Read 1st week

ATTACHMENT AND PLACEMENT OF POLYGRAPH INSTRUMENT RECORDING SENSORS[1]

FORENSIC SCIENCE 504

DEPARTMENT OF DEFENSE POLYGRAPH INSTITUTE

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[1] This supersedes previous versions of this handout – from January 1998.

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THE CONCEPTS AND APPLICATIONS OF PROPERLY ATTACHING POLYGRAPH INSTRUMENT SENSORS TO MAXIMIZE TEST DATA COLLECTION

1. OBJECTIVES

1.1. To discuss with and inform students as to DoDPI's recommended locations and most correct procedures for attaching the three primary sensors (Respiratory, Electrodermal Activity (EDA), and Cardiovascular) in order that optimum physiological data can be obtained from an examinee. Further, the advantages and consequences of failing to apply the sensors correctly will also be discussed. Additionally, general supporting strategies and remedies associated with attaching the sensors will also be discussed.

1.2. This block of instruction will also address the sequence of attachment for the three primary recording sensors of the polygraph instrument, the normal factors that should be considered in attaching these sensors to an examinee, and what effects these factors could have on the collection of an examinee's physiological data.

1.3. It should be noted that a general frame of reference for evaluating (and discussing) the size or degree of the examinee's response - as depicted on the tracings of the computer screen, analog chart, and or a printed chart grid is a "1/4 inch vertical rise," This will generally be scaled in the rectangular shape of measuring from "1 / 4 inch vertical rise by 1 / 2 inch horizontal." Example: [ ] Commonly or traditionally referred to as a "chart division."

1.4. Students at DoDPI should refer to other specific guidance for *Test Data Analysis* evaluation procedures and examinee response evaluations.

2. CONCEPTS AND GENERAL THEORIES.

2.1. The following brief paper will address [for students] DoDPI's philosophy and practice of formalized procedures it suggests for placement of the three primary polygraph instrument "sensors" on an examinee. It is believed that proper placement of these three sensors is critical for ensuring that optimum levels of the targeted physiological signals of interest are obtained which yield the greatest volume of useful data and clarity for test data analysis.

2.2. All examiners must remember to be diligent and remain cognizant of the extreme importance of proper attachment and placement of the polygraph instrument sensors on an examinee - relative to their professional duty and expectation of obtaining the best possible physiological data for analysis during the test data analysis phase.

2.3. PROPOSITION 1. That each of the three primary sensors (Respiratory, Electrodermal Activity (EDA), and Cardiovascular) for collecting physiological data during a Psychophysiological Detection of Deception (PDD) examination must be placed on an examinee's body at the optimum location to obtain the maximum physiological signals (for that

particular individual), which can then be transmitted to the sensor box and eventually depicted on the computer screen for digital systems (or chart paper for analog systems).

2.4. PROPOSTION 2. That the examiner must have a basic understanding of the relationships between human physiology, the actual physical placement [location] of the sensors on the examinee; the effect that interfacing these two variables will have on the quality of the collected test data; and the impact it could have on an examiner's attempts at interpreting/scoring the collected charts.

2.5. PROPOSITION 3. DoDPI has specified that there are optimum locations on an examinee's body where each of the three primary sensors should be placed. However, if for some reason any of these optimum locations are unavailable for use, there are secondary locations that may still yield adequate physiological data for analysis purposes. Therefore, common sense dictates that proper sensor placement on an examinee will yield the best possible physiological data. This will result in a higher level of confidence in the PDD examination results (examiner's opinion).

2.6. These blocks of instruction will address the location of attachment and placement for the three primary sensors, the normal order in which they are recommended to be attached, and what effects these factors could have on the examination results. The discussion will start with the respiratory sensor, then go to the EDA, and finally, discuss the cardiovascular cuff.

3. RESPIRATORY DATA. This first phase of instruction will address the proper location and procedures for attaching the respiratory sensors to an examinee.

