

**BTS EMG ANALYZER DASTURIY-APPARAT VOSITASIDA BIOSIGNALLARINI
TAHLIL ETISHNI AMALGA OSHIRISH**

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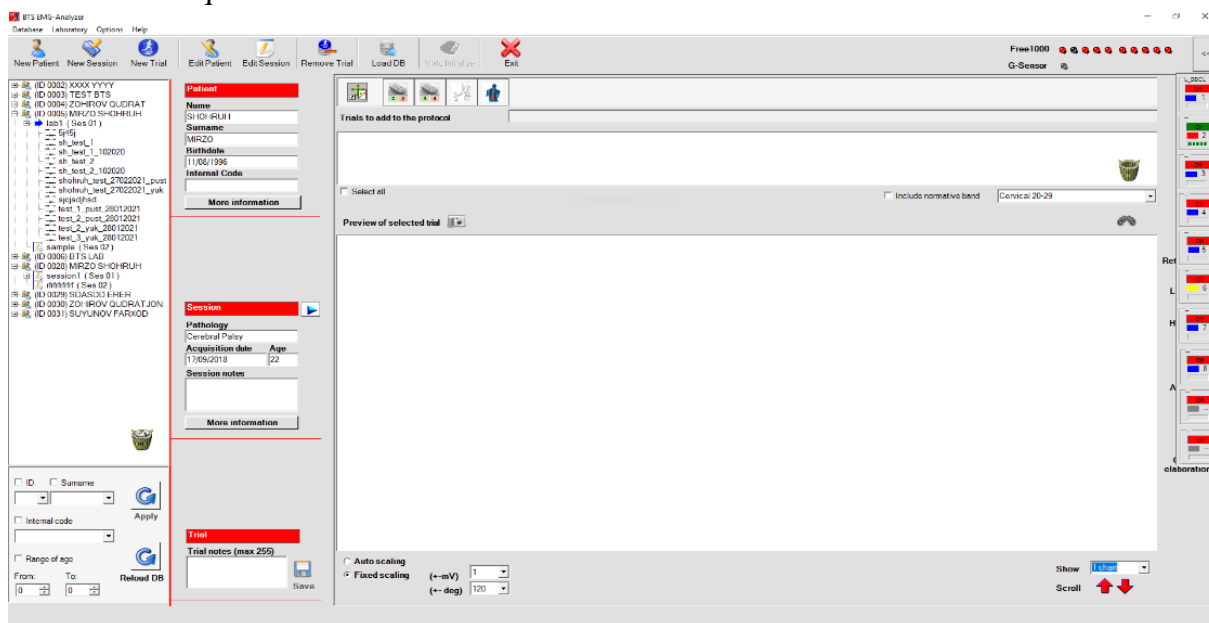
Abstract. This article discusses the analysis of biosignals of muscle activity using the BTS Analyzer hardware and software tool, the introduction of bioparameters of patients and athletes into the software tool, and the feature extraction.

Keywords: BTS Analyzer, EMG, biosignals of muscle activity, biosignal, signal, feature extraction, hardware and software, sport, rehabilitation, protocol, interface, pathology.

Kirish. BTS EMG-Analyzer - bu EMG signallarini tahlil qilish uchun eng to'liq dasturiy ta'minot yechimi hisoblanadi. Klinikada, sportda va tadqiqot sohasida baholash uchun oldindan belgilangan shablonni o'z ichiga oladi: sakrash, pliometriya, yurish, charchoqni tahlil qilish, izokinetikasi va boshqalar[1].

Ishlab chiqish protokollarini ishlab chiqish uchun muharrir kiradi: innovatsion ob'ekt tufayli matematik tahlil tilini grafik shaklga o'tkazadigan interfeys, foydalanuvchi tez va samarali ravishda moslashtirilgan ishlab chiqish protokollarini ishlab chiqishi mumkin[2,4].

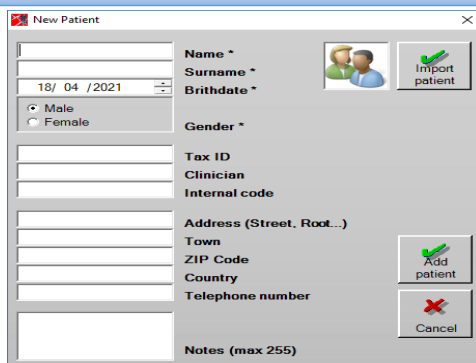
BTS Analyzer apparat-dasturiy ta'minot yordamida mushak faolligi biosignalini qayd etamiz va tahlil qilamiz.



