

# Bionic construction of the human body in the light of the slippery slope argument

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## Abstract

Composite tissue transplantation has gained a new dimension in line with advanced technological developments. In extremity losses, the traditionally implemented procedure is to enable the extremity to regain its functionality through replantation instead of transplantation. On the other hand, innovative studies are also carried out to support and strengthen the human body and improve the problematic body functions for increasing patients' quality of life. Studies on developing biomechatronic systems, which are related to biology, neurology, biophysics, mechanics, biomedical and tissue engineering, electronics, and computer sciences, are in progress, which indicates that a transformation has occurred in the approaches to composite tissue transplantation. This study aims to generate ideas about determining a conventional limit in the interventions towards the human body against the technological and scientific developments and to perform a value analysis on such interventions. This study was designed within the framework of the methodology of medical ethics and in the light of the slippery slope argument. The process of transformation from the medical procedures that aim to protect patients' bodily integrity to the innovative practices that provide an opportunity to bionically turn healthy human bodies into the half machine and half-human is investigated in the light of the slippery slope argument. This study indicated that the value-related problems regarding this issue are related to the principles of respect for autonomy, beneficence, non-maleficence, and justice. The limit to be determined for the practices that aim to protect the patients' bodily integrity and increase their quality of life and that are not life-saving depends on the distinction between an ill body and a healthy body. A meticulous clinical perspective and legislative regulations that prevent the instrumentalization of humans are required so as not to roll down to undesirable places on a slope. Advanced technological developments are implemented in medicine, protecting human dignity should be adopted as a fundamental value.

**Keywords:** Medical ethics, slippery slope argument, bionic construction

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## Introduction

When people's bodily integrity is impaired and severe extremity losses occur causing a dysfunction, composite tissue transplantation is performed [1]. Such practices aim to reshape the body, enable the limbs to gain functionality, and increase patients' quality of life. Throughout history, people have always tried to eliminate bodily defects using the limited information they have had and to develop means to replace the lost extremities. A tool made of leather and wood was found on a mummy's big toe during the archaeological excavations, which shows that the first examples of prostheses date back to the Ancient Egypt [2]. Iron hand prostheses were used by high-rank soldiers who lost their extremities during a war [3]. Prostheses are also seen in the written works of Ambroise Pare (1510-1590). Pare designed mechanic extremities working through latches and springs to help soldiers whose bodily integrity was impaired [4]. In the following centuries, more competent tools were developed and commonly used along with technological developments.

Composite tissue transplantation has gained a new dimension in line with advanced technological developments. In extremity losses, the traditionally implemented procedure is to enable the extremity to regain its functionality through replantation instead of transplantation. Both transplantation and replantation have severe medical risks; however, trying to regain the patients' own extremities is accepted as the golden standard as there is no need for an immunosuppressive therapy [1]. When this condition cannot be met, replantation is applied. First transplantation was performed on September 23, 1998 in Lyon, France; one hand was transplanted from a 41-year-old brain-dead donor to a 48-year-old patient [5]. Although this transplantation was not supported by all hand surgeons, it was evaluated as a step towards a better medical treatment within the medical field and society [6]. The composite tissue transplantations, which started with hand transplantations in the world, was first performed in Turkey in Akdeniz University, Faculty of Medicine in 2010 with a double

arm transplantation from a cadaver [7]. Lower and upper extremity and face transplants are successfully performed both in Western countries and Turkey considering legal norms and ethical principles [6,8].

Innovative studies are carried out to support and strengthen the human body and improve the problematic body functions using technological opportunities [9]. For example, a problem that occur in the case of a dysfunction in hand is related not only to the bodily integrity and also to the central nervous systems (CNS) [10]. Therefore, interdisciplinary studies must be conducted. Studies on developing biomechatronic systems, which is related to biology, neurology, biophysics, mechanics, biomedical and tissue engineering, electronics, and computer sciences, are in progress, which indicates that a transformation has occurred in the approaches to composite tissue transplantation.

