

APPLICATION GUIDE

«SMART-ORTHO 2D Pro»

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1. RECOMMENDED TECHNICAL CHARACTERISTICS OF MOBILE DEVICES

- **Processor:** 0.8 GHz.
- **RAM:** 1 GB.
- **Free space:** 200 MB or more, recommended more than 2 GB.
- **Screen size:** 5", recommended for 8" and more.
- **Built-in camera:** 1 megapixel, it is recommended that 2 or more megapixels.
- **Operating system:** Android 4.1 and later versions.
- **Built-in accelerometer.**
- **Internet connection** for software updates and telemedicine.

2.THE PRIMARY SETTING

2.1 configuring the software.

After start appears the main program window (Fig.1). When you first start the program you need to make the initial settings. To do this, click on the icon



Will appear the settings window.

The settings available for configuration (Fig. 1, 2):

the choice of language,

setting up the camera,

setting the sensitivity of the accelerometer,

the setting folder storage reports

the choice of color of background apps

the choice of font size.

2.1.1. The choice of language.

It is possible to work with 3 languages (Russian, English, Spanish). By default, set up Russian language.

Changing the language is done by selecting the desired option from the drop-down list. After that you click on the icon



to close the application.

After restart possible work application in the selected language.

2.1.2. Configuring the camera.

Camera selection is made by clicking on the icon



It is advisable to choose a camera "Rear facing camera" and set it resolution (Fig.3)

After that you click on the icon



and following clicking the icon



back in the settings window (Fig.2).



Fig. 1. The main application window

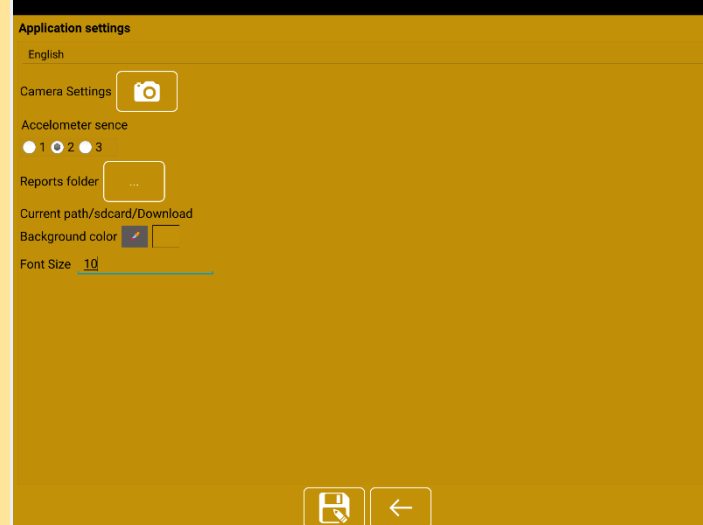


Fig. 2. The settings window

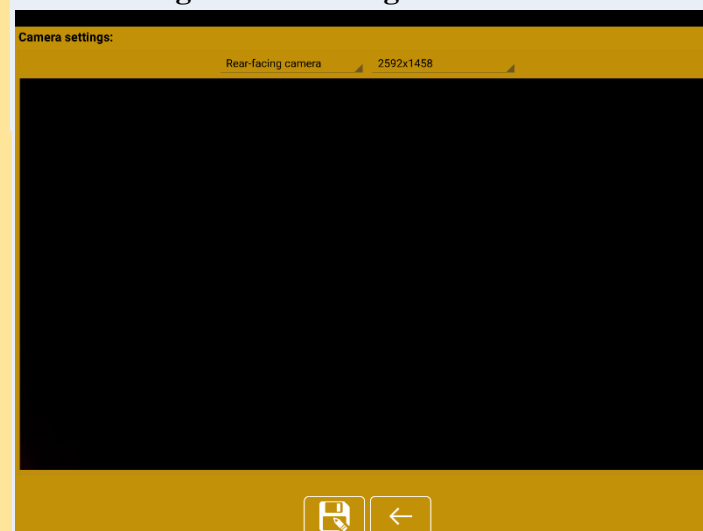



Fig. 3. Camera selection

2.1.3. Setting the sensitivity of the accelerometer.

The accelerometer is built into the gadget a special device which determines its position in space. The readings of the accelerometer are displayed when you make the pictures in the corner of the screen. When the correct position of the mobile device figures the axes X, Y and Z are green. The correct orientation of the mobile device reduces image distortion and improves the accuracy of diagnosis.

Select one of the options of sensitivity of the accelerometer

After that you will click on the icon  (Fig. 2, p. 2).

Accelometer sence



2.1.4. Select directory to store cards of patients.

For correct operation you must configure a folder to store information about patients.

This is done by clicking on the icon 

at the end of the phrase the "Folder storage reports", after clicking, a window appears select the directory. It is recommended to select the folder "Download".

After that you click on the icon

Choose

(Fig. 4)

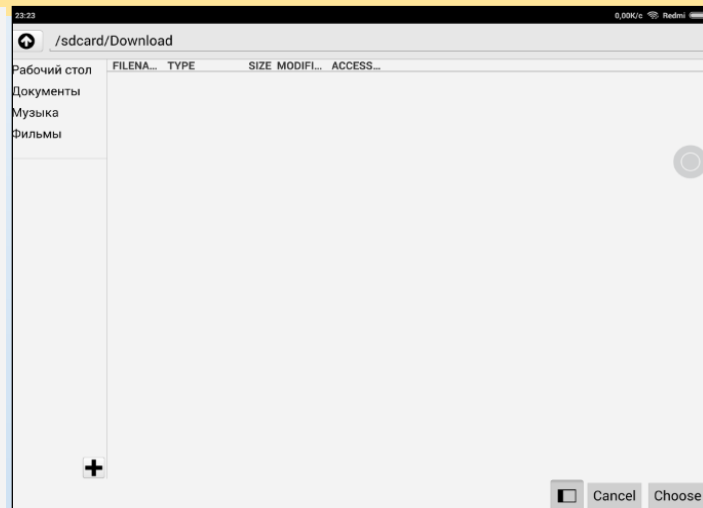




Fig. 4. Create folders to store reports on the

2.1.5. The choice of background colors.

Available wide range of background colors. The selection is made by clicking on the icon at the end of the phrase "background color" Background color 

When this window appears select the background color (Fig. 5).

