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QEEG Px Pendant Preliminary Study

Report of QEEG findings prepared by
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Recording and Analysis Procedures:
The electroencephalograph (EEG) was digitally recorded (256 samples/sec) utilizing 19 electrodes with the International 10/20 System of electrode placement. Electrode impedances were reduced to below 5Kohms. The EEG was recorded continuously in the awake state with eyes closed and eyes open and may have included additional tasks. The raw EEG has been visually inspected and ocular and muscle artifacts rejected before generating the Neurometric analysis report.

This QEEG assessment reveals locations of dysfunction in the brain and quantifies the degree of deviation (Z-scores) from a normalized database. This data is helpful for the detection and localization of brain pathologies and/or dysfunctions (dysregulations). This information may assist in the differential diagnosis and in guiding the selection of treatment protocols and appropriate medications.

There are 2 reports (each a separate file), generated with Neuroguide software (www.appliedneuroscience.com), labeled:

KL427EC……. eyes closed condition (Baseline)
KL427Dev2…….eyes closed condition (Px Enamel Pendant)

Pages 1- 2 are subject and technical information.

Page 3 is Z-scored FFT summary information. This is overall results for EC or Dev2 file. Labels at the top of each column show the EEG frequency bands: Delta, Theta, Alpha, Beta and High Beta as shown on Pages 14 - 17.
From page 3: The two top rows show colored brain topographic maps (topos, the dots indicate the 10-20 scalp electrode placements) for Absolute and Relative Power. Power is computed as the signal amplitude squared.
Absolute power is the total power computed for each frequency band in uV2.
Relative power is obtained by dividing the power in each band by the total power across all the bands (the sum of the power in each of the bands listed). Relative Power is therefore a % power value.
The color scale below the Alpha topo (Relative Power row), indicates the **Z-scores** derived from a comparison to the Normative database (RW Thatcher). This database compares the client's EEG values to an age and gender matched cohort and assigns a **Z-score** to indicate the degree of deviation from normal. Medium green is Z=0, normal values; positive Z-scores are light green, yellow, orange and red, indicating +1, +2, +3 values. Negative Z-scores are dark green, light blue to dark blue, indicating -1, -2, -3 values. Z-scores +- greater than 2.6 are statistically significant and **+- 3.0 or greater are considered highly statistically significant (red and blue respectively at each end of the scale).**

The 15 remaining topos, labeled: Amplitude asymmetry, Coherence and Phase are also known as **connectivity maps,** because they describe QEEG metrics related to brain functional connectivity. Note the Z-score is now indicated by the thickness of blue (negative values) and red (positive values) lines of varying thickness that connect pairs of dots (i.e recording sites). The software calculates these metrics for all paired combination of cortical sites. Medium and thick lines are Z-scores >= (greater than or equal to) 2.58 and >= 3.09, respectively.

Definitions

Coherence - The percentage of brain wave activity that is time-related between two locations. A measure of the coupling between two signals with a constant phase relationship at different locations. The normal coherence between all regions is around 60%.

Hypercoherence indicates hyper synchrony between two locations or regions and a loss of local, differentiated activity.

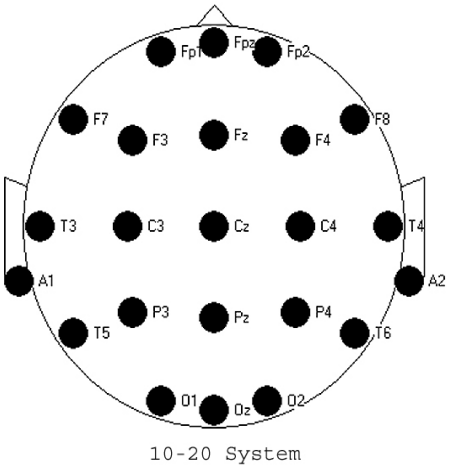
Hypocoherence indicate poor synchrony, reflecting impairment in the connection between two locations or regions.

