

SOCKET-BIOEMO SURVEY

This survey is conducted as part of the project titled "**BIOMECHANICAL AND EMOTIONAL ANALYSIS FOR ENHANCING THE DESIGN AND MANUFACTURE OF HAND PROSTHESIS SOCKETS**" (ANÁLISIS BIOMECÁNICO Y EMOCIONAL PARA LA MEJORA DEL DISEÑO Y FABRICACIÓN DE ENCAJES DE PRÓTESIS DE MANO) by the Biomechanics and Ergonomics Group at Universitat Jaume I, located in Castelló de la Plana, Spain.

The project, funded by Universitat Jaume I under project number UJI-A2022-19, aims to enhance both the design and manufacturing processes of prosthetic arm sockets. The goal is to tailor them to the specific needs of patients, ultimately reducing rejection rates and enhancing the quality of life for users.

We appreciate your collaboration in advance, as the results of the study could benefit society. Anonymized data may be shared with the scientific community for purposes such as defining protocols for the development of sockets using 3D printing and their improvement.

The researchers commit to using all the data obtained from the study solely for scientific purposes. Your privacy will be protected, and it will be impossible to identify participants in communications or scientific publications resulting from the analysis of the trial's results.

For any questions, you can contact the principal investigators of the project:

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The study was approved by the Institutional Ethics Committee of Universitat Jaume I (protocol code CEISH/82/2023 and date of approval July 14, 2023).

Informed consent

- ☐ I have read the information provided in the previous section and I freely consent to participate in this questionnaire.

Signature and date: _____

Contact data

If you wish, please provide contact data (email, phone, etc.) (not mandatory)

1. PERSONAL DATA

1.1. Gender

- ☐ Woman
- ☐ Man
- ☐ I prefer not to say

1.2. Age: _____

1.3. Nationality: _____

1.4. Level of upper limb amputation or congenital anomaly

- ☐ Partial hand amputation/congenital anomaly
- ☐ Wrist disarticulation
- ☐ Transradial
- ☐ Elbow disarticulation
- ☐ Transhumeral
- ☐ Other: _____

1.5. In the case of amputation, what has been the cause? (Non-mandatory)

- ☐ A specific pathology/disease
- ☐ Traumatism
- ☐ Surgery
- ☐ Other: _____

1.6. Limb affected

- ☐ Right
- ☐ Left
- ☐ Both

1.7. Dominant hand before amputation

- ☐ Right
- ☐ Left
- ☐ Both
- ☐ None

1.8. Dominant hand after amputation

- ☐ Right
- ☐ Left
- ☐ Both

1.9. Do you currently use a prosthetic arm?

- ☐ Yes (Please, respond **all the survey sections**)
- ☐ No, but I did in the past (Please, respond sections **2** and **10**, and explain the rejection reasons)
- ☐ No, and I never did (Please, respond section **10** and explain the rejection reasons)

Abandonment reasons: _____

2. PROSTHETIC ARM USE

Please, respond the following questions regarding the use of your prosthesis, both if you are currently using prosthesis or only used in the past (then, answer based in the prosthesis use you made in the past).

2.1. How often do you use the prosthesis while you are awake?

- ☐ 25% of awake time (1-3 hours)
- ☐ Between 25% and 50% of awake time (4-8 hours)
- ☐ More than 50% of awake time (more than 8 hours)
- ☐ All the awake time (12-16 hours)

2.2. Do you use the prosthesis to perform activities of daily living?

- ☐ Only for going to the orthopedist
- ☐ Only at home (not for going out)
- ☐ Occasionally outside the home
- ☐ Only outside the home (not at home)
- ☐ All the time (at home and outside)

2.3. How often do you use the prosthesis in the following environments? (Mark with an “x”)

	Never	Rarely	Sometimes	Often	Always
With family					
Alone					
At work					
During sports activities					
At beach/pool					
Social relationships					
Nightlife					

3. PROSTHESIS CHARACTERISTICS

We would appreciate information about your current prosthesis, in order to identify potential design aspects that could benefit from improvement.