3.1. The first sensor(s) to be attached to an examinee consists of two convoluted tubes with beaded chain or Velcro straps, which are placed on an examinee's abdomen and upper/middle to upper chest area, depending on whether or not the examinee is a male or female. These sensors record the examinee's respiration patterns.

3.2. During the pretest interview and other contact with the examinee, the examiner should attempt to casually observe the examinee's routine breathing pattern to determine if they are primarily an abdomen or chest breather. In making this determination, a number of variables may apply such as age, gender, build, size, and exercise level (i.e. weight lifter, scuba diver, office or related sedentary type etc.).

3.3. The usual protocol for placing the respiratory sensors on an examinee is to attach the lower or abdomen sensor first. When the examiner first attaches this sensor, the convoluted tube should be extended approximately one to two inches until it is secure enough to keep it from falling down or out of position - yet still yield or show movement of an examinee's respiratory pattern. The examiner should use caution to prevent over extending the convoluted tube to avoid exceeding the elasticity of the internal constricting mechanism (rubber band or spring). The examiner should guard against stretching the convoluted tube so tight that the examinee's respiratory pattern cannot be properly recorded. (Note: If a different device is used to attach the

pneumograph sensor to the examiner, i.e., Velcro, it should be properly secured in order to obtain an adequate respiratory tracing.)

3.4. The examiner then places the second or top convoluted tube into the proper position by following the same general procedures as described above. Usually, for males, the top sensor is placed just below or above the breast line. When the examinee is a female, the top sensor is usually placed a little higher above the breasts/brassiere so that it rests comfortably for the female examinee. When the examiner attaches the upper sensor, the convoluted tube should be extended approximately one to two inches (approximately four to eight chain beads) until it is secure enough to keep from falling or out of position. The examiner should use caution to keep from over extending the convoluted tube to avoid exceeding the elasticity of the internal constricting mechanism (rubber band or spring). The examiner should also guard against making the convoluted tube so tight that it prevents the examinee's respiratory pattern from being properly recorded.

3.5. After attaching both respiratory sensors to the examinee, the examiner should position him or herself in front of the examinee to check the location and secureness of the convoluted rubber tubing. The examiner should explain to the examinee that they are simply making minor adjustments to ensure that the examinee will not experience any discomfort from these sensors during the data collection phase.

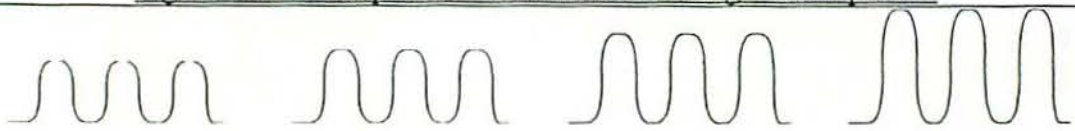
3.6. When attaching the convoluted tubes to a female examinee, a male examiner should always use "caution." In these instances, the lower convoluted tube is fairly easy to attach, while the upper sensor may require a more delicate approach. If the examiner attaches these sensors in a professional manner, it will avoid [or give appearance of] any offensive actions and accusations of alleged improprieties. Depending on the circumstances, after attaching the convoluted tubes, a male examiner may ask the female to make minor adjustments/settings of the sensors to avoid any discomfort. Of course, the examiner should ask the examinee to move the sensors in a gentle manner to avoid damaging or moving the sensors out of the proper placement location. However, it is the examiner's responsibility to ensure that this sensor is properly attached in a professional manner. As a means to evaluate whether or not the convoluted tubes have been properly attached, the examiner should check the size/amplitude of the tracings on the computer screen or analog chart at the beginning of the data collection phase.

3.7. When a male examiner has a female examinee, some agencies require a female witness/monitor. When a female examinee witness is utilized, the examinee should be informed [introduced] to the witness and told where the witness will be located (i.e., behind two-way mirror, etc.) during the PDD examination. However, in field situations, the examiner's agency policy will dictate what procedures are utilized in these circumstances.