Choose colour, like wish, press OK, the selection window disappears, and then press on the icon  to change the color of the background (Fig. 6).

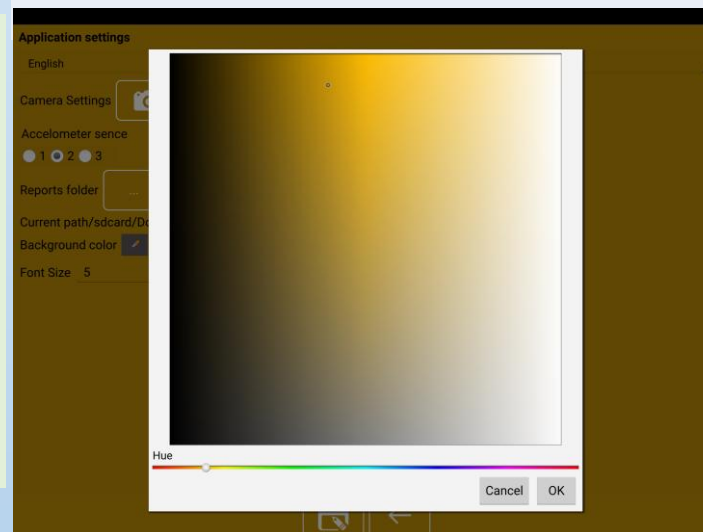



Fig. 5. Setting the background color of the program

2.1.6. The choice of font size.

At the end of the phrase "font Size" to select the desired value and clicking on the icon  save the changes (figure 6).

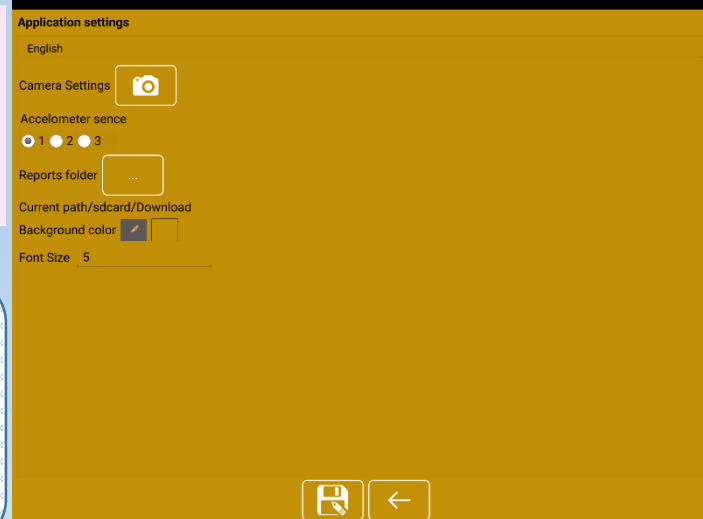



Fig. 6. Change the color of the app.


**Setup is complete.
The individual parameters are
configurable by the owner.**

3. CREATING AND WORKING WITH CARDS PATIENTS

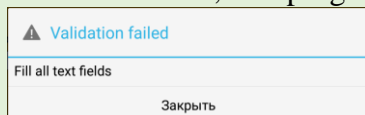
3.1. Create a new card.


To create new card of patient should click on the icon  of the main window (Fig. 1, p. 2).


After clicking a window will appear cards of patients. When you first start program the list will be empty (Fig.7).

To add a new card click on add card  and complete all fields in the appeared window (Fig.8).

If some field is not filled, the program will show a warning



After filling all fields, click the () icon and in the list of "Patient" will be the name and the name of the first patient (Fig. 9).

For each patient you can view key information, clicking on "patient card" icon  (Fig.10).

The electronic card of a patient was created.

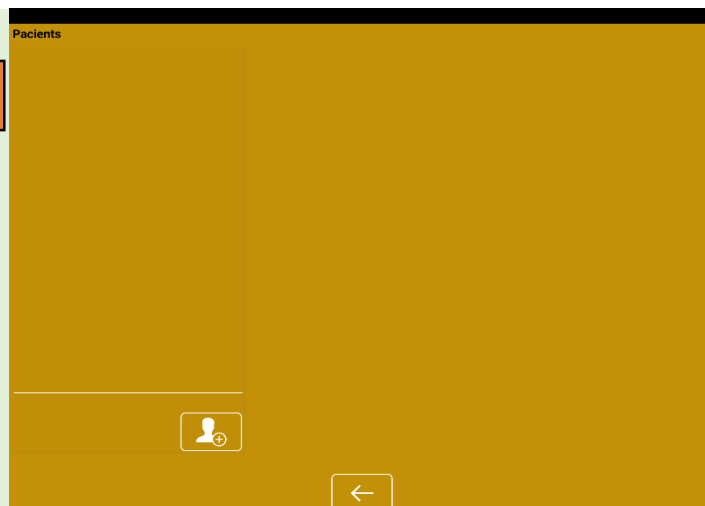


Fig. 7. Creating a new patient record.

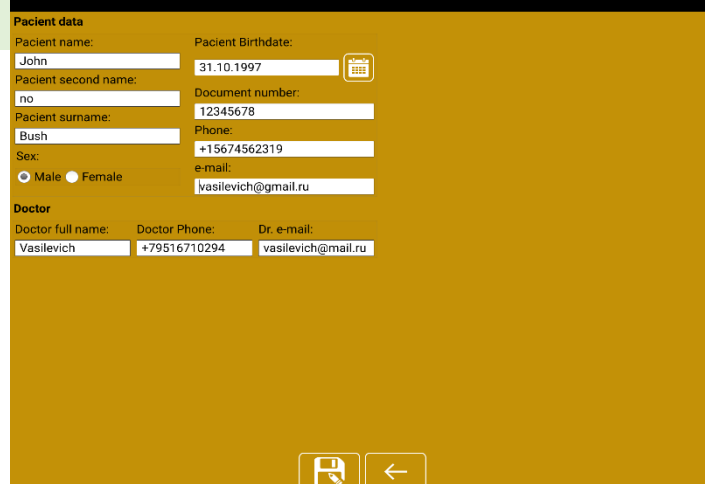
A screenshot of the "Patient data" form. It has a title bar "Patient data". The form is divided into two sections: "Patient data" and "Doctor". The "Patient data" section includes fields for "Patient name:" (John), "Patient Birthdate:" (31.10.1997), "Patient second name:" (no), "Document number:" (12345678), "Patient surname:" (Bush), "Phone:" (+15674562319), "Sex:" (Male), and "e-mail:" (vasilevich@gmail.ru). The "Doctor" section includes fields for "Doctor full name:" (Vasilevich), "Doctor Phone:" (+79516710294), and "Dr. e-mail:" (vasilevich@mail.ru). At the bottom, there are buttons for "Save" and "Back".