The studies carried out on loss of extremities in innovative surgery and engineering today suggest that an unprecedented connection can be established between the human body and machines. Bodily integrity can be ensured through bionic extremities, robotic prostheses, osseointegrated implants, and basic mechanical connections. An extremity developed for this purpose functions as a designed means and offers an opportunity to increase the performance of a human body. For example, it is now possible that a mountaineer who has lost his/her lower extremities has crampon feet that he/she can use during a mountain climbing [11]. Here, the body is redesigned and the body is indicated to be a formable identity [12]. Such an intervention in human body is called as the bionic reconstruction of human body, i.e. *homo silicium* [12]. It is remarkable that a higher number of reports are being submitted on the practices regarding the bionic reconstruction of the human body today [13,14]. This study aims to generate ideas about determining a conventional limit in terms of ethics and laws for the interventions targeting the protection of the integrity of the human body using technological opportunities and to perform a value analysis on such procedures.

## Materials and Methods

In this study, which was designed within the framework of the methodology of medical ethics, the bionic transformation of human body is discussed in the light of the slippery slope argument. The slippery slope argument is frequently used in the field of medical ethics for the critical evaluation of the decisions regarding the beginning and end of life [15-17], fair allocation of limited resources, the transplantation-related issues [18,19]. In composite tissue transplantation, some of the opportunities offered by advanced technological developments may include practices that can serve to reconstruct human body. The slippery slope argument was selected in this study because it allows the discussion of the ethical problems that may arise from the fact that the steps taken during the transition from transplantation and replantation to innovative practices, i.e. the construction of human body using technological means, in composite transplantation may lead to the transformation of humans into machines.

The slippery slope argument is also called by the metaphors such as *thin edge of the wedge*, *camel's nose*, and *open the floodgates* [20]. The fact that an action leads to other actions and that the results obtained by the new actions are unwanted or considered to be unacceptable means that innovative steps are not taken. A new practice should be restricted at a point to avoid obtaining a negative result or to prevent the occurrence of something bad, even if this new practice is not actually bad [21]. This point should be a conventional limit determined to avoid rolling down to undesirable places on a slope.

The slippery slope argument may be logical or causal according to the reasons of moving towards an undesirable process [21,22]. Since the acceptances regarding a phenomenon on the peak (P-0) of the slope in the current position under our control are not universally true, transition to a new position can be recommended. This new position, e.g. Position A, may frequently, if not necessarily, include the legislative regulations regarding a phenomenon. Emergence of the Position A is important; this position is not actually bad as it may include the moral values

that were discussed in terms of ethics or agreed upon. The Position A can be a position which is considered to be generally good, accepted as good by the addressees of the relevant phenomenon, or accepted to be neither good nor bad. Even though a practice to be carried out on the Position A seems innocent now, it may lead to the logical acceptance of many other positions that will yield unpredictable and undesirable results. This is because the other positions to be adopted after the Position A are based on the previous position and a logical slippery slope emerges between the adopted new positions. Thus, the Position A requires the logical acceptance of the Position B, C, or even though it is undesirable, the Position N [23]. The presence of a causal connection rather than a logical connection between the positions looks differently on the slope: An action taken considering that it will yield positive results may lead to the emergence of other actions that cannot be refused and introduce a new position [22]. The emergence of new positions connected to each other with causal connections cannot be objected and each new position may lead to the emergence of other positions connected to each other with logical connections.

## Results

### *The legislative regulations regarding composite tissue transplantation in Turkey*

The Constitution of the Republic of Turkey includes the following statements: "the individual's right to life, the integrity of his/her corporeal and spiritual existence shall be inviolable" (Article 15); "Everyone has the right to life and the right to protect and improve his/her corporeal and spiritual existence. The corporeal integrity of the individual shall not be violated except under medical necessity and in cases prescribed by law; and shall not be subjected to scientific or medical experiments without his/her consent" (Article 17), and "Everyone has the right to live in a healthy and balanced environment. The State shall regulate central planning and functioning of the health services to ensure that everyone leads a healthy life physically and mentally, and provide cooperation by saving and increasing productivity in human and material resources." (Article 56) [24]. These articles in

the Constitution, which come to the forefront in respect of individuals' right to health and life, are evaluated within the scope of "individuals' self-realization right" by the Turkish Medical Association [1].