3.8. For the training purposes in the PDD Program, at the DoDPI, with the type of computerized polygraph systems and equipment utilized in laboratory activities, the recommended range of amplitude for each of the respiratory tracings is a minimum of one half inch, optimum of three quarters of an inch, and maximum of one inch. (Note: During the data collection phase, this amplitude range is required for DoDPI PDD Course students, as they are

not allowed to make any corrections in the "replay mode" while being graded on their laboratory activities.)

Figure F.1. Examples of Recommended Range of Amplitude



One Quarter Inch (Too Small)	One Half Inch (Minimum)	Three Quarters Inch (Optimum)	Once Inch (Maximum)

3.9. POSSIBLE REMEDIES TO HELP IMPROVE RESPIRATORY TRACINGS. During the data collection phase, occasions may arise when an examiner cannot obtain adequate respiratory tracings suitable for subsequent test data analysis. In these instances, the following are suggested actions that might be taken to help obtain better respiratory tracings from your examinee:

3.9.1. Tighten or make the convoluted tubes more secure - so that the examinee's abdomen/chest movement activity is amplified and more easily detectable.

3.9.2. Relocate the convoluted tubes to a more active part of the abdomen/chest area.

3.9.3. Place something under the examinee's feet and elevate them to change the position of the diaphragm, which increases tension on the sensors.

3.9.4. Have the examinee lean forward in the examinee chair to increase tension on the sensors.

4. ELECTRODERMAL ACTIVITY (EDA) SENSOR (GSR/GSG). This second phase of instruction will address the proper attachment and placement procedures for the EDA sensor:

4.1. As noted above, usually, the second physiological sensor (considering that the two-pneumograph sensors are one physiological parameter) attached to the examinee is the EDA fingerplate electrode assembly. Normally, the fingerplate electrode assembly [hereafter referred to as the fingerplates] consists of two stainless steel plates, about one inch square, with Velcro straps and shielded cable for connection to the computer sensor box or analog instrument. The fingerplates are ideally placed on two fingers of the "non-dominant" hand. The is because the "dominant" hand will generally have more calluses, thicker outer skin levels, and other barriers that could disrupt or inhibit the EDA signal flow between the finger and the fingerplates. Therefore, before placing the fingerplates on an examinee, the examiner should ask the examinee which is their dominant hand and place the fingerplates on the opposite hand - examination suite environment permitting. Further, whatever hand the fingerplates are attached to, the cardio cuff will (usually) be placed on the opposite arm to prevent possible interference with the EDA signal.

4.2. The fingerplates are usually placed on the end joint/tips of the index and ring fingers. The examiner should insure that the fingerplates are placed on snugly so that they will not become loose; however, they should not be secured too tight that they are discomforting for the examinee. For the finger, this location has the highest concentration of sweat glands. This, in turn, will yield the maximum signal strength, as well as being convenient for attachment and examinee comfort. When the examiner is attaching the fingerplates, s/he should visually check/inspect the fingertips and briefly rub the fingertips to determine if there are any injuries, skin surface contamination, or other factors that might inhibit the EDA signal. The attachment location on these two fingers (index and ring) also seems to help minimize the chances of the two plates touching. Should the examinee move his/her fingers and touch the fingerplates together, it might interfere with the EDA signal. During the data collection phase, the examiner should periodically check the examinee and the fingerplates, especially after a break between charts, to insure that the fingerplates are still adequately attached.