Fig. 8. Filling a new patient's card.

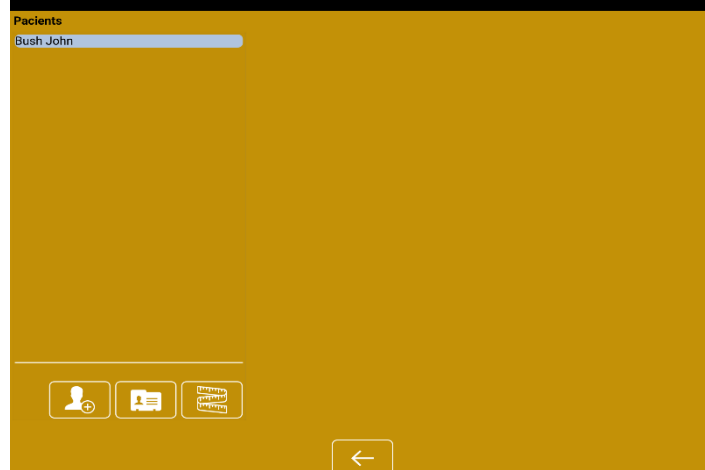


Fig. 9. The emergence of new card in the list



Fig. 10. Data on a patient.

3.2. Setting image of the patient.

The image of the patient is got through a digital camera of a device. To do this, clicking the "measure" button, go to the program window with icons of options for further work (Fig.11).

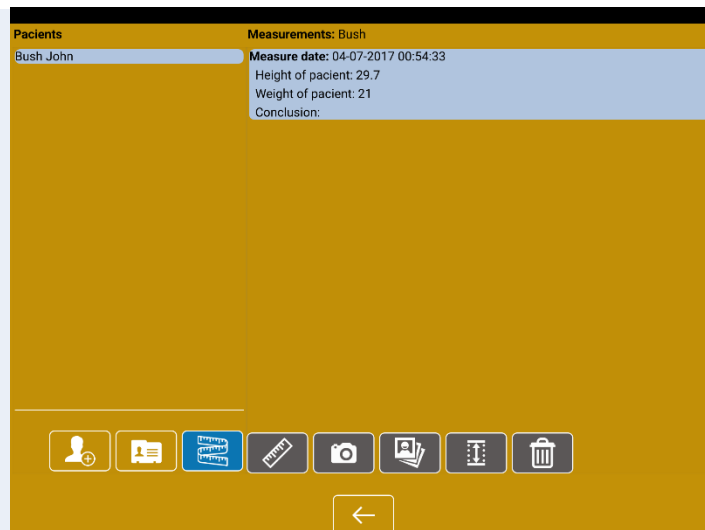
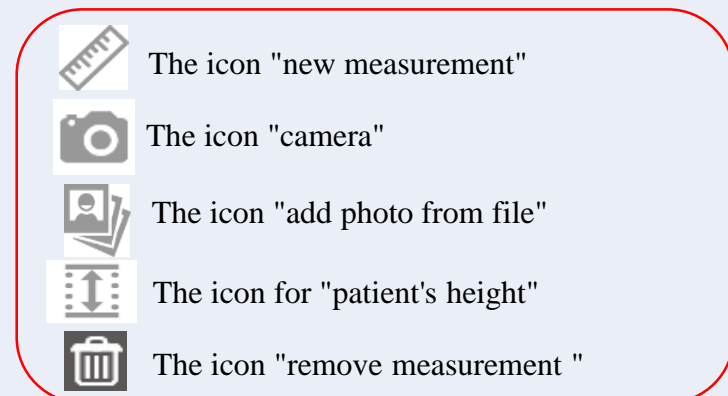


Fig. 11. The preparation for the photographing of the patient



Click on the icon.  After clicking a window will appear (Fig. 12).

On the screen the specialist will see the image of the patient. The device is placed vertically. Press "focus" to increase clarity. With the help of accelerometer readings in the top left corner of screen, orient the device right, and click on the icon "photo of a patient back view". Get the first image.

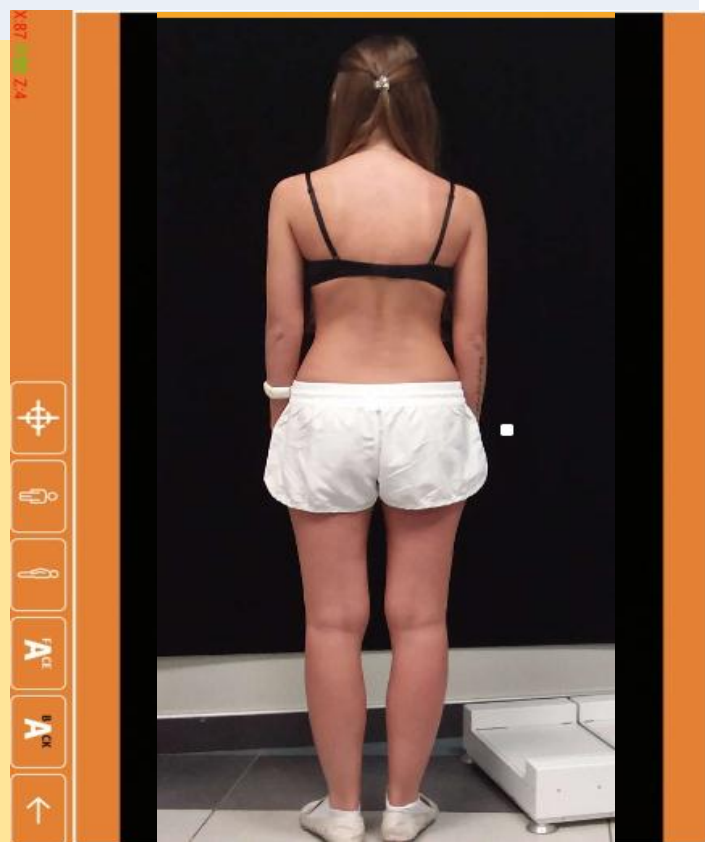
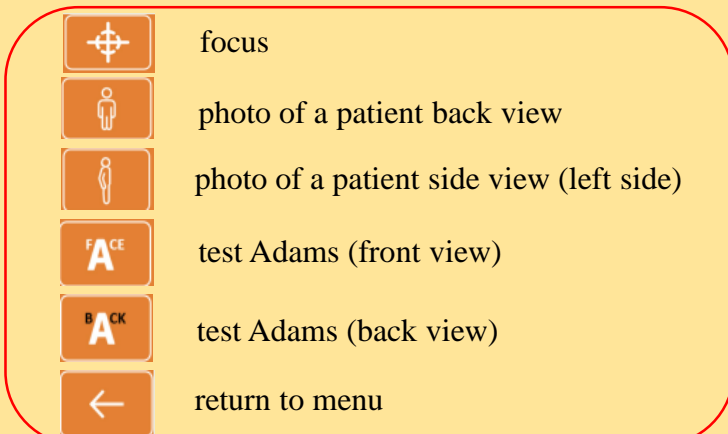