3.1. Type of prosthesis control

- ☐ Passive
- ☐ Mechanical control (controlled with other part of the body)
- ☐ Electric control (controlled with switches and electrical actuators)
- ☐ Myoelectric control (controlled with limb muscular activation)
- ☐ Other: _____

3.2. Type of prosthesis

- ☐ Commercial
- ☐ 3D printed
- ☐ Other: _____

3.3. Please indicate the model/manufacturer of your prosthetic arm. If you don't know, please describe its type (hook, anthropomorphic, etc.): _____

3.4. How long did it take you to learn to use your prosthesis? _____

4. PROSTHETIC SOCKET CHARACTERISTICS

We would appreciate information about your current prosthetic socket, in order to identify potential design aspects that could benefit from improvement.

4.1. Socket fixing system

- ☐ Elastic straps
- ☐ Velcro straps
- ☐ Rigid structure
- ☐ Mechanical fixing system
- ☐ Other: _____

4.2. In which part of the upper limb is the socket attached? (select as many as necessary)

- ☐ Hand
- ☐ Forearm
- ☐ Elbow
- ☐ Arm (biceps - triceps)
- ☐ Shoulder
- ☐ Scapula
- ☐ Torso
- ☐ Other: _____

4.3. Socket material(s) (select as many as necessary)

- ☐ Rigid polymers (plastic, resin)
- ☐ Flexible polymers (rubber, foam)
- ☐ Fabric
- ☐ Metal
- ☐ Other: _____

4.4. Socket material(s) in direct contact with the limb (select as many as necessary)

- ☐ Rigid polymers (plastic, resin)
- ☐ Flexible polymers (rubber, foam)
- ☐ Fabric
- ☐ Metal
- ☐ Other: _____

4.5. Is the socket sensorized?

- ☐ Yes, with EMG electrodes
- ☐ No
- ☐ Other: _____

4.6. If your prosthesis is electric, is the battery located within the socket itself?

- ☐ Yes
- ☐ No
- ☐ Other: _____

4.7. Which was the socket manufacturing process?

- ☐ Molding
- ☐ 3D printing
- ☐ Other: _____

4.8. How were the anthropometric measurements obtained for the fabrication of your socket?
(select as many as necessary)

- ☐ X-ray imaging
- ☐ MRI imaging / CAT scan
- ☐ 3D scanning technology
- ☐ Molding
- ☐ Manual anthropometric measurements by a prosthetist
- ☐ Other: _____

5. SOCKET MANUFACTURING

Please indicate on a scale of 1 to 5 your level of agreement with the following statements:

M1. The socket was ready in a short period of time

	1	2	3	4	5	
Strongly disagree	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Strongly agree

M2. The residual limb morphology measurement was comfortable

	1	2	3	4	5	
Strongly disagree	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Strongly agree

M3. The residual limb morphology measurement was not invasive

	1	2	3	4	5	
Strongly disagree	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Strongly agree

M4. Almost no fit adjustments were required after the final shape

	1	2	3	4	5	
Strongly disagree	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Strongly agree

M5. In general, I am satisfied with the socket manufacturing process

	1	2	3	4	5	
Strongly disagree	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Strongly agree

If you have any further comments about the manufacturing process of your socket we would appreciate it:

6. SOCKET COMFORT

Please indicate on a scale of 1 to 5 your level of agreement with the following statements:

C1. The socket is comfortable and does not cause any skin wound

	1	2	3	4	5	
Strongly disagree	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Strongly agree

C2. The socket has an appropriate weight given its characteristics

	1	2	3	4	5	
Strongly disagree	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Strongly agree

C3. The socket is breathable and does not cause excess sweating

	1	2	3	4	5	
Strongly disagree	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Strongly agree

C4. The socket has a good fixing system and there are no unexpected displacements

	1	2	3	4	5	
Strongly disagree	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Strongly agree

C5. The socket has a good fixing system and the motion control is not lost (only for prosthetics with mechanical, electrical or myoelectrical control)

	1	2	3	4	5	
Strongly disagree	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Strongly agree

C6. The socket does not cause pain

	1	2	3	4	5	
Strongly disagree	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Strongly agree

C7. The process of fixing and removing the socket is comfortable

	1	2	3	4	5	
Strongly disagree	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Strongly agree

C8. In general, I am satisfied with socket comfort

	1	2	3	4	5	
Strongly disagree	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Strongly agree

If you have any further comments about the comfort of your socket we would appreciate it:

7. SOCKET FUNCTIONALITY

Please indicate on a scale of 1 to 5 your level of agreement with the following statements:

F1. The socket allows me to perform all the activities of daily living I need

	1	2	3	4	5	
Strongly disagree	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Strongly agree

Please indicate your level of ability to perform activities in the following fields by marking with an "x":

	With considerable difficulty	With difficulty	Can be accomplished	Easily	Very easily
Personal hygiene					
Personal care					
Dressing/Undressing					
Eating/Drinking					
Cooking					
Cleaning					
Home DIY activities					
Entertainment					
Sports					
Using computer					

Are there any activities that you would like to do in your daily life that your prosthesis does not allow you to? Please indicate them: _____

F2. The socket allows me to perform all the activities of daily living with all the products I need

	1	2	3	4	5	
Strongly disagree	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Strongly agree

Please indicate your level of ability to perform activities with the following products by marking with an "x":

	With considerable difficulty	With difficulty	Can be accomplished	Easily	Very easily
Bottles and glasses					
Cereal boxes and books					
Medium size balls					
Pens and pencils					
Coins and credit cards					
Keys					
Fork and knife					
Bags and luggage					
Keyboard and mobile phone					

Are there products you would like to use that your prosthesis does not allow you to? Please indicate them: _____

F3. The socket has enough rigidity and does not deform while performing high-stress tasks

	1	2	3	4	5	
Strongly disagree	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Strongly agree

Approximately, what is the maximum weight (in kg) that you can lift with your prosthesis?

F4. In general, I am satisfied with socket functionality

	1	2	3	4	5	
Strongly disagree	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Strongly agree

If you have any further comments about the functionality of your socket we would appreciate it:

8. SOCKET APPEARANCE

Please indicate on a scale of 1 to 5 your level of agreement with the following statements:

A1. I like the socket's shape

	1	2	3	4	5	
Strongly disagree	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Strongly agree

A2. The socket size is not excessive

	1	2	3	4	5	
Strongly disagree	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Strongly agree

A3. The socket color is appropriate

	1	2	3	4	5	
Strongly disagree	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Strongly agree

A4. I like the socket surface finishing

	1	2	3	4	5	
Strongly disagree	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Strongly agree

A5. The socket design is attractive and does not look like orthopedic

	1	2	3	4	5	
Strongly disagree	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Strongly agree

A6. I had the chance of choosing between different socket designs

	1	2	3	4	5	
Strongly disagree	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Strongly agree

A7. In general, I am satisfied with the socket's appearance

	1	2	3	4	5	
Strongly disagree	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Strongly agree

A8. Which of these words would best define the style of socket you would prefer? Mark with an “x”.

	1	2	3	4	5	
Stylish						Sportive
Modern						Classic
Colorful						Neutral
Eye-catching						Discreet
Patterned						Plain

If you have any further comments about the appearance of your socket we would appreciate it:

9. DURABILITY AND COST

D1. How often do you change your socket? _____

D2. How often do you send a component of your prosthesis for repair or replacement? _____

D3. If your prosthesis is electric, how often do you recharge its battery? _____

D4. Can you afford the costs of purchasing and/or maintaining your socket?

	1	2	3	4	5	
With considerable difficulty	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Very easily

D5. Can you afford the costs of purchasing and/or maintaining your prosthesis?

	1	2	3	4	5	
With considerable difficulty	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Very easily

10. UPPER LIMB SOCKETS CHARACTERISTICS

Please indicate on a scale of 1 to 5 how important you consider the following aspects in a prosthetic socket (mark with an “x”):

	Not important at all	Low importance	Indifferent	Somewhat important	Very important
P1. Fast manufacturing					
P2. Easy anthropometric measurement process					
P3. No need for shape adjustments					
P4. Comfort (not causing skin wounds)					
P5. Breathability					
P6. Easy fixing system					
P7. Stable fixing system					
P8. Lightweight					
P9. Allows me to perform the activities of daily living I need					
P10. Allows me to use the products I need					
P11. Allows me to carry the weight I need					
P12. Has enough rigidity and does not deform in high-stress tasks					
P13. Attractive shape					
P14. Small size					
P15. Appropriate color					
P16. Appropriate surface finishing					
P17. Attractive design					
P18. Low maintenance required					
P19. Low cost					