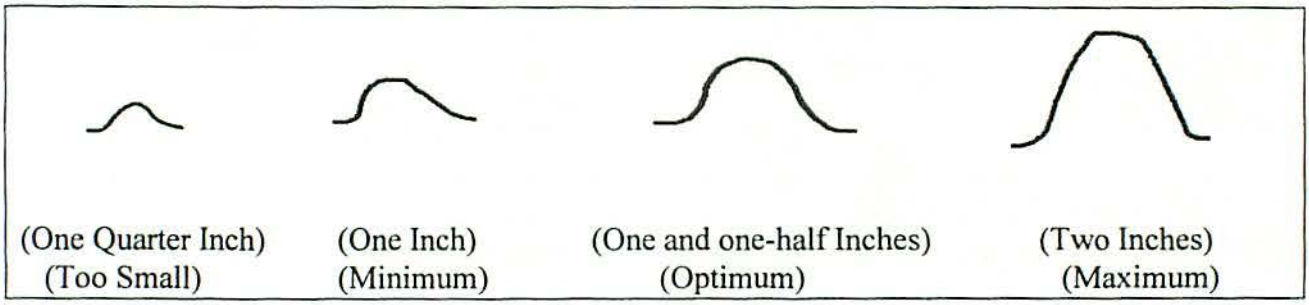
4.3. If, for some reason, the tips of the index and ring fingers cannot be utilized (i. e. injury, missing fingers, or other factors), there are acceptable alternate locations for attaching the EDA sensor. In these instances, the fingerplates could be placed on the 2nd joint of the two fingers, if available, or on top of the fingers (realizing there is a less density of sweat glands at this location). In the event that the examinee has an injured arm, hand, or missing limb, the fingerplates could be placed on the tips of the toes on one of the examinee's feet. The toe location has a significant concentration of sweat glands, but perhaps less than the fingertips. Of course, utilizing the foot would require removal of an examinee's shoes and socks. In this situation, the examiner should be tactful and professional during this potentially awkward process and fully explain the rationale for using such procedures.

4.4. For analog and computerized instruments, the examiner should make every effort to eliminate or at least minimize static electricity on the floor or carpet from potentially interfering with an examinee's EDA signals. If available, a rubber mat or other remedies may assist in discharging static electricity. Additionally, for analog instruments, the examiner should ensure that the instrument is properly grounded to help eliminate or minimize erratic EDA recording "pin chatter" or periodic "pin whip." For both computerized and analog instruments, the examiner should insure that the fingerplates are properly and snugly attached to each finger to maintain good contact between the fingerplates and the skin. Further, the examiner should be protective of the EDA sensor to insure that the shielded cable or connections do not become damaged or worn. If they do, this might impede or affect the examinee's EDA signal that is being transmitted to the sensor box or analog instrument galvanograph component. As a means to evaluate whether or not the fingerplates have been properly attached, the examiner should check the size/amplitude of the tracings on the computer screen or analog chart at the beginning of the data collection phase.

4.5. For training purposes in the PDD Program, at the DoDPI, with the type of computerized polygraph systems and equipment utilized in laboratory activities, to ensure that the examinee is properly "balanced" into the system at the beginning of a chart (before first scorable question is

asked), the recommended range of amplitude for the ideal EDA tracing is a minimum of one inch, optimum of one and one-half inches and maximum of two inches. (Note: During the data collection phase, this amplitude range is required for DoDPI PDD Course students, as they are not allowed to make any corrections in the "replay mode" while being graded on their laboratory activities.)

Figure F.2.Recommended Ranges for EDA Training.



4.6. Generally, the examiner will have to assess an examinee's EDA reactivity potential for that day of testing. To assist in this process, there are several windows of opportunity - when stimuli are applied prior to the "X" (and/or first scorable question if the testing format allows) - where the examiner can try to assess an examinee's ideal EDA sensitivity setting for that chart. The examiner should pay attention when s/he informs the examinee that they are: placing the instrument into operation; when they tell the examinee that they are going to inflate the blood pressure cuff; as they inflate the cuff; massage the cuff; and announce that the test is about to begin. When each of these stimuli are applied, there should be instances of EDA reactivity (or a lack of it) to help the examiner determine whether s/he needs to increase or decrease EDA sensitivity. If during this process, there is too much EDA activity, the examiner should be decreasing the sensitivity until the desired level of response is obtained. Likewise, if there is insufficient EDA response, then the examiner should be taking action to obtain an adequate tracing size. During this process and before the "X," once the examinee has shown that s/he is capable of responding at the desired level (between one to two inches), this response does not have to occur each and every time a stimulus is presented.