For example, we measure coherence by comparing the stability of phase differences of the brainwaves at two different locations (e.g.FP1 and FP2). If, according to normative databases, there is too much similarity between two locations, there is hyper-coherence. The opposite of this is hypocoherence, where there is excess dissimilarity. Coherence is a measure of the extent to which two brain locations share activity or work together. In hyper-coherence there is too much sharing of information, meaning that the two brain areas are not sufficiently differentiated for optimal performance of whatever task they are sharing. Hypocoherence on the other hand, means that the two brain areas are too independent of each other. They do not cooperate to the extent required by the task at hand.

Abnormal coherence patterns are seen commonly in cases of Traumatic Brain Injury and Post Concussion Syndrome.

Phase Lag . Based on the calculated phase angle, converted to ms (milliseconds), between all connected pairs of scalp locations. An excess (Z+2,3 or higher) phase lag translates to slowing of neural signal transmission (reduced conduction speed) between connected sites

Below is the International 10-20 system of scalp electrodes placements.
F frontal, C central, T temporal, P parietal, O occipital



10-20 System

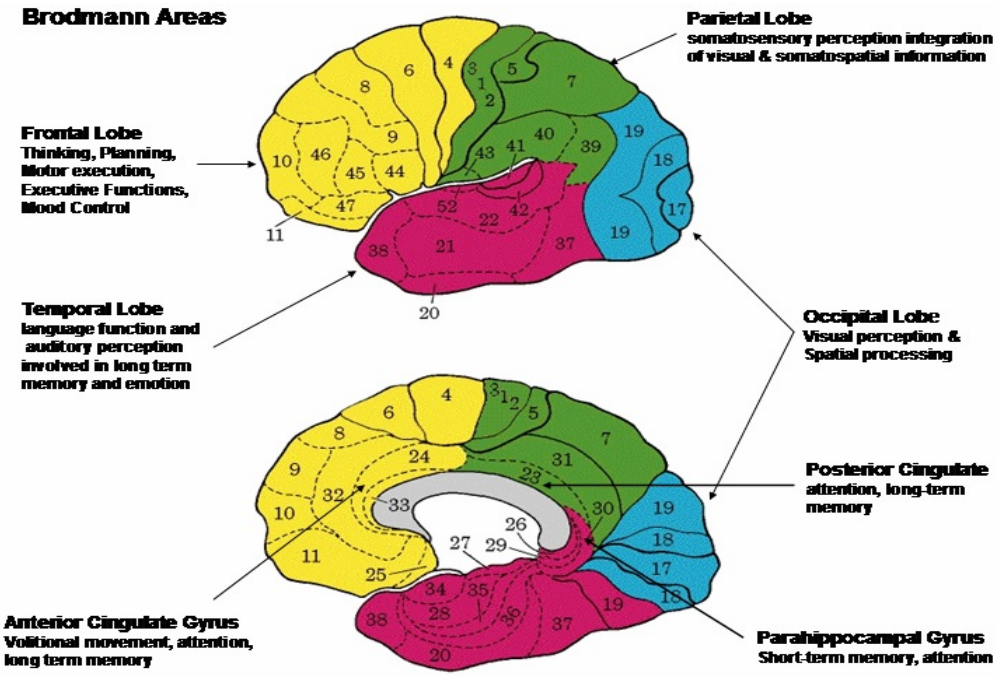


Illustration of Brodmann areas (Brodmann, 1909) linked to particular functions. Brodmann areas operate at the macroscopic level as measured by the QEEG with spatial areas of common functional cytoarchitecture that range in size from about 1 cm^3 to 6 cm^3. The goal is to link a patient's symptoms and complaints to deregulation or deviation from normal in brain regions known to be related to specific functions. QEEG also provides high temporal resolution so that measures of dynamic connectivity and phase reset can also be evaluated with respect to an age match normative database. Treatment then follows.

SUBJECT Z Scored FFT Summary - Baseline/Px Pendant Data Comparison

Page 3
Baseline in Delta frequency Absolute Power and Relative Power indicate a notable degree of deviation from normal, especially in the temporal lobes. Baseline recording also indicates a **highly statistically significant** degree of deviation from normal in Delta Amplitude Asymmetry, Coherency, parietal and right temporal Phase Lag. Furthermore, Theta Amplitude Asymmetry (F3/F2/F4, and F8/T4), Coherency (F4/C4/P4/T4) levels measurements indicate statistically significant and/or **highly statistically significant** deviation from normal.

