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PERFORM Operating Document

Applying Standard Individual Scalp Electrodes

Using the Ten-Twenty System

PC-POD-FA-004-v01

Revision History

Version	Reason for Revision	Date
01	New POD	March/31/2015

Summary

The content of this PERFORM Operating Document (POD) provides guidelines for:

- Applying Individual Scalp Electrodes
- Cleaning Electrode Sites with Alcohol and Abrasive Paste
- Alternative: Cleaning Electrode Sites with Soap and Water

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1. Definition of Terms

EEG	Electroencephalography
Instructor	Person that has attained an adequate level of certification and expertise which qualifies them to supervise and teach students.
International Ten-Twenty System of Electrode Placement	An internationally recognized method to apply the location of scalp electrodes in the context of an electroencephalogram.
Internship student	An internship student is a current student or recent graduate that is undergoing supervised practical training supervised by PERFORM employees.
Impedance	It is defined as the measure of the opposition that a circuit presents to a current when a voltage is applied. It is the AC (alternating current) equivalent to resistance.
K Ohms	1 ohm is equal to 0.001 kilo ohms, K Ohms.
Ohm (symbol: Ω)	The ohm is the unit of measure for electrical resistance. It is the resistance between two points of a conductor when a constant potential difference of 1 volt produces in the conductor a current of 1 amp (ampere).
PERFORM operating document (POD)	Operating documents that are specific to an instrument or technique that require approval by area managers.
Project Lead	The project lead is the person who is responsible for all aspects of a given project at PERFORM
User	Person using space or equipment at the PERFORM Centre that has received adequate technical and safety training.

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2. Introduction

2.1 Background

When the individual EEG electrodes are properly applied according the International Ten-Twenty (10-20) System, the coverage of the two hemispheres is symmetrical. If electrodes are not symmetrically placed on the scalp, voltage asymmetries may occur during the recording.

Skin preparation differs depending on the type of electrode. In general, cleaning of the scalp surface from oil and removing dried skin is recommended. With disc type of electrodes, abrasive paste is used to remove the oil and dry skin from the scalp. With cap systems, an abrasive conductive paste or a blunt-tip needle is used for scraping the scalp surface. The disc type of electrode is filled with conductive paste. With the cap systems, there is a small hole to inject conductive gel with a blunt-tip needle.

High impedance can lead to a distortion in the EEG signal and it may allow interference from changes outside the brain (interference of the recording equipment) and changes produced by biological activity (eye movements, heart beat and scalp muscle). In order to prevent signal distortions from high impedances, impedance should kept <10KOhms.

2.2 Purpose

To establish a POD for the application of individual EEG scalp electrodes according to the International 10-20 System of Electrode Placement (Jasper H. The '10-20' system. Electroenceph Clin Neurophysiol 1958;10:371-375; American Electroencephalographic Society. Guideline thirteen: Guidelines for standard electrode position nomenclature. J Clin Neurophysiol, 11:111-113, 1994).

2.3 Scope

This POD applies to all users and supervisors using EEG scalp electrodes at the PERFORM Centre, Concordia University.

2.4 Responsibility

It is the responsibility of user to apply the scalp electrodes to the proper locations with acceptable impedances.

2.5 Equipment

2.5.1 For applying individual scalp electrodes

- Reusable disc electrodes, e.g. (gold, silver, stainless steel or tin)
- Conducting electrolyte paste or gel (e.g.Ten20 paste, EC2 electrode cream)

- Metal cup electrodes (gold, tin, Ag/Silver)
- Abrasive paste (e.g. Nuprep)
- EEG conductive paste (Ten20)
- Cotton-tipped applicators
- Gauze squares
- Hair clips, if necessary
- Alcohol
- Non-sterile, non latex, powerless gloves
- Lab coat, if desired
- Impedance meter (optional)
- Scissors

3.0 General Considerations

- Hair should be dry and all hair pins, barrettes and earrings must be removed.
- When applying EEG electrodes, each site is cleaned with alcohol and an abrasive paste. However, if irritation occurs or if the subject complains of pain at the site, then follow the alternative method for cleaning the site using soap and water.

4.0 Procedure

4.1 Cleaning Electrode Sites with Alcohol and Abrasive Paste

1. Have subject prepare for electrode application (e.g., wear shirt they would like to wear for duration of the recording).
2. Seat subject in set-up area
3. Locate application site (refer to PC-POD-FA-003, Placement of Standard Scalp Electrodes Using the International Ten-Twenty System).
4. Part hair away from site using hair clips or back of cotton-tipped applicator. Keep hair away from site until electrode has been applied.
5. Using a circular motion, gently clean site with a cotton-tip applicator saturated with alcohol*. The size of the site that you clean should only be slightly larger than the electrode cup.
6. Using cotton swab, apply a small dab of abrasive paste (e.g. Nuprep)* to site. Gently scrub using a circular motion.

Cleaning sites with alcohol and Nuprep is abrasive, may irritate the subject's skin and increase risk of infection.