4.6.1. Other EDA sensitivity evaluation opportunities that the examiner should watch for is the examinee's EDA reactivity profile during the *"Acquaintance Test."* This test data sample can act as a gauge as to what to expect; i.e., whether there are significant reactions at the beginning of the chart, or whether these reactions subside or decrease as the chart progresses. Therefore, the examiner should pay close attention to the amplitude of the EDA reactions before or at the beginning of each chart, during the chart, and after the "XX" to see what the examinee's demonstrated physiological potential was at these stages of data collection.

4.6.2. Following the above procedures should assist the examiner in formulating his/her judgment concerning the optimum EDA sensitivity. It could be that the examiner might have to endure a larger than normal size tracing at the beginning of a chart if the tracing diminishes near the end of the chart. At least, the EDA tracing [near the middle or end of the chart] will be sufficient enough to record any reaction from the examinee. Also, when a particular testing

format allows, the examiner may have to increase or decrease the EDA sensitivity [at authorized points] within the chart to be able to adequately score the collected physiological data.

4.7. Other factors or judgments the examiner may have to make are whether or not to start out in the *"manual"* or *"auto"* EDA mode. When the instrument is in the auto mode, part of the examinee's actual EDA signal strength is lost through filterization. Although the EDA auto mode is usually perceived as being "easier or more convenient" for the examiner to manage/score, s/he should recognize that they are sacrificing an opportunity to observe and record the examinee's true/unfiltered EDA signal.

4.7.1. For computerized instruments, the examiner should understand that the "sensor box" generally has two positions labeled "manual" and "auto" mode. However, in reality, both of these computer modes undergo filtering - with auto mode being filtered more than the manual mode. The manufacturers of the Axciton and Lafayette computerized polygraph systems recommend that the EDA physiological data be collected in the auto mode to ensure compatibility with the scoring algorithm software. Stoelting computerized manufacturers recommend using the manual EDA mode.

4.7.2. For analog instruments, it is recommended that the EDA tracing be collected in the manual mode, as this enables collection of an examinee's physiological data without any filterization. However, should the EDA tracing become inadequate, too erratic, or start to "plunge" excessively, the examiner may have to switch to the auto mode to obtain usable and interpretable physiological data. Generally, a guideline for determining if an EDA tracing is plunging excessively is when it rapidly plunges at a 45-degree angle or more.

5. ELECTRODERMAL ACTIVITY REMEDIES AND STRATEGIES

5.1. A factor that should be considered in an examiner's efforts to collect adequate EDA data is the temperature of the room/environment where the PDD examination is being administered. Common sense dictates that a cold environment will inhibit sweat gland activity and a hot/humid environment will usually increase sweat gland activity. Therefore, the examiner may have to take specific actions to insure these factors are minimized so as not to significantly impede collecting the desired EDA signal. The examiner may have to take active steps to warm a cold examination room or cool an overly hot examination room. Some factors for consideration are the amount and types of clothing worn by the examinee, air flow/fans/portable heaters, covering an examinee's hand with a coat or other garment, or perhaps holding a cup of warm coffee/water for a few minutes before starting each chart to warm the fingers where the EDA sensors are placed. Depending on the situation, there are probably several more potential remedies, but the point is that the examiner must take active steps to ensure they obtain an adequate EDA tracing from an examinee.