Fig. 12. Photo of patient.



The image is automatically rotated 90° clockwise. If not – carry out the rotation manually by clicking on icon . Then push on the icon  to complete the operation and return to the window (Fig. 13).

The patient turns to the specialist left side and repeat actions in the same sequence: the device is placed vertically, with the help of accelerometer readings in the top left corner, orient the device, and click on the icon "photos of a patient side view" received the second image.

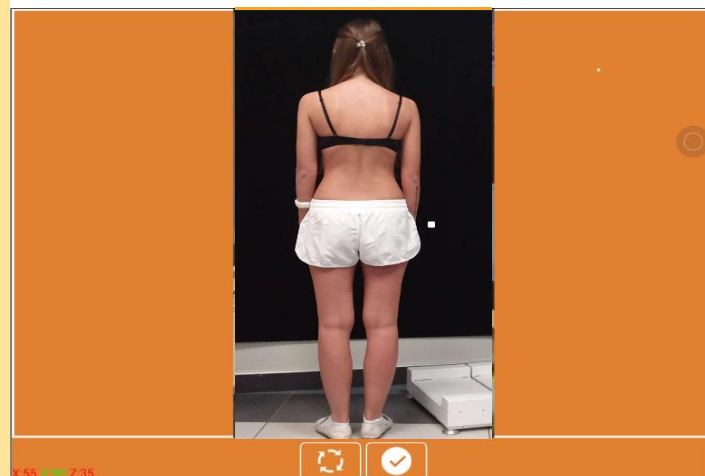







Fig. 13. Image rotation.

Similar action is provided for profile "Test Adams*".
 Front view"  and "Test Adams. Back view" 
 After that, click the icon  and return to the window shown in figure 14.

3.3. The introduction of additional parameters.

You can optionally enter the patient's height and shoulder width (if known). To do this, click on the icon  to open the input window (Fig. 15)

Enter the required value and press "Save".

Click on the icon  (and exit to the main program window (Fig.1).

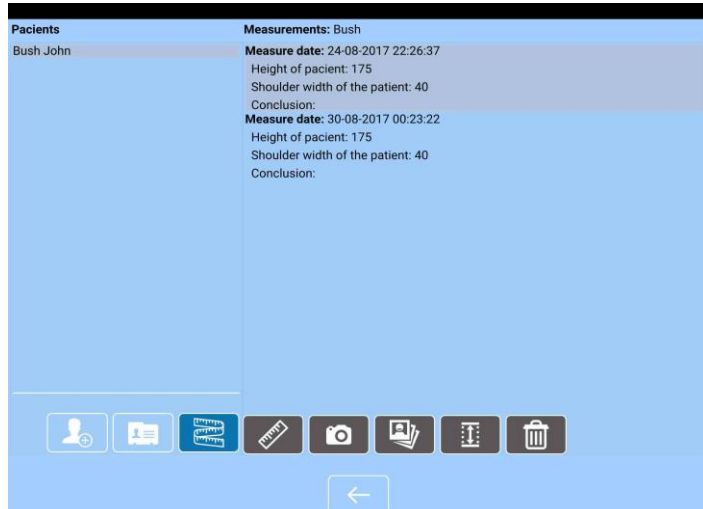



Fig. 14. The program window after executing all the photos.

Fig. 15. The window for entering additional parameters.

4. THE ALIGNMENT POINTS ON THE PHOTO.

The next step with is the placement of reference points. To do this, click on the icon  to see a photo of the patient (Fig. 16). The first step will prompt you to set point "Assessment of the neck and shoulder girdle": spinous process of C7, top of the m/gluteal folds, the transition of the neck into the shoulder girdle, crossing the shoulder girdle to the shoulder.

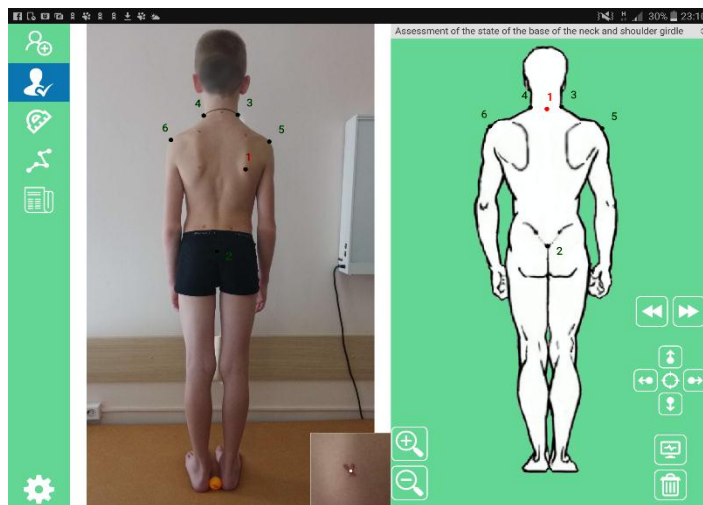



Fig. 16. Placement of reference points.