With the application of the Px Pendant, an immediate and significant trend towards normalization is noted, especially within the Delta frequency temporal lobe Absolute Power and Relative Power; along with Amplitude Asymmetry, Coherency, and Phase Lag. Moreover, Theta Amplitude Asymmetry and Coherence are notably normalized as well; thus indicating changes with Px application.

FFT Absolute Power (uV Sq) - Baseline/Px Pendant Data Comparison

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	Delta	Theta	Alpha	Beta	High Beta	Beta 1	Beta 2	Beta 3
BASELINE	**6 – 24**	**4 – 17**	**5 – 58**	**5 – 33**	**.54 – 1.49**	**1 - 19**	**1.5 – 5.3**	**2.1 – 9.4**
Px Pendant	**7.9 – 14.8**	**4 – 17**	**6 – 71**	**6 – 40**	**.5 – 1.8**	**2 - 24**	**1.5 – 5.5**	**2.3 - 11**
BASELINE MEAN	**15**	**10.5**	**31.5**	**19**	**1.02**	**10**	**3.4**	**5.8**
Px MEAN	**11.4**	**10.5**	**38.5**	**23**	**1.1**	**13**	**3.5**	**6.7**
+ or - % Mean Change	**- 24%**	**O%**	**+ 22%**	**+ 21%**	**+7.8%**	**+ 30%**	**+ 2.9%**	**+1.6%**

The chart above (quantifying the images on page 4) indicates shifts in **Absolute power** which is calculated as the total power computed for each frequency band in uV2. Comparing the second and third rows in the chart, it is evident that the range of numbers is changed. For instance the Delta Baseline ranges from 6 to 24 and the addition of the Px Pendant instigated a change of range from 7.9 to 14.8 within the subject; while the Mean Absolute Power (bottom row) is decreases by 24%. Notice on the images provided on page 3 that the Delta temporal Absolute Power images show a trend towards normalization from yellows to greens with the application of the Px Pendant. The Delta Baseline measurement may be indicative of Traumatic Brain Injury or Post Concussion Syndrome, and/or a “slowing down” or sleepy state. Following the application of the Px Pendant, the shift in Delta shows that this technology is initiating an improvement in this frequency range towards normalization.

The Alpha Baseline ranges from 5 to 58 and the addition of the Px Pendant instigated a change of range from 6 to 71 within the subject. Moreover, the Beta Baseline ranges from 5 to 33 and the addition of the Px Pendant instigated a change of range from 6 to 40 within the subject; while the Alpha and Beta frequency ranges gained Mean Absolute Power by 22% and 21% respectively. This significant increase is often found with devises that promote wellbeing. Additionally, research has shown that these increases are often found in the brain maps of healers. The increased Alpha state is indicative of a state of "relaxed awareness".
Beta, High Beta and Beta 1. 2, and 3 increases are typically quite small because Beta is a very small amplitude. Based upon this understanding, the Beta frequency changes are worthy of note. Beta frequencies represent brain activity, focus and concentration; often called "the brain on task".

These quantitative comparisons indicate that the Px Pendant has shown to suppress Delta and enhance Alpha and Beta frequency ranges indicating a state of calm awareness normally found in the brain maps of elite athletes who are capable of maintaining focused and calm concentration while under a significantly stressful environment.

Z Score FFT Absolute Power - Baseline/Px Pendant Data Comparison

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These images identify the incremental Hz ranges; 1 through 30. Where Delta ranges between 1 to 4 Hz; Theta ranges between 4 to 8 Hz; Alpha ranges between 8 to 12 Hz; Beta ranges between 12 to 25 Hz, and High Beta ranges between 25 and 30Hz.
Under the 1 Hz Baseline image the subject shows 3 value standard deviations (Z Scores) too much Delta at the temporal areas (red). With the application of the Px Pendant, the map shows a 2 Z Score value improvement towards normal. Normalizing (trends towards green) are displayed in Delta and Theta frequency ranges 1 Hz through 6 Hz; while increased Absolute Power is shown by increased yellow coloration in the 11 Hz Alpha through the 25 Hz Beta ranges. This maps indicate that the application of the Px Pendant incites higher mental activity combined with relaxed awareness while normalizing the heightened Delta abnormality.