5.2. The examiner should also be aware of various substances that may be used to contaminate the hands/finger tips and act as a barrier between the skin surface and the EDA sensor fingerplates. Such substances could be utilized inadvertently, be the result of the

examinee's normal work environment, or even could used as an "intended" countermeasure. Since the chemical receptor for eccrine sweat glands is muscarinic, an anti-muscarinic solution might interfere with collecting a suitable EDA tracing (i.e., antihistimes, body deodorant, etc.). Substances as hand creams, fuel oils, hair spray, nail polish, and especially cleaning solvents (like weapons' cleaner, mechanic's cleaners, etc.), usually dry the skin, penetrate the skin pores (sweat glands), and may interfere in varying degrees with the desired contact between the fingerplates and reactivity of the eccrine sweat glands. The examinee may or may not be aware of these factors. Therefore, the examiner may have to take active corrective measures, such as having the examinee wash his/her hands in clear water (without soap) as thoroughly as possible. Further, the examiner may have to take other corrective actions such as applying EDA electrode paste or relocating the fingerplates in another area that is less contaminated.

5.3. With these environmental and skin contamination problems, the examiner may have to utilize a specially formulated electrode paste to help offset or minimize these impeding factors. The role of this medium is intended to hydrate the corneum (dead, dry skin cells on top layer of skin) and improve the contact between the skin and sensor. For best results, the electrode paste should be composed of a neutral base and physiological saline. Another alternative is "KY" jelly that is available at most drug or department stores. Whatever the medium used, it should be placed on the EDA fingerplates to create a better contact between the sensor and the skin. A small amount can also be rubbed into the skin; however, the electrode paste should be thoroughly cleaned from the fingerplates immediately after removal to prevent corroding of the sensor.

6. CARDIOVASCULAR SENSOR (CARDIO CUFF). This third phase of instruction will address the proper placement and attachment procedures for the cardiovascular sensor.

6.1. As noted above, the third sensor to be attached to the examinee is the cardiovascular monitoring sensor, usually consisting of and referred to as the "cardio cuff" assembly. Usually, the cardio cuff assembly consists of a rubber bladder, covered with a cloth sleeve and tightening component (Velcro wrap), pump bulb assembly, including a sphygmomanometer and associated rubber tubing for connection of the sensor to the computer sensor box or analog instrument.

6.2. The cardio cuff is preferably placed over the brachial artery of the upper portion of an examinee's arm; however, some examiner discretion is allowed in attaching the cardio cuff sensor. Some examiners prefer to place the cuff on the left arm, under the proposition that it is closer to the heart and produces a stronger cardio signal. Other examiners believe that the cuff should be located on the right arm (with no significant loss of cardio signal), as it allows the examiner to constantly view the cuff and detect any possible movements or other anomalies. Regardless of which arm is selected, the cardio cuff is placed on the arm opposite of the hand where the EDA sensor is to minimize possible artifacts in the EDA tracing.

6.3. Once the proper site for the cardio cuff placement is made, the examiner should use extreme care in attaching this sensor. For the ideal cardiovascular signal to be obtained by the bladder and transmitted to the sensor box or analog instrument, it is recommended that the "center of the rubber bladder" be placed directly over the brachial artery (as indicated above). It

is believed that the farther away from this target zone from where the cuff is placed, the weaker the signal becomes. This is because the adjacent muscle and concentrated tissue could inhibit or decrease the original arterial cardiovascular signal.

6.3.1. If for some reason one of the upper arm biceps cannot be used (i.e., injury, missing limb, or other relative factor), there are acceptable alternative locations for attaching the cardiovascular sensor. However, before selecting one of the following acceptable alternative sites, the examiner should remember that the farther away a sensor is placed from the transmitter (in this case - the heart), the smaller or weaker the signal becomes. Accordingly, selecting an alternative site may yield less intense or less dynamic reactions/chart tracings. Therefore, careful attention must be given in selecting an alternative cuff site to ensure that acceptable cardiovascular tracings are obtained for subsequent test data analysis purposes.

6.3.2. The list of alternative sites for the cardio cuff placement includes the forearm, wrist, and/or calf of the leg. If one of these alternative sites is selected, the examiner should fully explain to the examinee the rationale for such non-routine procedures. With these alternative cardio cuff sensor sites, there are additional problems that could inhibit the sensor from detecting the maximum signal. Usually, the forearm, and definitely the calf of the leg, are slightly beveled (wide to narrow proportions). During the process of inflating or deflating the cardio cuff, it may slip toward the narrow section if the cuff is not secured tightly. When the cardio cuff is placed on the wrist, there is usually less concern with this problem. Additionally, because the wrist is significantly smaller than the bicep or forearm, the examiner may have to utilize a wrist cardio cuff (usually a smaller-sized cuff). For this reason, examiners should probably have different sized cardio cuffs available.