On the other hand, "the Law on the Harvesting, Storage, Grafting, and Transplantation of Organs and Tissues" published on May 29, 1979 in the Official Gazette involves regulations regarding the harvesting, storage, grafting, and transplantation of organs and tissues [25]. The Regulation on Organ and Tissue Transplantation Services published on 1 February, 2012 in the Official Gazette was created to determine the procedures and principles to be followed in the implementation of organ and tissue transplantation services by opening, running, and supervising organ and tissue transplantation centers, organ and tissue source centers, and tissue typing centers where the transplantations to enable the patients to maintain their lives when their treatment is possible through tissue or organ transplantation [26].

The Composite Tissue Centers Directive published by the Ministry of Health includes information on how to make medical decisions on transplantation [8]. The Directive also explains the composite transplantation types and indications and presents a list of the indications regarding extremity transplantation [8]. Pursuant to the Directive, the Composite Tissue Transplant Scientific Advisory Commission is responsible for evaluating the transplantations in terms of indications and discussing on the exceptional cases where no decisions can be made according to the indications list. In addition, a Composite Tissue Transplantation Council including a medical ethics expert should be established in the hospitals with a Composite Tissue Center. It is indicated that transplantation can be performed for the patients approved by the Council and that the transplantation procedure, its results, and the Council decisions should be reported to the Ministry.

The Convention for the Protection of Human Rights and Human Dignity in Terms of the Implementation of Biology and Medicine: The Law on the Approval of Human Rights

and Biomedicine Convention, which entered into effect by being published in the Official Gazette in Turkey, stipulates that the parties of the convention shall be responsible for the protection of all individuals' identity and dignity and guaranteeing that every individual, their integrity, and other fundamental rights and liberties are respected without any discrimination during the biological and medical practices [27]. The Convention also stipulates that the human body and its parts cannot be a subject of making commercial profits (Article 21) and that when any part of a human body is removed during an intervention, this part can be stored and used for a purpose other than the purpose of its removal only provided that the relevant information and obtaining consent procedures are followed (Article 22).

#### *Ethical issues regarding composite tissue transplantation*

It is accepted that whether composite tissue transplantation will be performed for a patient can be decided after all treatment options run out [1]. Therefore, patients' physical appearance itself is insufficient for performing such a practice; the practice should also aim to eliminate severe function losses in the extremity in question [1]. It should also be noted that composite tissue transplantation is not life-saving and the receivers will use immunosuppressive drugs and be subject to the complications and adverse effects due to these drugs throughout their life [8]. Moreover, before the transplantation, the candidate receivers of the composite tissue or their legal representatives must declare in writing that they are not satisfied although they used other existing alternatives such as mechanic and myoelectrical prosthesis or orthosis or despite the surgeries performed to fix the loss of tissue or organ [8]. The transplantation requests made by the patients who meet these criteria are evaluated within the scope of the right to health, and the accessibility and usability of this right are among the responsibilities of the state [1]. For the last 20 years, the ethical issues regarding composite tissue transplantation have been evaluated under the following titles considering human existence, dignity, and integrity [1,28,29].

**Respect for Autonomy:** In medical ethics, respect for autonomy means that individuals make decisions about themselves based on their own values [30]. Whether this principle is complied with in a medical practice depends on the implementation of a valid informed consent process. In Turkey, the informed consent process in composite tissue transplantation continues for a long period of time and involves the investigation of any changes in the individuals' decisions. Unlike the informed consent obtained for other medical practices, consent is obtained before the transplantation to assess the patients' suitability for transplantation [8]. This consent includes the information that the patients will be in contact with the healthcare personnel and participate in the procedures assessing their suitability for transplantation with their free will, and that the success of the non-life-saving transplantation to be performed to increase the quality of life cannot be guaranteed. It also includes the information that rehabilitation may be needed after the transplantation and complications that can risk the patients' life can develop depending on the medication. In addition, it includes the preoperative interviews, explanations regarding the suitability evaluation procedures including psychiatric, hematological, microbiological, ethical, and legal evaluations, and the information that another consent will be obtained in the case that such evaluations require interventional routine procedures.

