude of the patient's normal respiratory pattern (Fig. 9-2).

There may be a definite change in frequency and amplitude (Fig. 9-2). This change on the respiratory pattern could be in frequency and amplitude singularly or together. There may be an apnea in the breathing cycle upon verbal stimulation of a relevant question as seen in the pneumograph pattern in (Fig. 10-2).

B. Galvanograph Tracing

The galvanograph recording would have the most dramatic response. Any decrease in the patient's skin resistance will give an upward shift of the recording pen. This galvanic skin reflex is amplified to a great extent and the recording pen may move the entire width of the recording chart (Fig. 9-2). Any marked change in the normal baseline (verbal stimulation of irrelevant questions) pattern of that individual would be an indication of deception.

C. Cardiograph Tracing

1. Any change in the rate of the patient's normal cardiosphygmograph recording shown as a marked change in the baseline (Fig. 9-2).
2. Any change in position of the dicrotic notch (Fig. 9-2).
3. Any change in the amplitude of the patient's cardiosphygmograph recording shown as a marked change in the baseline (Fig. 9-2), (Fig. 10-2,3).

The cardiosphygmograph recording may vary in degree of responses. In some patients the dicrotic notch may remain in a normal position with little change in heart rate, but the amplitude may vary. Conversely, the heart rate may increase or remain steady with changes in the dicrotic notch and amplitude. Lastly, the heart rate and amplitude may remain fairly normal with changes in the dicrotic notch.

Figure 11 represents some abnormal recording patterns that might be interpreted as indications of deception. It should therefore, be noted here that there exists a definite art of chart interpretation. Careful observation and notation of all abnormal patient movements (cough, sigh, sneeze, etc.) aid the examiner in the chart interpretation.

All three tracings were evaluated as an integral unit by being compared to the normal tracings of the patient as recorded on the polygraph chart. These normal tracings were provided by

the irrelevant questions. They reflect the normal physiologic functions of the patients throughout the examination. All the charts were analyzed in the same manner. These answers were then recorded on a master chart along with the evaluation of the answers as "true" or "false".

CHAPTER III
EXPERIMENTAL RESULTS

In using physiological responses to indicate attempted deception, there are many problems concerning the wording of the questions. The decision to use several forms of the questions was an attempt to minimize the somatic problems rather than an attempt to introduce several variables.

ELASTICS:

1. Test A (3) Have you been faithful about wearing your
elastics?

Test C (17) Have you been less faithful about wearing
your elastics than you told me?

2. Test A (4) Other than to change or eat have you
removed your elastics?

Test C (18) Have you kept your elastics off a lot more
than you told me about?

3. Test A (7) Have you always worn your elastics _____ per
day?

Test C (19) Have you worn your elastics at least _____
hours a day?

4. Test A (8) Are you purposely trying to withhold any
information from me about wearing your
elastics?

Test C (8) "Same"

ELASTICS
 PHYSIOLOGICAL RESPONSES INTERPRETED AS INDICATING TRUTH
 FOR EACH SUBJECT

<u>SUBJECTS</u>	<u>TEST I</u>	<u>TEST II</u>
1	4	4
2	1	4
3	0	0
4	2	2
5	0	2
6	1	2
7	4	3
8	0	0
9	4	4
10	4	4
11	3	3
12	0	0
13	4	4
14	0	0
15	1	4
<u>Total</u>	<u>28</u>	<u>36</u>
Indication of Truthfulness	46%	60%

IMPROVEMENT 13.4%

In Test A and C three of the relevant questions were worded slightly different. The subjects who were given Test C had already admitted to being unfaithful in the interview. Those subjects given Test A did not admit to being unfaithful in the interview.

The physiologic responses of these four questions as recorded on the polygraph were studied for deception and the number of truthful indicators recorded. For every subject there was a possibility of four truthful indicators or a sum of sixty truthful indicators for the group.

The number of truthful answers to the four relevant questions regarding elastics totaled 28 out of a possible 60. It was then calculated that the percentage of truthfulness of the group was 46.6 percent. A second test on elastics resulted in a total of 26 truthful answers. Thus the percentage of truthfulness of the group was 60 percent. There was an improvement of 13.4 percent from Test I to Test II. This improvement was not significant at the five percent level.

HEADGEAR:

In the evaluation of the percent of truthfulness three relevant questions were selected.

1. Test B (11) Have you been faithful about wearing your headgear?

Test D (2D) Have you been faithful about wearing your headgear as much as you have told me?

2. Test B (12) Have you always worn your headgear the required time?

Test D (21) Have you kept your headgear off a lot more than you told me about?