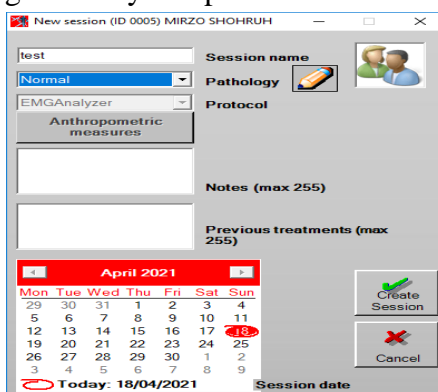
1-rasm. Dastur interfeysi.

Bu oynada sportchilarning ma'lumotlari va qayd etilgan signalni tahlil qilish bo'limlari ko'rsatilgan. Birinchi navbatda biz bemor yoki sportchini kiritib olish zarur(1-rasm).

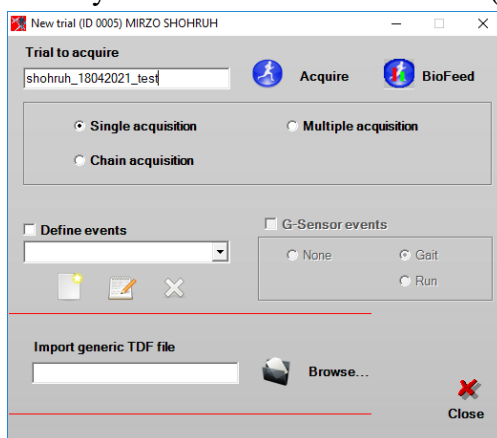
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2-rasm. Yangi bemor(yoki sportchi) qo'shish oynasi.
Bu qismda biz dasturga yangi bemor yoki sportchini biriktiriladi(2-rasm).



3-rasm. Bemor yoki sportchi uchun jarayon qo'shish.
Bemor yoki sportchini biriktirganimizdan so'ng, ular uchun yangi jarayon ochishimiz zarur. Jarayondan keyin ma'lumotlarni yozib olish uchun trial ochiladi(3-4-rasmlar).

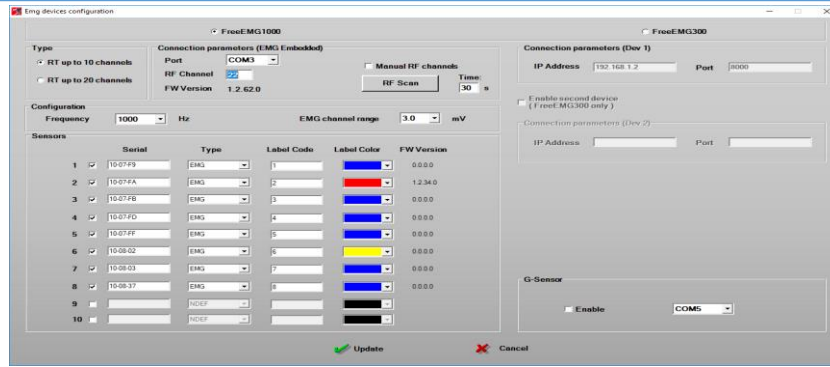


4-rasm. Trial (tibbiy tahlil) yaratish oynasi.

Tahlil uchun ma'lumotlar kiritilgandan so'ng, ma'lumot jo'natuvchi apparat vositaning dasturga bog'langanligini tekshiriladi(5-rasm).