6.4. In addition to deciding where the cardio cuff is placed, the examiner should also ensure that no other external or secondary pressure can be applied to the cuff after it has inflated and is sending a signal to the computer sensor box or analog instrument. For instance, if the cuff is placed on one of the biceps, the examiner should ensure that the rubber bladder is placed over the targeted brachial artery without being pressed against the chest cavity or other area of the body during the respiratory process. Further, the examiner should always ensure that none of the associated cardio cuff tubing is crimped, bent, pressed, or otherwise constricted during the data collection period. If the cardio cuff is placed on the forearm, wrist, or calf of the leg, the examiner should ensure that it is placed on properly to prevent the examinee from applying pressure (intentional or unintentional) and affecting the cardiovascular tracing during the data collection phase.

6.5. It is recommended that the cardio cuff sensor be isolated (or positioned) away from the rest of the body or arm of the examinee polygraph chair. If the PDD examination is being conducted in other than a routine polygraph suite (i.e., remote location), the examiner may have to utilize extra diligence and care in arranging a testing environment that does not create factors leading to undesirable artifacts in any of the three physiological parameters, especially the cardio cuff sensor.

7. REMEDIES AND STRATEGIES FOR IMPROVING CARDIOVASCULAR TRACINGS

7.1. If the pressure in the cardio cuff is too low, the cardio tracing may become erratic, or appear in a *"wavy"* type pattern, which interferes with or possibly precludes any attempt at performing meaningful test data analysis. Assuming that the cardio cuff has been properly attached/placed on the examinee, one possible remedy is simply to increase the pressure until the cardio tracing becomes adequately stable and an adequate tracing is obtained. Generally, with this type of cardiovascular pattern, increasing the pressure will stabilize the tracing.

7.2. Also, if the cardio cuff has become caught or pinched between the examinee's arm and chest cavity, the cardiovascular tracing may appear in a *wavy-type* pattern as the signal is being distorted by the examinee's breathing pattern. If an examiner observers this type of disruptive cardiovascular tracing, s/he should also look at the examinee's breathing pattern to determine if the wavy cardio pattern is in sequence with the respiratory pattern. If so, corrective action must be taken to move the cardio cuff's position or other appropriate action accomplished to prevent the cardiovascular tracing from being artifacted.

7.2.1. If a standard polygraph chair is not being utilized to support and stabilize the examinee's arms, the examiner should consider lifting the examinee's arm up and away from the body. If at a remote site, the examiner could have the examinee sit in a chair adjacent to a desk and stack some books or other items in a fashion for the examinee to comfortably rest his/her arm. Another alternative might be to utilize the back of a chair that is near shoulder height of the examinee. The examinee can then sit in one chair and place his/her arm with the cardio cuff over the back of the adjacent chair. If a chair has arms on either side that are lower than the examinee's comfort level, the examiner may want to consider placing another chair in front of or to the side of the examinee for arm comfort, rather than allowing the arm with the cardio cuff to hang in an awkward position.