3. Test B (14) Have you always worn your headgear _____ hours per day?

Test D (14) "Same"

In Test B and D two of the relevant questions were worded slightly different. The subjects who were given Test D had already admitted to being unfaithful in the interview. The subjects given Test B did not admit to being unfaithful.

The physiologic responses of these three questions as recorded on the polygraph, were studied for deception and the number of indicated truthful answers recorded. For every subject there was a possibility of three truthful indicators or a sum of twenty-one truthful indicators for the group.

HEADGEAR

PHYSIOLOGICAL RESPONSES INTERPRETED AS INDICATING TRUTH
FOR EACH SUBJECT

<u>SUBJECTS</u>	<u>TEST I</u>	<u>TEST II</u>
1	3	3
2	0	1
3	0	2
4	0	0
5	0	0
6	2	3
7	1	3
<u>Total</u>	<u>6</u>	<u>12</u>
Indication of Truthfulness	28.6%	57.1%

IMPROVEMENT 28.5%

The number of truthful answers to the three relevant questions regarding headgear totaled 6 out of a possible 21 truthful answers on the first test. It was then calculated that the percent of truthfulness of the group was 28.6 percent. The second test on Headgear resulted in a total of 12 truthful answers. Thus the percentage of truthfulness of the group was 57.1 percent. This was a 28.5 percent improvement over the first test. This improvement from Test I to Test II was found to be significant at the five percent level.

CHAPTER IV

DISCUSSION

The purpose of this experiment was the determination of the truthfulness of female Orthodontic patients to questions concerning cooperation. The results of the study show the percentage of truthfulness of the group. This may be interpreted as one of the indicators of cooperation. The experiment was divided into female and male categories. I did the cooperation study on the female subjects and Dr. Campisi (fellow graduate student) did the cooperation study on the male patients. We both worked with groups of fifteen subjects with the same age limitations. Our experimental procedures were adapted together, so that a reasonable comparison would be possible between male and female groups.

Due to the increase in patient enthusiasm at the onset of orthodontic therapy, it was necessary that we select patients who were under care for a reasonable length of time. This presented a group of patients that were well-adapted to many undesirable problems every patient must struggle with. Other than 11 - 14 years of age limitations, there were no other barriers in the selection of patients.

A series of two tests were given. The intention was to observe any stimulation for improvement through the use of the polygraph. The patients were not informed of the experiment

prior to the first test. After completion of the first test the patient was advised that there would be a duplicate of this test in four weeks. During the pre-test interview of the second test, the patient was advised that in the following series of questions, we were concerned with her cooperation in the past four weeks. This was found efficient to ascertain the amount of patient improvement.

The experimental results indicated a degree of improvement in elastics and headgear. With the elastics the female subjects demonstrated a 13.4 percent improvement. Although this was an improvement, it was not significant at the five percent level. The females improved 28.5 percent with the headgear. This improvement was significant at the five percent level.

This should now be said about practical application of elastics and headgear. It has been a general clinical conception that the female patients have little desire to wear the headgear. From our experimental results the females seem to tolerate the elastics more than the males. Use of the headgear presents another problem which is a drawback with the female patients. The headgear which they are required to wear does not have a very pleasing appearance and does not conform with any of the latest hair styles. That the patients do not want to wear the headgear due to the poor effect on the patient's personal appearance, is an important factor that contributes to a low level of cooperation with the headgear.

It is important to mention some of the other findings in this experiment that have a reasonable bearing on the cooperation level. The patients were cooperative and subjected themselves willingly to the tests. Some of the children were inquisitive but this was not a general rule.

At the time of the pre-test interview the patient was informed as to the use of the polygraph in this experiment with this statement: "This machine will tell me if you have or have not been cooperating." A large number of patients admitted to being unfaithful at this time. These were some of the excuses or rationalizations most often heard at the interview: "The headgear looks terrible, I only wear it at night," "I only wear them when my parents make me," "I never wear my elastics and headgear, only sometimes before my next appointment," "They hurt while I talk, so I only wear them at night," "I forget to put them on." This one statement "just before my next appointment" brings out a very interesting observation. Testing the mobility of the teeth has long been a clinical criterion of patient cooperation. It was thought that a mobile tooth showed constant usage of elastics. Patients became aware of this and used their elastics two or three days before their appointment. When tested, they were mobile, and the patient was complimented for doing their part. By way of the grapevine, the remaining patients in the clinic became aware of this and many followed in the same footsteps. The polygraph results show this. Yet the results in many instances did not

substantiate the fact that elastics were constantly worn. Where then the paradox? Was it the mechanics, or was it what we had been judging to be a reliable test - mobility - deceiving us. Realizing that the patients were wearing their elastics and also being reasonably certain the mechanics of the force systems employed were adequate, it then occurred to us, in view of the poor progress, to determine the level of patient cooperation, and what we found was astounding. There would be no hesitation in saying that some of the children wear their elastics faithfully a few days prior to their next appointment for this will result in some tooth mobility.