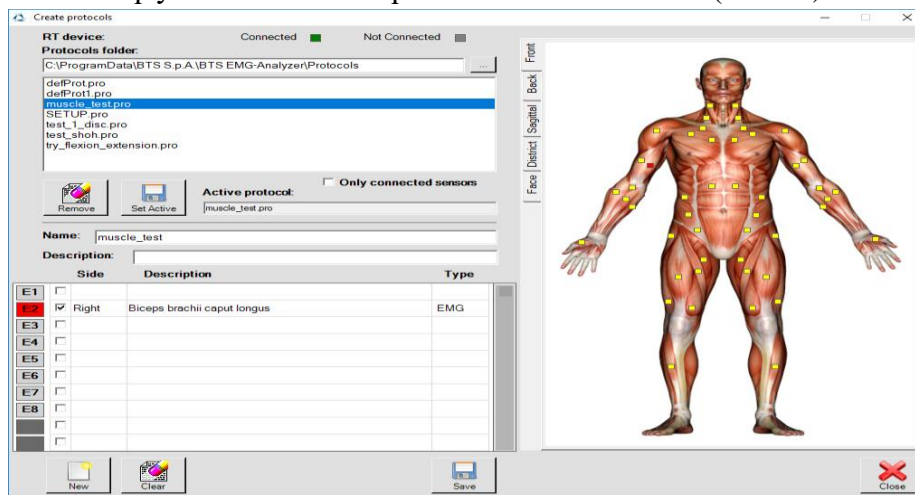
To'liq simsiz texnologiyalarga asoslangan BTS FREEEMG EMG signallarini olish va uzatish uchun 20 tagacha o'zgaruvchan geometriyali zondlardan foydalanadi. Shuningdek, u elektrogoniometrlarni ulash uchun zondlarni boshqaradi, bu esa burchaklarni, burchak tezligini, burchak tezlatishlarini va oyoq-polning aloqa joyini aniqlash uchun oyoq kalitlarini baholash imkonini beradi[2,4].

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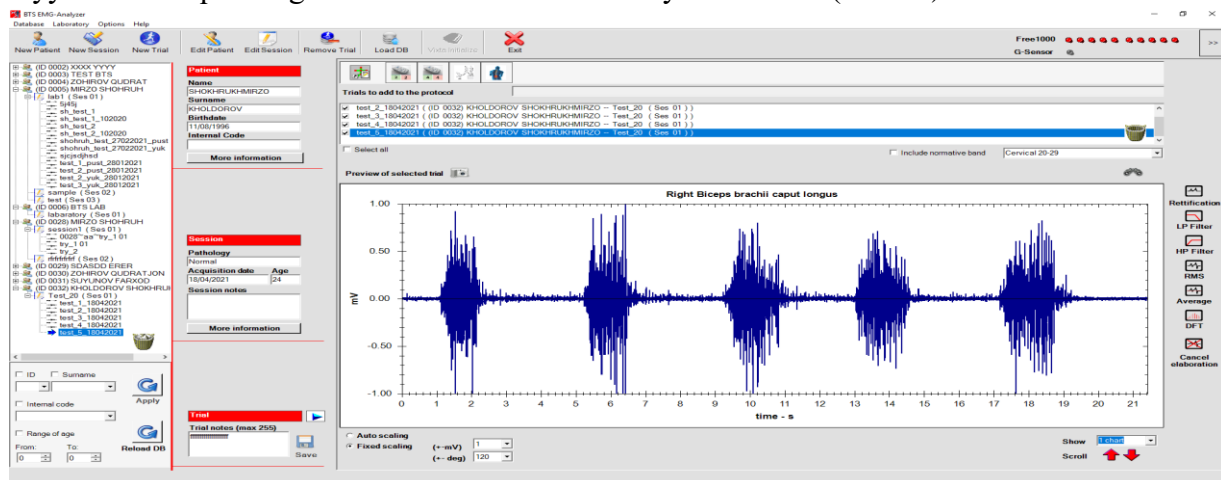
5-rasm. Apparat vositani tekshirish oynasi.

Apparat vositaning dasturga bog'langanligi tekshirilib, tahlil uchun protocol tanlanadi. Tanlanadigan protokolda qaysi mushak tahlil qilish kerakli ko'rsatiladi (6-rasm).



6-rasm. Tahlil qilinadigan (Sensor o'rnatilgan) mushakni belgilash oynasi.