The points are placed according to the drawing on the right side of the window. Active point the figure in the right half of the screen highlighted in red. You must to install the same point on the patient's pictures on the left in the working field photos. Rough positioning the point to make by touching the screen in the place of its location. The exact positioning of the dots is made by using the "joystick"  and the loupe tool in the lower right corner of the patient (Fig. 17).

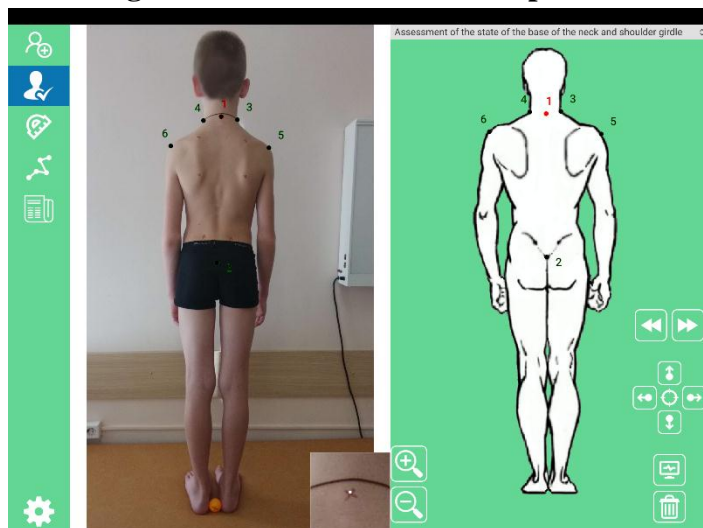




Fig. 17. An example of the positioning of point 1.

After placing the point click on the icon  to move to the next point. If necessary, by pressing the arrows in the opposite direction, you can return to any point and adjust its position on the photo.

After placing all 6 points «Assessment of the base of the neck and shoulder girdle" (Fig. 16 and 17), click on the save icon  and proceed to the next step (profile) assessment "Assessment of the blades" (Fig.18).

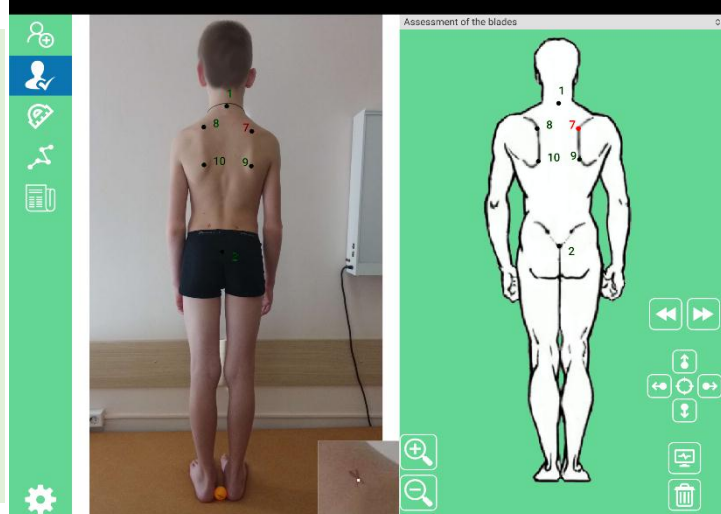


Fig. 18. Assessment of the blades.

Similarly, without changing the algorithm all interesting points from the drop-down list are placed on the photo (Fig. 19).

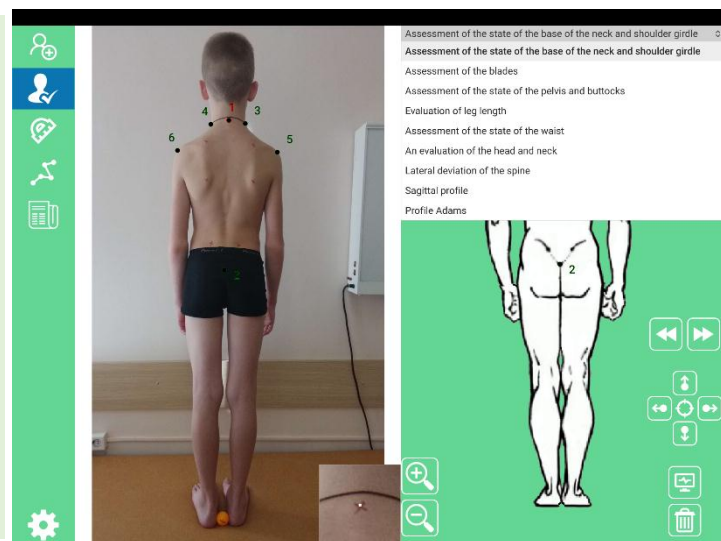


Fig. 19. A list of placing points on different profiles.

For more accurate positioning of reference points, it is advisable before to make photography, produce a markup of anatomical landmarks on the body of the patient (line spinous processes, the upper and lower corners of the blades, the rear upper iliac spine).

This layout improves the comfort of work with the application and makes possible the use of diagnostics in patients with overweight.

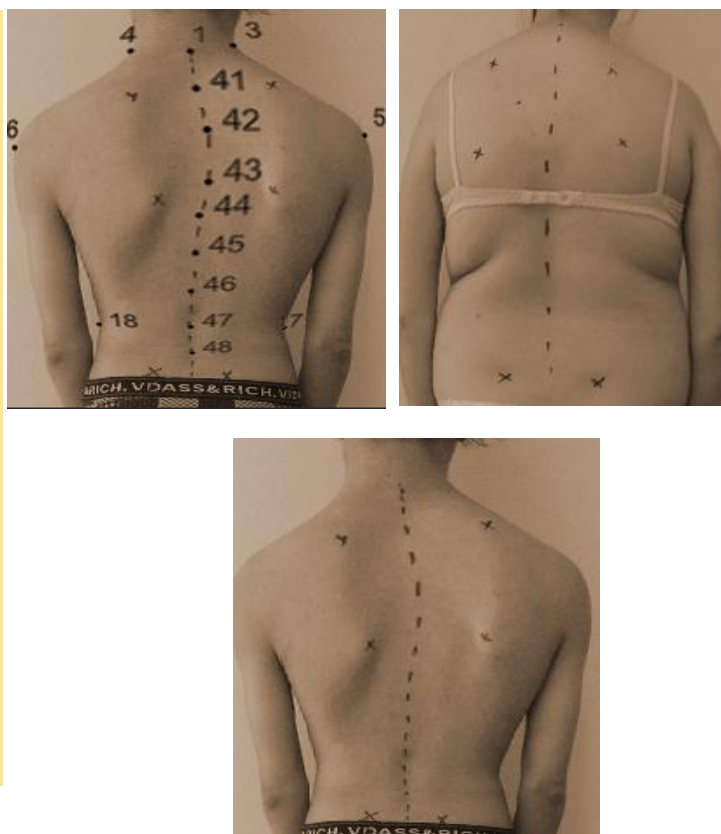



Fig. 20. Markings anatomical landmarks.