Other than the consent obtained from the patients subjected to preliminary evaluation, another consent is obtained before the practice aiming to increase the quality of life [8]. This consent includes the information that the patients will undergo a practice which is only on the onset around the world and that the following treatment can somewhat be evaluated as an experimental project. It is stated that the practice to be permitted by the patients is not life-saving. Interviews are carried out on the alternative practices, primarily including biomechanical prosthetics, which are previously known by the patients but is still reminded to them. The patients must report that they find biomechanical prostheses impractical and inappropriate for them although they already

tried them repeatedly. The informed consent form was prepared with the following titles: social, economic, and business practices; surgical operation and direct complications; anesthesia; postoperative follow-up; privacy; confrontation; and ethics. The patients must express their request for the recovery and reduction of their defect with their strong will.

**Beneficence:** In medical ethics, beneficence means doctors' duty to do their best to contribute to their patients' well-being [30]. Unlike the other principles of medical ethics, the principle of beneficence highlights the importance of the fact that when there is a benefit, patients should primarily take advantage of it [30]. Paying regard to the benefit-harm balance in composite transplantation is closely related to the effort to provide benefits to the patients. In this regard, it is accepted that effort should be made to minimize the risk that the patients will take, the risk should not exceed the benefits provided to the patients, and human health and well-being should be protected [31].

**Non-maleficence:** In medical ethics, non-maleficence means that doctors should avoid causing damage to their patients [30]. While damage may occur when a doctor carries out a practice, it may also occur when a doctor does not carry out a practice considered to be useful to his/her patient [30]. As in the principle of beneficence, benefit-harm balance is also sought before, during and after composite tissue transplantation in the principle of non-maleficence. In the Turkish Bioethics Association's Statement on the Organ Transplantation and Ethics, it is accepted that practices related to composite tissue transplantation, which increases the quality of human life, should be avoided in the cases where the risk exposed by the patients is higher than the benefits they will take advantage of [31]. It is also stated that the success of the practice depends on the postoperative medical care, whether the body accepts the tissue, and as in the lower and upper extremity transplantation, the organs' gain of function. In this regard, the accepted approach is to avoid the practices with high risks [31].

**Justice:** In medical ethics, the principle of justice means that no random discrimination will be made against anyone during the allocation of the fundamental rights and duties, social benefits, and burdens [30]. Particularly when the fair allocation of limited resources is in question as in composite tissue transplantation, the Central Organ Coordination system is accepted to be an appropriate solution [31]. In this context, the approach that can be ethically justified is to prioritize the patients in the most urgent and highest level of need according to the order of priority in patients list [31]. In addition, World Medical Association indicates that the surgical techniques developed today increase the success rates in transplantations and highlights the importance of several principles including equality and justice in terms of maintaining the ethical standards [32].

In connection with the above-mentioned fundamental principles of medical ethics, the relevant literature shows respecting the patients' privacy and private life, maintaining medical confidentiality, taking religious and cultural sensitivities into consideration, having realistic expectations from the practice, informing the public, planning the process transparently and in a way to allow investigation, and the size and length of the extremity as the other principles that should be considered [32].

## Discussion

In the slippery slope argument, it is difficult to prevent the logically connected practices from being accepted one after each other. A conventional limit is needed between over restricting and unconditionally allowing the composite tissue transplantation and the adaptation of advanced technological practices to medicine. A discussion should be made on the practices to be allowed during the transition from traditional practices to the innovative practices offered by advanced technological developments so as not to roll down to undesirable places on the slope.