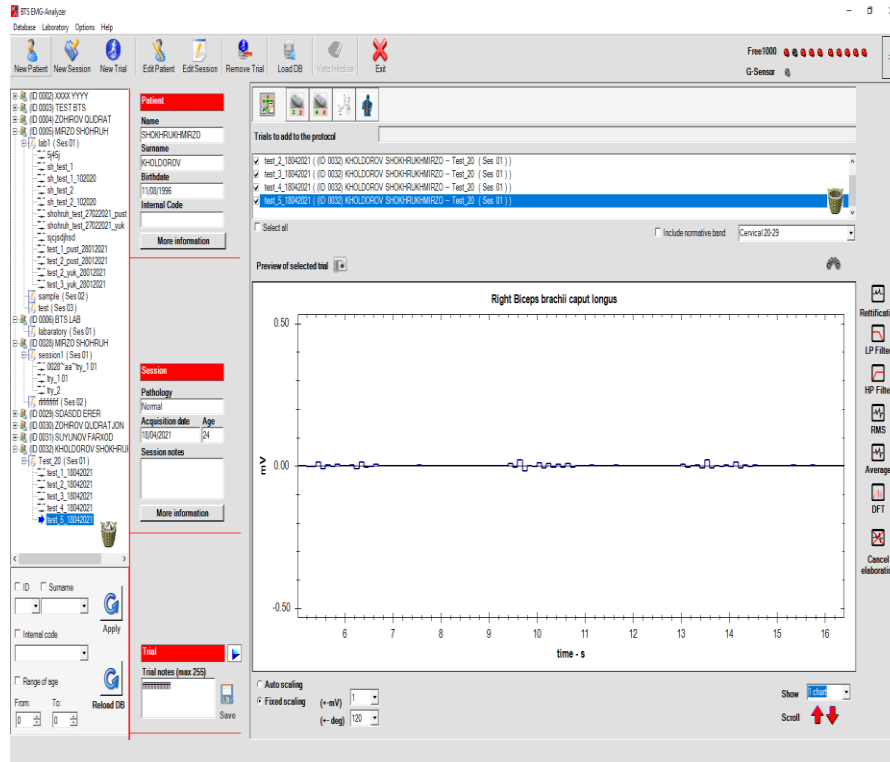
Barcha jarayonlar belgilab olindi va protokollar qo'yildi. Apparat-dasturiy vosita ishga tayyor. Tahlil qilinadigan mushakdan ma'lumotlar yozib olinadi (7-rasm).



7-rasm. Mushakdan keladigan ma'lumotlarni yozib olish oynasi.

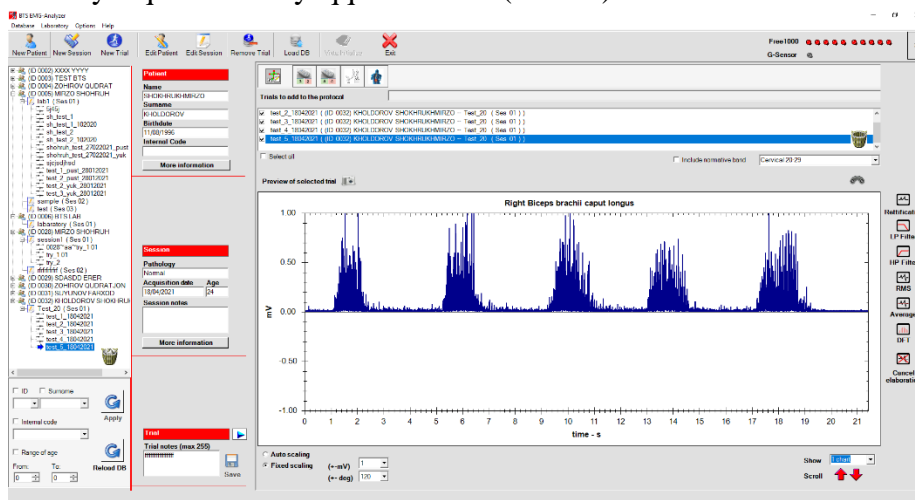
Signal yozib olingan so'ng tahlil qilinadi. Signallarga dastlabki ishlov beriladi. BTS Analyzer dasturi yordamida signallarning bir nechta xususiyati tahlil qilinadi va natijalar olinadi. O'rtacha qiymat (Average) xususiyati signalning aplituda o'zgarishi ifodalab beradi (8-rasm).

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8 – rasm. O’rtacha qiymat xususiyati tahlilining grafik ko’rinishi.