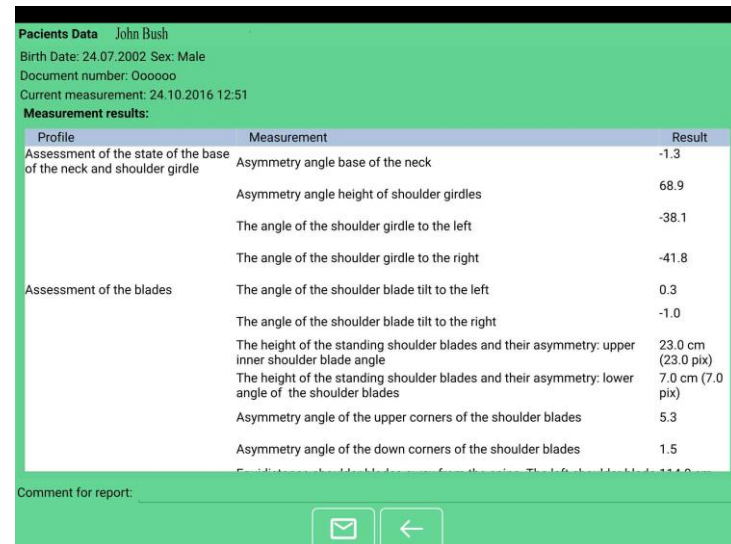
5. THE RESULTS OF THE MEASUREMENTS AND REPORT.

After correct setting of all points on the photographs, it is possible to obtain the report. To do this, click on the icon  and go to the program window with the report (Fig. 21).

Report rendering occurs with the calculated values when working with profiles. The report includes only those measurements that were calculated.

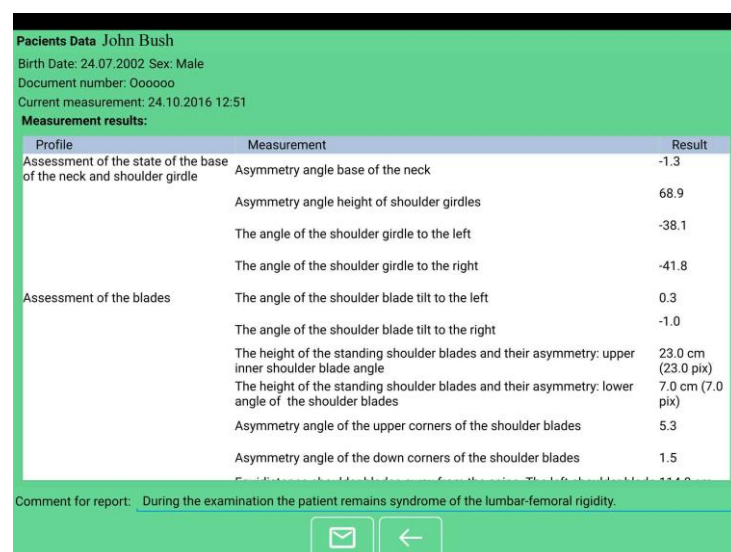
Additionally, the physician has the opportunity of making any comments to the diagnosis, writing the final conclusion, etc. (Fig. 22).

The resulting report can be sent by e-mail to another specialist for the implementation of continuity of treatment of the patient.



Profile	Measurement	Result
Assessment of the state of the base of the neck and shoulder girdle	Asymmetry angle base of the neck	-1.3
	Asymmetry angle height of shoulder girdles	68.9
	The angle of the shoulder girdle to the left	-38.1
	The angle of the shoulder girdle to the right	-41.8
Assessment of the blades	The angle of the shoulder blade tilt to the left	0.3
	The angle of the shoulder blade tilt to the right	-1.0
	The height of the standing shoulder blades and their asymmetry: upper inner shoulder blade angle	23.0 cm (23.0 pix)
	The height of the standing shoulder blades and their asymmetry: lower angle of the shoulder blades	7.0 cm (7.0 pix)
	Asymmetry angle of the upper corners of the shoulder blades	5.3
	Asymmetry angle of the down corners of the shoulder blades	1.5
	Asymmetry angle of the shoulder blades from the spine	11.8

Fig. 21. The window with program's report.

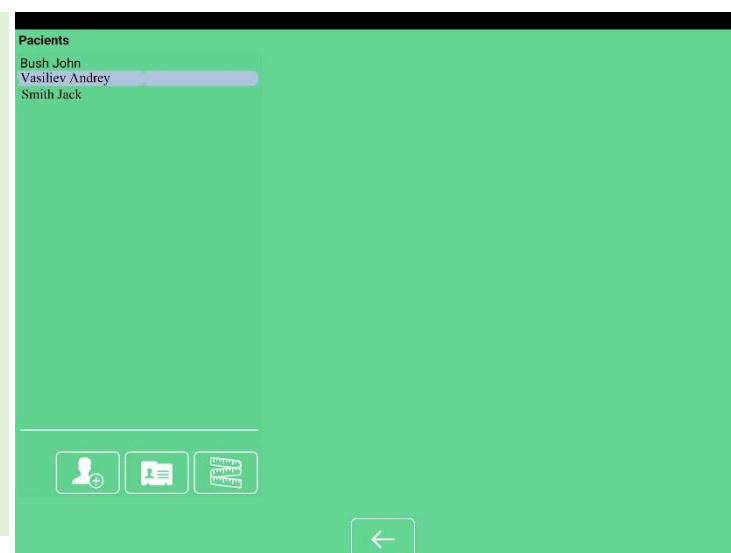


Profile	Measurement	Result
Assessment of the state of the base of the neck and shoulder girdle	Asymmetry angle base of the neck	-1.3
	Asymmetry angle height of shoulder girdles	68.9
	The angle of the shoulder girdle to the left	-38.1
	The angle of the shoulder girdle to the right	-41.8
Assessment of the blades	The angle of the shoulder blade tilt to the left	0.3
	The angle of the shoulder blade tilt to the right	-1.0
	The height of the standing shoulder blades and their asymmetry: upper inner shoulder blade angle	23.0 cm (23.0 pix)
	The height of the standing shoulder blades and their asymmetry: lower angle of the shoulder blades	7.0 cm (7.0 pix)
	Asymmetry angle of the upper corners of the shoulder blades	5.3
	Asymmetry angle of the down corners of the shoulder blades	1.5
	Asymmetry angle of the shoulder blades from the spine	11.8