The first definitions of the concept of health throughout history include "health, physical well-being and competency" and "the fact that

an organism functions well as a whole and uses the resources of the living body at the maximum level" [30]. Health was defined as the physical, mental, and social well-being of the World Health Organization; however, its meaning has expanded over time. As generally accepted, the purpose of medicine is to eliminate the patients' pain and heal and recover them. In line with the concept of health and the purpose of medicine, the composite tissue transplantation is defined as "the composite tissue transplantation which is performed for the restoration of form and function in patients with composite tissue loss that impairs their bodily integrity and causes loss of function and which aims to increase their quality of life" [8]. This definition clearly shows the aim and potential benefits of composite tissue transplantation from a clinical perspective. It should be noted that the concept of restoration in this definition emphasizes "repairing" the human body. Here, repairing the human body means ensuring the bodily integrity and regaining health. However, repairing a body (completing an incomplete body) also includes healing that body (in terms of medicine and competency). Thus, if this situation is not limited, construction of the human body will be possible because repairing a body can introduce practices that allow strengthening the functionality of the extremities of a healthy human body in the case of moving away from clinical purposes.

The presence of the above-mentioned possibility does not require the prevention of the innovative studies that require composite tissue transplantation to increase the quality of life and that aim to enable the extremities to gain functionality. On the contrary, it reminds us that clinical purposes should be adhered to. In medical practices, the opportunities offered by advanced technology should be utilized in line with clinical purposes.

In composite tissue transplantation, the peak of the slope is a position where ethical and legal consensus is reached. Moving away from this position is possible because the constant improvement of scientific information in addition to replantation, which is accepted as the golden standard today, inevitably leads to a

change in the practices. The indications list for composite tissue transplantation is reviewed by adding new transplantation types. Thus, staying away from the practices beneficial to the patients to avoid the negative situations that may arise prevents scientific developments. Such an attitude cannot be ethically accepted. Therefore, addition of the transplantation types that are not currently included in the indications list will pave the way for the transition to new positions. The transition from the current position to a more controversial position will probably be accepted with a sufficient and valid justification such as protecting bodily integrity. This new position will also change after a while in line with the new decisions to be made. In the last accepted position, removable body extremities with increased functions and different characteristics and in different appearances can contribute to the transformation of the human body into a demountable image. While rolling down on the slope, the human body can transform into a half-human and half-machine creature and new characteristics may lead to its use through instrumentalization.

The slippery slope arguments regarding composite tissue transplantation include the following:

**Argument-0:** Medical opportunities should be used to protect a patient's bodily integrity.

In the case that a patient with a lost extremity gives consent, protection of bodily integrity is the patient's right and the peak of the slope today. The Turkish Medical Association accepts that composite tissue transplantation is related to the right to life and health and interprets such practices within the scope of self-realization [1]. The aims of composite tissue transplantation include enabling the patients to get involved in life and maintain their lives without needing others' help. A legal limit was determined for lower and upper extremity transplantations based on the Composite Tissue Transplantation Indication List in Turkey. The guides on indications and contraindication are updated in line with scientific information. Therefore, addition of the transplantation types other than lower-upper extremity and face transplants,

which are successfully implemented today, to the indications list will change the opinions on the Argument-0. In this regard, making new decisions to increase patients' quality of life may be required.

**Argument-I:** Innovative medical opportunities should be used to protect a patient's bodily integrity.

Medicine is liable to eliminate a defect, in other words, an undesirable situation, using the opportunities offered by technology [33]. However, it is generally accepted that doctors do not have to do everything that is technologically possible [34]. The possibility of a damage during the implementation of advanced technology in medicine should not prevent the use of the advantages of technology. Here, it should be noted that Argument-0 is not an absolute position and it can be criticized, changed, or improved. Difficult cases which are not currently included in the indications guide or where the risk-damage balance of the practice cannot be accurately evaluated even if they are included in the guide may lead to a change in the existing practices at the peak of the slope. On the other hand, it is expressed that transplantation should be the last method to be used and it is not appropriate to perform it to eliminate an aesthetic problem [1]. It is important to move away from the aim of eliminate a health problem or a severe loss of function in the body; otherwise, the way would be paved for some experimental practices. Innovative surgical practices are also supported by engineering. If robotic prostheses and/or osseointegrated implants contribute to increasing patients' quality of life compared to traditional prostheses, their use should be supported. In addition, considering the high number of patients waiting for a composite tissue transplantation and the low number of donors, using technological means may provide many advantages to the patients; primarily time. Today, the advantages and disadvantages of extremity transplantations and prostheses are being reported based on the patients' experiences [35, 36]. The Argument-I can contribute to a transformation in medical services even if it is not considered to be bad itself. Medicine can

transform into a service that supports recovering the body within the existing opportunities and/or aesthetically shaping the body in addition to eliminating a bodily defect.

