Artikel Penelitian

Electromyogram Similarity of The Morphologically Similar Muscles

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Abstract

Introduction: *Muscles are the largest tissue group in the body and can be classified into various classifications, one of which is based on their morphological shape. Examination of muscles, especially skeletal muscles, can use electromyography. The purpose of this study was to determine whether muscles that have similar morphology have no different electromyogram.*
Method: *This is a descriptive observational study using needle electromyography. The sample amounted to 5 with five times MUP (Motor Unit Potential) in each musculus deltoideus and musculus*
Result: *The mean amplitude, duration, number of voltage phases and the number of voltage turns off the musculus deltoideus and musculus gluteus medius in the study subjects were similar (p-value > 0.05).*
Conclusion: *Muscles that have similar morphology in each parameter of amplitude, duration, number of voltage phases, and number of voltage turns do not have a significant difference in electromyogram.*

Keywords: *electromyography, muscle, similar morphology*

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Kesamaan Elektromiogram pada Otot yang Memiliki Morfologi Mirip

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Abstrak

Pendahuluan: *Otot merupakan kelompok jaringan yang paling besar di dalam tubuh. Otot bisa digolongkan pada berbagai macam klasifikasi, salah satunya adalah berdasarkan bentuknya secara morfologi. Pemeriksaan otot, terutama otot rangka bisa menggunakan elektromiografi. Tujuan dari penelitian ini adalah mengetahui apakah otot yang memiliki morfologi mirip memiliki elektromiogram yang tidak berbeda.*
Metode: *Jenis penelitian yang dilakukan adalah deskriptif observasional dengan menggunakan alat needle electromyography. Sampel pada penelitian ini adalah sebesar lima subjek dengan masing-masing diambil lima kali Motor Unit Potential (MUP) di tiap otot Deltoideus dan otot Gluteus Medius*
Hasil: *Rata-rata nilai amplitudo, durasi, jumlah fase tegangan dan jumlah belokan tegangan otot Deltoideus dan otot Gluteus Medius pada subjek penelitian menunjukkan nilai yang tidak berbeda (p-value > 0,05).*
Kesimpulan: *Otot yang memiliki morfologi mirip pada masing-masing parameter amplitudo, durasi, jumlah fase tegangan, dan jumlah belokan tegangan tidak didapatkan perbedaan yang signifikan.*

Kata kunci: *elektromiografi, otot, morfologi mirip*

Introduction

Muscles are the largest tissue group in the body. Muscle also makes up about half of the body's body weight. The main function of muscles, in general is to contract. With controlled muscle contraction, we can perform movements aimed at the body as a whole or in part, manipulate external objects, drain the contents of various organs in the body and empty the contents of the organs to the external body.[1]

Muscles can be classified under various classifications. Muscle types can be classified based on the shape, size, number of heads and stomachs, depth to the surface, attachment, location on the body, and the form of action. The names of the muscles in the human body are also largely based on this type of classification. Based on its shape, muscles are divided into several types, namely deltoid or triangle, quadratus or square, rhomboid or diamond-shaped, teres or round, gracilis or slendered, rectus or straight, and lumbrical or snaking.[2]

There are many ways to do an examination of the muscles, especially the skeletal muscle. One of those is using electromyography. Electromyography is a technique for examining and recording muscle activity. An electromyogram is a record containing muscle signal activity. The recording was recorded using a device called an electromyograph. The way the electromyography works is to detect the electrical potential generated by muscle cells when active or at rest.[2]

The purpose of this study was to determine whether muscles that have similar morphology, such as musculus deltoideus and musculus gluteus medius, have no different electromyogram. The phrase 'no different' means to have an insignificant difference statistically.

Method

This research used descriptive and observational methods because the author

did not give the subjects any different treatment. The primary data in this research was obtained from the electromyogram of the Motor Unit Potential (MUP) from the musculus deltoideus and musculus gluteus medius. The recording was taken in each musculus deltoideus and musculus gluteus medius. The study subjects were all members of the 2017 Men's Basketball Team of the Dekan Cup FK Unair 2018 located in Surabaya, Indonesia. The sample size was taken based on the inclusion and exclusion criteria determined by the researcher. Total sampling is used for this study. The inclusion criteria for the study were normal examination results of physiological spontaneous muscle activity. The exclusion criteria for the study was the examination result of pathological spontaneous muscle activity.