Fig. 22. The doctor's comment to the report.


6. RE-MEASUREMENT OF THE PATIENT.

The application allows for repeated measurements per patient during treatment, orthotics, passive monitoring, etc. To perform a repeated measurement select the desired patient from the list (Fig. 23)



Pacients
Bush John
Vasiliev Andrey
Smith Jack

Fig. 23. The choice of the patient for repeated measurements.

Click on the icon  and obtain the information on previously conducted measurements (Fig. 24).

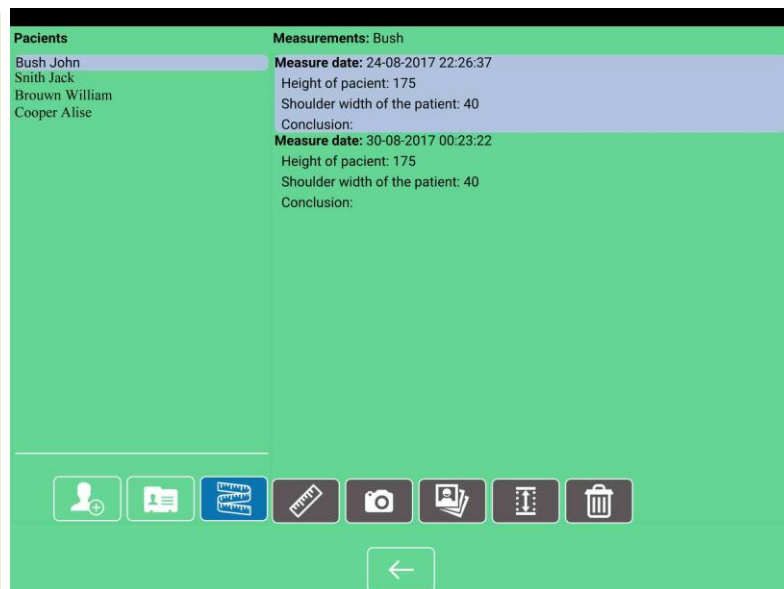




Fig. 24. Previous examination of the patient.

In the opened window click on the icon  "add measurement", to appear a new record with the current date and time (Fig. 25).

This recording is not binded to a specific photo. To bind the dimension to the new pictures you must repeat the steps described in section 3.2, starting with clicking on the icon  (page 5). Repeat all the steps described in sections 3.2, 3.3. The technique of placement of points – see section 4.

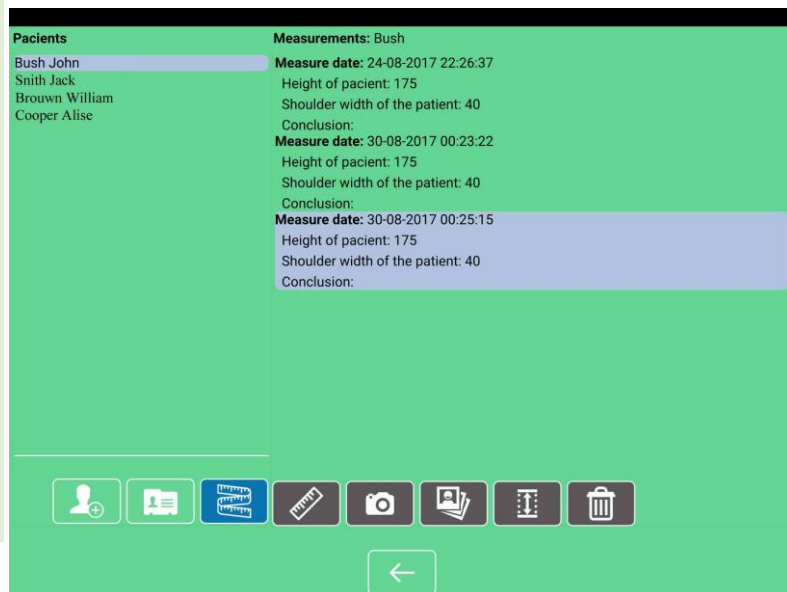



Fig. 25. Creating a new dimension.

7. ADDITIONAL OPPORTUNITIES OF THE APPLICATION.

7.1. Goniometer

App the allows arbitrary measurement of angles like wish user.

To measure the angle, click on the icon  Setup on the image consecutive three points through touch (second point – is top corner) and get in the right part of the screen the measured angle.

The accuracy of the virtual goniometer ± 1 degree (Fig. 26, 27, 28).

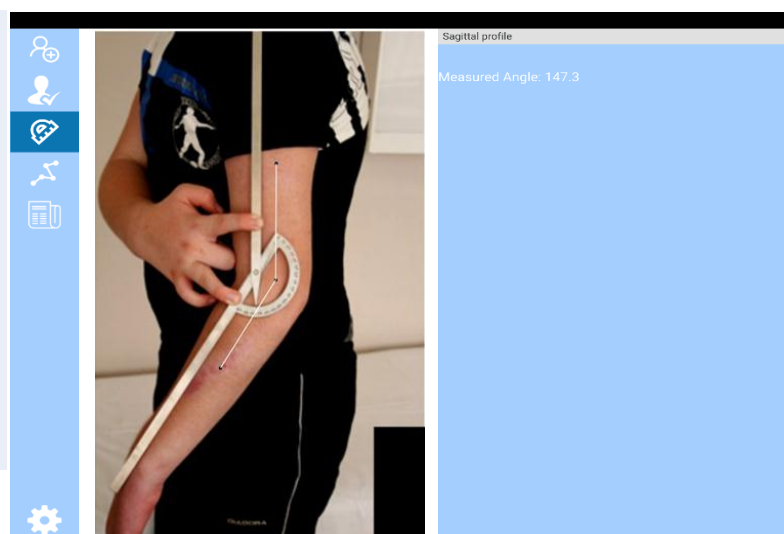


Fig. 26. The measurement of the angle of extension at the elbow with flexion contracture.