*Argument-II:* Innovative medical opportunities should be used to increase a patient's body performance.

Acceptance of the Argument-I always means that the Argument-II will also be accepted. Protecting bodily integrity and increasing body performance are different phenomena. The Argument-I aims at obtaining positive results but it also generates a new phenomenon such as the Argument-II. In this case, a causal connection is established between the Argument-I and the Argument-II according to the slippery slope argument; presence of the Argument-I leads to the emergence of the Argument-II. The innovative studies carried out on loss of extremities today indicate that an unprecedented connection can be established between the human body and the machines. Bodily integrity is protected thanks to bionic extremities and basic mechanic connections. An extremity developed for this purpose functions as a designed means and the performance of a patient's body can be increased. In the Argument-II, patients' expectations will probably become a priority. Such practices become difficult to access for the majority of society when their costs are not met by social security or insurance systems. This may lead to a period when the inequalities in healthcare services deepen further.

The main purpose is to increase the quality of life for the patients who need composite tissue transplantation for any reason. When clinical perspective is not adhered to, this main purpose may turn towards a system where human body extremities are produced over time. In addition, patients who need an extremity that becomes a commercial instrument should be psychologically prepared for the transplantation process. When individually developed extremities have an economic value and making profit from the sales of extremities is determined as the main goal, whether the patients are ready to use such extremities can be ignored. Conflicts of interest can occur between healthcare

professionals, patients, and the firms that provide the extremities; and the success of the practice can be evaluated based on customer satisfaction. Under such circumstances, maintaining an approach that accepts human health as a value can become difficult.

*Argument-III:* Innovative medical opportunities should be used to increase an individual's body performance.

For the patients who do not have a lost extremity but suffers from loss of function in their extremities, increasing body performance can be evaluated within the scope of a healthcare service. However; the subjects of the new practices on the slope can shift from the patients who have problems with their extremities to healthy people. Thus, a logical connection is established between the Argument-II and the Argument-III, and even if they are undesirable, objection to new arguments is prevented. In this regard, the limit of the autonomous decisions of individuals without any health problems on their own bodies can be a subject for discussion because in such a scenario, individuals' autonomous choices about their extremities will be no longer related to health, and reconstruction of body can come into question. This reconstruction can even lead to legitimization of any interventions (such as adding or removing an extremity) in bodily integrity, which would probably be difficult to reasonably evaluate.

In medical ethics, the consistency between supporting the treatment of a health problem for many years and objecting to the health promoting practices (which seek perfection in a sense) is discussed. Harris (1993) claims that there is no moral difference between the interventions to treat a defect by reasoning based on gene therapy and the practices that aim at achieving perfection [37]. All steps to be taken to increase the quality of life of a mountaineer or a dancer who has lost his/her lower extremities and to eliminate the existing defect should be supported. Practices that aim to ensure bodily integrity and heal a defective body are positive developments for humanity.

The problem, or the point to take into

consideration, is that the first steps of an ontic transformation that will lead to dehumanization are taken. This can be individuals' autonomous decision; however, when rolling down from the slope continues, a healthy individual's hands, arms, and legs can be strengthened and/or shaped in line with the purpose without obtaining their autonomous decision. This can enable the use of humans for increasing the efficiency of the production system or similar systems. When human body is introduced as a formable identity, humans can be used for certain purposes; and it is ethically impossible to accept this last position.

## Conclusion

To avoid rolling down to undesirable places on the slope and instrumentalizing the humans, composite tissue transplantation indications should be meticulously evaluated in clinical terms. The aim of protecting bodily integrity and increasing the quality of life should be adhered to. Non-life-saving innovative opportunities should be offered to be used for ill bodies, not for healthy bodies, and should be legally regulated. Protection of human dignity while using advanced technological developments in medicine should be adopted as a main value.

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