Z Score FFT Relative Power - Baseline/Px Pendant Data Comparison

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These images identify the incremental Hz ranges; 1 through 30. Where Delta ranges between 1 to 4 Hz; Theta ranges between 4 to 8 Hz; Alpha ranges between 8 to 12 Hz; Beta ranges between 12 to 25 Hz, and High Beta ranges between 25 and 30Hz.
Normalizing (trends towards green) are displayed in Delta and Theta frequency ranges 1 Hz through 6 Hz; moreover the 1 Hz Delta map shows a decrease in relative power which is considered an improvement for waking state activities. While increased Relative Power is shown by increased yellow and red coloration in the 11 Hz Alpha through the 23 Hz Beta ranges. This maps indicate that the application of the Px Pendant incites higher mental activity combined with relaxed awareness while normalizing the heightened Delta abnormal values.

FFT Absolute Power (uV Sq) - Baseline/Px Pendant Data Comparison

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Baseline

FFT Absolute Power (uV Sq)

Intrahemispheric: LEFT

	DELTA	THETA	ALPHA	BETA	HIGH BETA	BETA 1	BETA 2	BETA 3
FP1 - LE	9.78	7.18	11.42	11.73	1.01	3.95	3.20	4.58
F7 - LE	14.57	7.29	9.76	11.41	0.94	4.47	2.96	3.98
F3 - LE	14.71	13.25	18.31	15.66	1.04	5.37	4.31	5.98
T3 - LE	15.96	8.24	11.44	13.74	0.98	5.24	3.41	5.09
C3 - LE	17.35	13.16	21.94	17.92	1.20	6.56	4.63	6.72
T5 - LE	19.30	9.96	26.29	22.69	1.17	9.27	4.26	9.16
P3 - LE	18.53	12.60	31.81	23.37	1.31	9.45	4.90	9.03
O1 - LE	14.69	10.74	54.14	31.54	1.35	17.46	4.74	9.35

Intrahemispheric: RIGHT

	DELTA	THETA	ALPHA	BETA	HIGH BETA	BETA 1	BETA 2	BETA 3
FP2 - LE	6.95	5.97	10.22	9.86	0.94	3.12	2.71	4.03
F4 - LE	20.19	13.98	18.28	15.00	1.02	4.74	4.25	6.01
F8 - LE	8.58	4.14	5.66	5.91	0.63	1.98	1.68	2.25
C4 - LE	23.48	13.75	20.14	15.65	1.21	5.34	4.28	6.03
T4 - LE	17.01	5.97	6.71	6.01	0.54	2.29	1.53	2.19
P4 - LE	20.10	11.86	31.75	20.65	1.21	8.52	4.29	7.83
T6 - LE	14.77	7.59	28.01	16.94	0.88	8.31	2.58	6.05
O2 - LE	11.61	9.98	57.49	32.10	1.32	18.57	4.52	9.01

Intrahemispheric: CENTER

	DELTA	THETA	ALPHA	BETA	HIGH BETA	BETA 1	BETA 2	BETA 3
Fz - LE	9.16	11.15	17.07	14.73	0.87	4.69	4.11	5.92
Cz - LE	12.35	16.35	26.14	19.22	1.27	6.83	5.21	7.18
Pz - LE	17.98	13.68	37.84	23.54	1.48	10.01	5.26	8.27

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Px Pendant

FFT Absolute Power (uV Sq)

Intrahemispheric: LEFT

	DELTA	THETA	ALPHA	BETA	HIGH BETA	BETA 1	BETA 2	BETA 3
FP1 - LE	10.67	7.60	13.13	12.65	1.16	4.71	3.18	4.76
F7 - LE	14.69	7.70	11.60	12.18	1.04	5.08	2.95	4.15
F3 - LE	14.07	12.99	20.98	16.84	1.13	6.45	4.22	6.17
T3 - LE	12.22	7.53	14.13	14.52	1.04	6.02	3.28	5.21
C3 - LE	14.13	12.77	25.55	19.54	1.29	7.91	4.66	6.97
T5 - LE	10.06	8.11	33.88	25.35	1.26	11.42	4.10	9.83
P3 - LE	14.80	11.37	38.55	26.55	1.44	11.66	4.83	10.07
O1 - LE	12.81	11.21	68.37	38.52	1.61	22.50	5.11	10.91