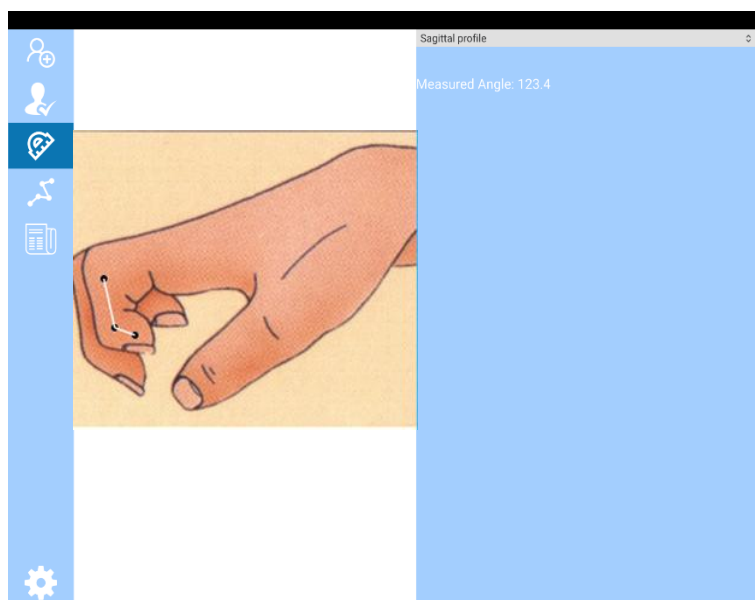


Fig. 28. The measurement of the angle of flexion in the interphalangeal joint.

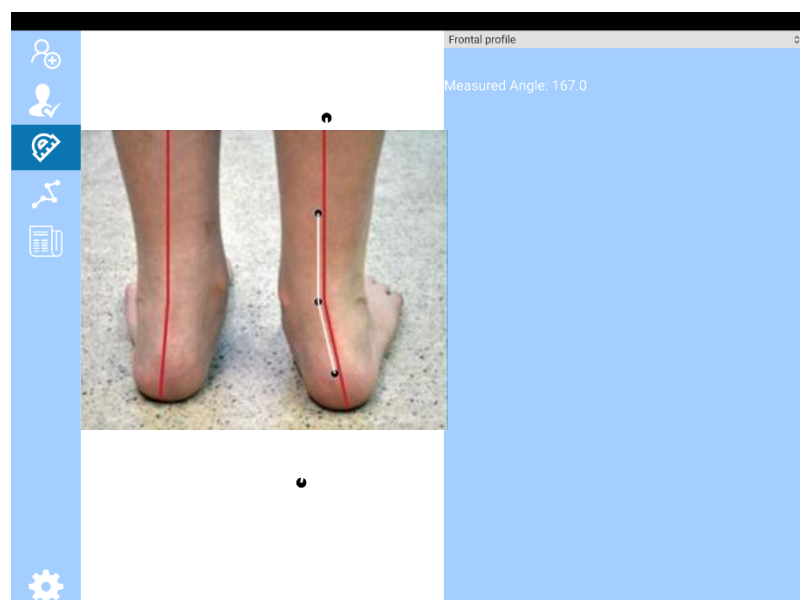



Fig. 27. The measurement of the angle of valgus deviation of the foot.

7.2. Length measurement.

On the same principle are possible and measure the length of an arbitrary segment. You click on the icon.  Measurement be carried out by two clicking on the segment of the image (Fig. 28).

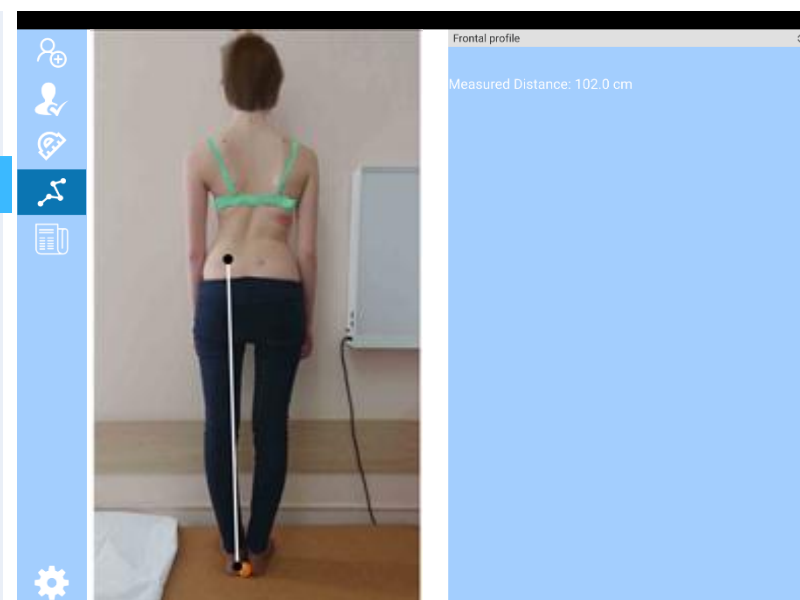


Fig. 28. Length measurement.

Applications

* **Adams test** is a clinical technique for detection one of the main symptoms of scoliosis – an abnormal rotation. Verified by the patient when tilting forward with the identification of a unilateral paravertebral asymmetry in the form of a rib hump (in the localization of scoliotic arch in the thoracic spine), or muscular "cushion" (in the localization of arc in the lumbar).

The test is named after the English surgeon Wiliam Adams (1820-1900), who described it in the mid-nineteenth century after the analysis of the morphological changes of the spine in scoliosis by the example of the macro specimens of his departed friend Mantell'a Gideon Algernon (1790-1852).

Information about a test of Adams appears with courtesy of Professor Dudin.M.G. (private communication).