The variables of this study on the electromyogram were the four parameters of the MUP: amplitude, duration, number of voltage phases, and number of voltage turns. Each subject's muscle recordings were collected and averaged then the mean data were grouped based on the four main parameters. The grouped data were processed and analyzed in two different conditions. If the grouped data has a normal distribution, it will be analyzed using the Sample Paired T-Test. If the grouped data does not have a normal distribution, it will be analyzed using the Wilcoxon Signed Rank Test. The data processing is included 1) editing by checking the completeness of data, 2) entry by entering the collected data into the computerized analyzing program and 3) cleaning to recheck the result of processed and analyzed data.

This study was approved by the Health Research Ethical Committee (Komite Etik Penelitian Kesehatan) RSUD Dr Soetomo Surabaya with reference number 2018/KEPK/IV/2020. Before collecting the data, the subjects were given some information for consent and asked for informed consent as approval. By signing the informed consent, the research subjects' rights were guaranteed.

Result

Amplitude

On the table 1 there is laid the average of the mean MUP amplitude of m. Deltoideus and m. Gluteus Medius for each research subject

After using the Shapiro-Wilk normality test, it was found that Asymp. Sig (2-tailed) or p-value on both the m. Deltoideus and m. Gluteus Medius amplitude data were 0.275 and 0.635, respectively. Thus, the distribution of data was classified as normal because the p-value was greater than the α value (p-value > 0.05). Therefore, analysis data was continued to Sample Paired T-Test. Based on the results of calculations using the Sample Paired T-Test, it was found that the Sig. (2-tailed) or the p-value is 0.838. Thus, because the p-value is greater than the α value (p-value > 0.05), there is no statistical difference from the MUP amplitude value of the m. Deltoideus and m. Gluteus Medius

Table 1. Amplitude Comparison Analysis between M. Deltoideus and M. Gluteus

Subject	M. Deltoideus	M. Gluteus Medius
A	168.96	293.66
B	390.70	490.37
C	409.96	708.19
D	824.44	355.68
E	352.90	441.22
Normality Test (α = 0.05)	0.275	0.635
Sample Paired T Test (α = 0.05)	0.838	

Duration

On the table 2 there is laid the average of the mean MUP duration of m. Deltoideus and m. Gluteus Medius for each research subject.

After using the Shapiro-Wilk normality test, it was found that Asymp. Sig (2-tailed) or p-value on both the m. Deltoideus and m. Gluteus Medius duration data were 0.175 and 0.563, respectively. Thus, the distribution of data was classified as normal because the

Table 2. Duration Comparison Analysis between M. Deltoideus and M. Gluteus

Subject	M. Deltoideus	M. Gluteus Medius
A	5.59	3.49
B	6.31	7.58
C	7.46	9.38
D	7.57	6.84
E	7.71	6.79
Normality Test (α = 0.05)	0.175	0.563
Sample Paired T Test (α = 0.05)	0.887	

p-value was greater than the α value (p-value > 0.05). Therefore, analysis data was continued to Sample Paired T-Test.

Based on the results of calculations using the Sample Paired T-Test, it was found that the Sig. (2-tailed) or the p-value is 0.887. Thus, because the p-value is greater than the α value (p-value > 0.05), there is no statistical difference from the MUP duration value of the m. Deltoideus and m. Gluteus Medius.

Number of Voltage Turns

On the table 4 there is laid the mean number of voltage turns of the m. Deltoideus and m. Gluteus Medius

Table 3. Number of Voltage Phases Comparison Analysis between M. Deltoideus and M. Gluteus

Subject	M. Deltoideus	M. Gluteus Medius
A	3.40	3.20
B	3.00	3.80
C	3.60	3.00
D	3.80	3.40
E	3.20	3.00
Normality Test (α = 0.05)	0.967	0.314
Sample Paired T Test (α = 0.05)	0.646	

Number of Voltage Phases

On the table 3 there is laid the mean number of voltage phases of the m. Deltoideus and m. Gluteus Medius.