Signal yozib olinayotgan vaqtda, manfiy va musbat qiymatlar mavjud bo’ladi. Mushak faolligi biosignallari bioelektrik signallar bo’lganligi sababli musbat va manfiy qiymatlardan iborat bo’ladi. Biosignallarni tahlil qilishdagi yana bir xususiyatlardan biri bu “rektifikatsiya(rectification)” xususiyati xisoblanadi. Bu xususiyat mushak faolligi biosignallarini manfiy qiymatlarini musbatga o’girib, signalni tahlil qilish uchun qulay holatga olib keladi. Bunda, signalning amplitudaviy taqsimlanishi yaqqol aks etadi(9-rasm).

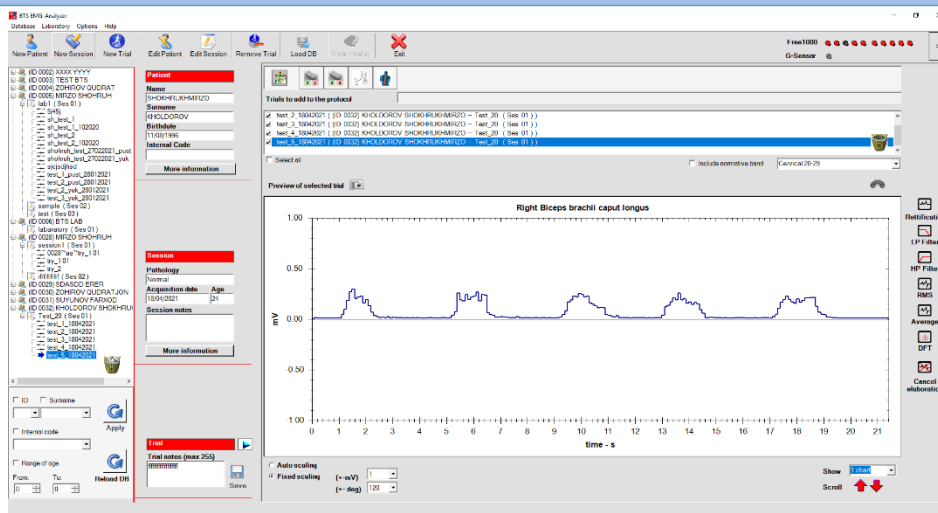


9-rasm. Rektifikatsiya(rectification) xususiyati tahlilining grafik ko’rinishi.

Biosignallarni tahlil qilishdagi yana bir xususiyat bu “o’rtacha kvadrat qiymat (RMS – Root Mean Square)” hisoblanadi. Bu xususiyat hisoblash onson va mushak biosignallarini tahlil qilishda eng ko’p foydalaniladigan xususiyat hisoblanadi. RMS biosignalning kuchini ifodalaydi desak mubolag’a bo’lmaydi(10-rasm).

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10-rasm. RMS xususiyati tahlilining grafik ko'rinishi.

FREEEMG - sirt elektromiyografiyasini (EMG) tahlil qilish uchun simsiz qurilma. Signalning aniqligi, simlarning yo'qligi, zondlarning yengilligi va kichraytirilgan o'lchamlari foydalanuvchilarga sinovdan o'tayotgan shaxsning tabiiy harakatini o'zgartirmasdan, tananing har bir qismi uchun har qanday harakat turini baholash imkonini beruvchi xususiyatlardir[2,3,4].

Ushbu apparat-dasturiy vositadan tadqiqot, sport, kasbiy tibbiyot, gnatologiya, nevrologiya va ortopediya kabi turli sohalarda foydalanadilar. FREEEMG - bu bir nechta maqsadlarda qo'llaniladigan yagona tizim: monitoringdan diagnostikagacha va jarohatlarning oldini olishgacha.

FREEEMG H2O versiyasida ham mavjud: bu suvni o'lchash uchun maxsus ishlab chiqilgan EMG tahlili uchun BTS texnologiyasining evolyutsiyasidir[1,2].

Maxsus himoya jeli tufayli korpusga kiritilgan elektron komponentlar to'liq suv o'tkazmaydigan va zondni 3 metr gacha (IP68 tasnifi) suvga cho'mish imkonini beradi[2].

Suvdagi mushaklarning faolligini baholash rehabilitatsiya maqsadlarida ham (neyromotor va ortopedik) va sport kontekstlarida (suv sporti, yopiq mashg'ulotlar va jarohatlardan keyingi tiklanish) amalga oshirilishi mumkin. Bundan tashqari, terga nisbatan yuqori qarshilik tufayli zondlar boshqa har qanday sport turida foydalanish uchun idealdir.

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