Intrahemispheric: RIGHT

	DELTA	THETA	ALPHA	BETA	HIGH BETA	BETA 1	BETA 2	BETA 3
FP2 - LE	7.92	6.54	11.42	10.81	0.98	3.78	2.78	4.25
F4 - LE	11.59	12.52	19.52	15.74	1.06	5.56	4.08	6.09
F8 - LE	8.33	4.55	6.74	6.47	0.70	2.38	1.71	2.37
C4 - LE	13.19	11.34	21.91	16.70	1.21	6.12	4.24	6.35
T4 - LE	8.48	4.52	7.89	6.39	0.52	2.48	1.58	2.33
P4 - LE	13.74	10.46	37.37	23.44	1.34	10.01	4.47	8.96
T6 - LE	8.46	6.48	33.66	19.04	0.98	9.42	2.80	6.81
O2 - LE	10.62	10.38	70.87	39.24	1.59	23.21	5.14	10.89

Intrahemispheric: CENTER

	DELTA	THETA	ALPHA	BETA	HIGH BETA	BETA 1	BETA 2	BETA 3
Fz - LE	11.93	11.61	19.08	15.95	1.00	5.68	4.09	6.18
Cz - LE	13.60	16.13	29.10	21.33	1.38	8.39	5.33	7.61
Pz - LE	14.78	13.09	43.79	27.04	1.73	12.31	5.49	9.24

The Baseline charts above display high Absolute Power values in the Delta column, especially in the Right Intrahemispheric measurements. Note that the Px Pendant decreases these values by up to 50% (T4-LE) and 44% (P4-LE). This reduction in Delta incited by the Px Pendant brings the Absolute values towards normal. Concurrently, Alpha Absolute Power values are increased in nearly all measurements. 29% (T5), 24% (T3), 21% (P3), 23% (O2), etc. Likewise, Beta values are also increased in nearly all measurments with the introduction of the Px Pendant; 22% (O1), 14% (P4), 12% (T6), 15% (Pz), etc.

Conclusion:
The baseline mapping shows a notable degree of deviation from normal and a highly statistically significant degree of deviation from normal in Delta Amplitude Asymmetry, Coherency, parietal and right temporal Phase Lag. Furthermore, Theta Amplitude Asymmetry and Coherency value measurements indicate statistically significant and/or highly statistically significant deviation from normal. These Delta Baseline value measurements may be indicative of Traumatic Brain Injury or Post Concussion Syndrome, and/or a "slowing down" or sleepy state.

With the application of the Px Pendant, an immediate and significant trend towards normalization is noted within the Delta frequency temporal lobe Absolute Power and Relative Power; along with Amplitude Asymmetry, Coherency, and Phase Lag. Moreover, Theta Amplitude Asymmetry and Coherence are notably normalized as well; thus indicating improved changes with Px application.

The Alpha and Beta frequency Mean ranged from 31.5 and 19 respectively. These Absolute Power Mean values were increased by 22% and 21% respectively with the Px Pendant application. This significant increase is often found with devises that promote well-being. Additionally, research has shown that these increases are often found in the brain maps of healers. The increased Alpha state is indicative of a state of "relaxed awareness".

Furthermore with the application of the Px Pendant, Beta, High Beta and Beta 1, 2, and 3, Absolute Power Mean values increased 21%, 7.8%, 30%, 2.9%, and 1.6% respectively. The Beta frequency changes are worthy of note as they represent brain activity, focus and concentration; often called "the brain on task".

Summary:
These quantitative comparisons indicate that the Px Pendant has shown to suppress Delta while enhancing Alpha and Beta frequency ranges indicating a state of calm awareness, combined with heightened focus and concentration normally found in the brain maps of elite athletes who must perform while under a significantly stressful environment of competition. Additionally, the application of the Px Pendant shows an immediate trend towards normalization where statistically significant degrees of deviation from normal in Delta and Theta Amplitude Asymmetry, Coherency, and Phase Lag were measured in the baseline; thus reflecting improvement in the connection between two or more locations or regions. This unusual trend towards normalization warrants further study.