After using the Shapiro-Wilk normality test, it was found that Asymp. Sig (2-tailed) or p-value on both the m. Deltoideus and m. Gluteus Medius duration data were 0.967 and 0.314, respectively. Thus, the distribution of data was classified as normal because the p-value was greater than the α value (p-value > 0.05). Therefore, analysis data was continued to Sample Paired T-Test.

Based on the results of calculations using the Sample Paired T-Test, it was found that the Sig. (2-tailed) or the p-value is 0.646. Thus, because the p-value is greater than the α value (p-value > 0.05), there is no statistical difference in the number of MUP phases of the m. Deltoideus and m. Gluteus Medius.

After using the Shapiro-Wilk normality test, it was found that Asymp. Sig (2-tailed) or p-value on both the m. Deltoideus and m. Gluteus Medius duration data were 0.015 and 0.00, respectively. Thus, the distribution of data was not classified as normal because the p-value was less than the α value (p-value < 0.05). Therefore, analyzing data was continued to the Wilcoxon Signed Rank Test.

Based on the results of calculations using the Wilcoxon Signed Rank Test, it was found that the Sig. (2-tailed) or the p-value is 0.715. Thus, because the p-value is greater than the α value (p-value > 0.05), there is no statistical difference in the number of MUP turns of the m. Deltoideus and m. Gluteus Medius.

Table 4. Number of Voltage Turns Comparison Analysis between M. Deltoideus and M. Gluteus

Subject	M. Deltoideus	M. Gluteus Medius
A	2.00	2.80
B	3.00	3.00
C	2.60	3.00
D	7.00	3.00
E	2.00	3.00
Normality Test (α = 0.05)	0,015	0,00
Wilcoxon Signed Rank Test (α = 0.05)	0.715	

Discussions

This research was a descriptive observational study that focuses only on the results of data collection without paying attention to the relationship to these data results. Until this research was written, there was still no literature that showed scientific evidence of electromyogram comparisons based on minimal contraction.

The amplitude data above were shown to indicate variation in each subject. A lot of factors made the amplitude variation. Abdurahman et al[2] stated the close proximity of the EMG needle to the motor unit would provide high amplitude. The optimal amplitude was obtained when the placement of the electrodes was exact in the motor unit. In various subjects, it is possible that the location of the motor unit may be located differently in each subject in the same muscles.[3] In a study according to Woods and Bigland-Ritchie,[4] the amplitude can increase linearly and parabolically with the increasing force. In data collection in this study, subjects were only asked to contract their muscles "minimally". It is possible that the "minimal contraction" of one subject has a different strength than the "minimal contraction" of another subject.

In data collection, it appears that the duration of the MUP for each subject has varied data. There are several things that can make a difference in the duration of MUP, one of which is muscle temperature. Buchthal et al.[5] stated that the mean duration increases with the decreasing muscle temperature. The age difference also determines the mean duration of the MUP. The older a person is, the longer the mean duration of MUP.[2,5]

Shape is formed from the phases and turns. Factors such as fatigue also influence the value of the different number of phases and turns. Buchthal and Pinelli[6] stated that the amount of polyphasic action potential increases, which indicates that the action potential that was originally not polyphasic changed to polyphasic due to fatigue. In addition, the increasing or decreasing muscle fibres in motor units also affects all parts of MUP.[7]

Conclusions

Based on the result of this study, it could be concluded that the electromyographic value measured at the time of minimal contraction was MUP with parameters of amplitude, duration, the number of phases and number of turns in muscles that had similar morphology did not have a difference statistically.

Conflicts of Interest

The authors confirmed no conflict of interest.

Acknowledgment

All authors have seen and approved the final manuscript. TM designed the outline concept of the research and wrote the initial draft. A, S, and II revised and expanded the manuscript.

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