It was another interesting observation that the patients who admitted to unfaithfulness were usually a lot more unfaithful than they conceded to. The results appear to indicate that patients who expressed they were cooperative usually were very truthful. The patients who confessed to uncooperation indicated a much lower level of cooperation than they had previously confessed to.

There were two other physiologic reactions that were observed on all the tracings for each patient. When the attachments were connected and normal tracings were being recorded the announcement that "The test is about to begin" was a very stimulating comment. The physiologic responses were noticeable on all three tracings; pneumograph, cardio-graph and galvanograph, which was indicative of a well-functioning unit. The second stimulating question was added at the conclusion of

each test, "Do you like Dr. Jarabak"? This was two-fold in its application. It was very good in the stimulation of the physiologic reactions and to observe any feeling of resentment that may exist among the patient and the Chairman of the Department that may effect cooperation. Many of the children showed a definite physiologic response to this question that may indicate dislike for Dr. Jarabak. Although many patients showed reactions, this may not truly indicate dislike, but rather fear. Uncooperation may come from dislike, where cooperation may come from fear.

With this experiment as the foundation, the true light for further experiments in this field can easily be recognized. I would like to mention a few interesting points that were made evident with this experiment.

There is a reasonable possibility that patients who cannot withstand mild pain (observed with the use of the blood pressure cuff) are very poor orthodontic patients. There exists a relationship between the pain threshold and the amount of cooperation.

We have different ways to motivate these children to cooperate. When these do not stimulate the child the problem may exist elsewhere. Did this child want orthodontic care in the first place? Are the parents the ones that want the child to have orthodontic therapy? Did this child have any intention of cooperating? Must we motivate some children differently than others? All of these have a definite place in variability

of patient cooperation.

It is a definite assumption that patient cooperation is a problem of great importance that exist with orthodontics. Where there is a lack of cooperation there is an increase in the length of treatment. It would aid the orthodontist to a great extent if he understood at the onset of treatment what level of cooperation he might expect from that patient. If he understood their motivations he could work with them directly and augment his treatment plan that would best fit psycho-biophysiologic make-up of that individual. This advanced knowledge would be a tremendous treatment asset to the orthodontist.

The polygraph now seems to be an answer to some of the problems. It is a very helpful aid in research and a definite stimulation to cooperation. It will be very helpful with some of the various problems that do exist.

CHAPTER V

SUMMARY AND CONCLUSIONS

The purpose of this investigation was the determination of the truthfulness of female Orthodontic Patients from the appraisal of the physiologic responses of that individual to questions concerning cooperation. The results of this investigation show the percentage of truthfulness of the group. This may be interpreted as one of the indicators of cooperation

Fifteen female patients were selected from the Orthodontic Department, Loyola University School of Dentistry. All the patients were 11 - 15 years of age and receiving orthodontic care for 7 - 10 months.

The principles of the polygraph technic were used and the medium for investigation was the elastics and headgear each patient was required to wear. The subjects were asked a series of relevant and irrelevant questions concerning their cooperation in the use of elastics and headgear. Their physiologic responses were recorded on the polygraph when asked these relevant questions and compared to the normal (irrelevant questions). These recordings were studied for deception. Every subject was given two tests, four weeks apart, so designed that a reasonable comparison could be made between the tests.

In comparison of Test I to Test II concerning truthfulness this can be said for the female group:

ELASTICS:

- 1.) On the first test the percentage of truthfulness of the group was 46.6 percent.
- 2.) On the second test the percentage of truthfulness of the group was 60 percent.
- 3.) There was an improvement of 13.4 percent from Test I to Test II. This improvement was not significant at the five percent level.

HEADGEAR:

- 4.) On the first test the percentage of truthfulness of the group was 28.6 percent.
- 5.) On the second test the percentage of truthfulness of the group was 57.1 percent.
- 6.) There was an improvement of 28.5 percent from Test I to Test II. This improvement was significant at the five percent level.

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APPROVAL SHEET

The thesis submitted by Dr. Thomas P. Cavanaugh 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.

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