FOLLOW THE PROCEDURE AT THE BOTTOM OF THIS POD FOR CLEANING ELECTRODE SITES WITH SOAP AND WATER WHEN ANY OF THE FOLLOWING OCCUR.

- *The site looks irritated or the subject complains of pain at the site. NOTE: Must inform the Project Leader and document.*
- *Requested by the Project Leader.*

7. Do not touch site, or allow hair to touch site, after cleaning or applying the abrasive paste – unwanted oils and dirt can easily be introduced.
8. Fill the electrode cup completely with electrolyte paste, creating a slight convex surface.
9. Carefully remove excess strands of hair from site without introducing unwanted oils and dirt.
10. Apply electrode to site with lead directed towards back of head to later form a "ponytail bundle (see below)". Gently maintain pressure on the center of the electrode cup.
11. Center a single piece of gauze over the electrode.
12. Gently apply, and maintain, pressure to keep electrode in place.
13. Smooth, secure, and fully seal gauze around electrode.
14. Repeat above steps for remaining electrodes.
15. Neatly bundle electrode wires at completion of application using tape or a ponytail wrap.

4.2 Alternative: Cleaning Electrode Sites with Soap and Water

PURPOSE:

To establish a standard alternative procedure for cleaning electrode sites with soap and water instead of alcohol and abrasive paste when any of the following occur.

a. *The site looks irritated or the subject complains of pain at the site. NOTE: Must inform the Project Leader and document.*
b. *Requested by the project leader.*

ADDITIONAL EQUIPMENT:

- Foaming skin cleanser
- Water
- Paper Cup

PROCEDURE:

1. Follow steps above for preparing the equipment.
2. Prepare a paper cup with lukewarm water and a small pump of foaming skin cleanser.
3. Follow the steps for cleaning the sites and applying electrodes to sites in section, "*2.5.1 For applying individual scalp electrodes"* but DO NOT use abrasive paste (e.g. Nuprep) and/or alcohol to clean the site, instead use the steps listed below to clean the site with soap and water.
4. Dip a cotton-tipped applicator in the soap and water and clean the site using a slow circular motion.
5. Rinse site with a gauze pad dampened with lukewarm water, being careful not to introduce dirt from outside the area into the electrode site.
6. Dry site with a dry gauze pad.
7. Repeat these steps for cleaning each of the sites with soap and water prior to

applying the remaining electrodes.

8. Document application with soap and water.

4.3 Standard Electrode Bundling

EQUIPMENT

- 1inch Transpore tape (or 3 Velcro straps)
- Set of applied EEG electrodes

PROCEDURE

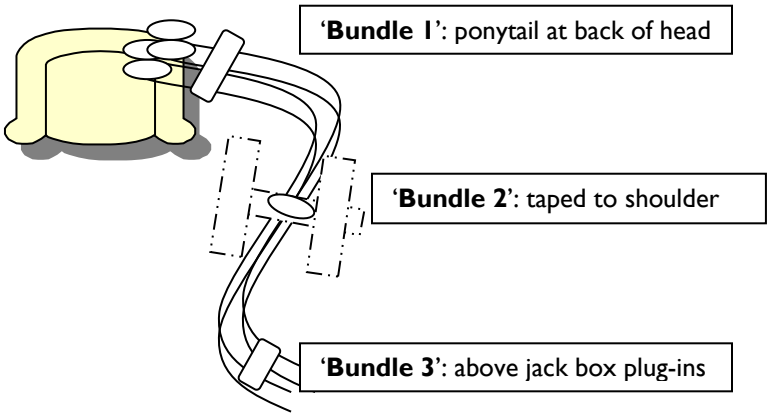
1. Fold a 4" piece of 1" transpore tape (or instead use a Velcro strap) onto itself so the adhesive side of the tape will not touch the electrode leads. Leave approximately 1 inch of the adhesive side exposed. Tab the adhesive end for easy removal.

2. Neatly collect all electrode leads at the nape of the subject's neck and tightly wrap tape around electrodes to create a bundle (**'Bundle 1'**) - leave tab accessible.

3. Ask the subject to move his/her head in all directions to ensure comfort. Adjust as needed.

4. Repeat Step 1. Bundle electrodes about half way down the length of the leads (**'Bundle 2'**).

5. Place a piece of transpore tape (or Velcro strap) directly over 'Bundle 2' and secure it to the subject's shirt near his/her shoulder. To secure the tape over 'Bundle 2', place another piece of transpore tape over, and perpendicular, to each end.



6. Repeat Step 1, and wrap tape around the electrodes a few inches above plug-ins (**'Bundle 3'**).

7. Re-check electrode attachment and subject comfort.

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APPENDIX I

POD Training Record Form

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POD Title

Application of Standard Scalp Electrodes

SOP Code

Ownership	Document type	Area	SOP Number	Version
PC	POD	FA	004	01

Training Record

Full Name	
Institution	
Contact (email or phone number)	

Signature

Sign here

Date