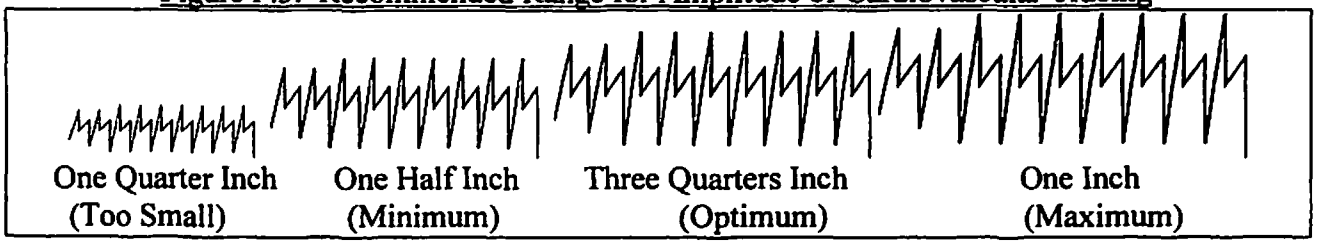
7.2.2. There may be many other similar home remedies that an examiner might formulate to help obtain a more useful cardiovascular tracing. Usually, the examiner would be limited only by the extent of his/her imagination. The point is to attempt to make the examinee as comfortable as possible while simultaneously creating test conditions that yield the maximum amount of an examinee's physiological data.

7.3. During the data collection phase, the examiner should pay attention to the location of the dicrotic notch in the cardiovascular tracing. Generally, when the dicrotic notch is near the top or upper portion of the cardio tracing, it is suggestive that either the cardio cuff is off center of the brachial artery or there is insufficient pressure in the cardio cuff. Conversely, when the dicrotic notch is near the bottom or lower edge of the cardiovascular tracing, it may indicate that the cardio cuff is again off target of the brachial artery or there may be too much pressure in the cardio cuff. The point being that when the cardio cuff had been properly attached at the ideal location over the brachial artery, Mean Cuff Pressure (MCP) is nearest Mean Arterial Pressure (ideal goal), and there is a 2-millimeter deflection of the sphygmomanometer needle, the dicrotic notch should appear near the center of the cardiovascular tracing.

7.4. The above factors generally apply to both the computer and analog instruments. However, examiners are reminded that in the analog instruments, the appearance/ location/movement of the dicrotic notch is a result of the cardio cuff sensor reflecting changes in physiological data. However, in computerized polygraph systems, the manufacturers have engineered an artificial dicrotic notch into the tracing for esoteric purposes. As a result, this artificially created dicrotic notch may be helpful during the data collection phase, but it will not be a useful criteria for test data analysis.

7.5. For training purposes in the PDD Program, at the DoDPI, with the type of computerized polygraph systems and equipment utilized in laboratory activities, the recommended range for amplitude of the cardiovascular tracing is a minimum of one half inch, optimum of three quarters of an inch, and maximum of one inch. (Note: During the data collection phase, this amplitude range is required for DoDPI PDD Course students, as they are not allowed to make any corrections in the "replay mode" while being graded on their laboratory activities.)

Figure F.3. Recommended Range for Amplitude of Cardiovascular Tracing



8. SUMMARY

8.1. The reader should note that not every possible situation or solution regarding the attachment and placement of physiological recording sensors for a computerized polygraph system or analog polygraph instrument has been addressed in this brief discussion. However, the most prominent or most frequently encountered situations have been described, examined, and acceptable proposals for possible solutions [based on the current state of the art knowledge] have been covered. Even though this discussion may not have been all-inclusive or totally exhaustive, it should still help guide the examiner and act as a catalyst to stimulate the examiner's thinking and approach in overcoming one of the major difficulties in the PDD profession. Historically, that has been the failure to collect sufficient and adequate physiological data for test data analysis purposes.

8.2. The intended point or primary goal of this brief discussion on attachment and placement of polygraph instrument sensors is simply to remind and reemphasize to examiners that it is critically important for them to properly place the three primary sensors (Pneumographs, Fingerplates, and Cardio Cuff) at their optimum locations in order to obtain the best possible physiological signals for subsequent analysis during the data analysis phase.

8.3. Further, this discussion should act as a common sense warning. If an examiner, for whatever reason, fails to adhere to the above basic principles and concepts, s/he unnecessarily risks collecting less-than-ideal examinee physiological data. This subsequently exposes both the examinee and examiner to a greater potential for errors in the results of a PDD examination or the necessity to conduct additional testing, which might otherwise have not been required.