ETHICAL ISSUES WITH ARTIFICIAL SKIN GRAFTING

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INTRODUCTION

At NeoDerma Inc., artificial skin grafting is at the forefront of research and application due to the success rate with patients and the low amount of body rejection. With a Master’s Degree in bioengineering, most of my past research has been focused on the applications of artificial skin grafting, with an emphasis on the use of stem cells to create these grafts. While the success rate proves our products are efficient, many potential clients refuse to support and buy the technology due to the use of embryonic stem cells.

My boss refuses to be rejected by more clients, and has instructed me to create a more generalized description of our products, omitting the fact that our company relies on the use of stem cells. He intends to send this edited description to different organizations, which will, in turn, boost our clientele and sales, gaining our company more money and more support. He shows no qualms on blatantly misinforming our clients; our company is desperate for more support from more right-winged organizations, since these companies possess the money that our company can use to complete further research and completely replace the stem cell technology with an artificial, rather than an embryonic, source.

Unfortunately, I am faced with an ethical dilemma: do I support my boss and the company, producing false information for the public, or do I remain true to potential clients, losing the support of my boss and potentially losing my job at the company? How will my decision affect the company, and how will my decision affect the patients exposed to our technology? My boss left me in a compromising position, and I must determine the right path to take based on the current codes of ethics of the bioengineering field, as well as past case studies for related issues.

WHAT DOES OUR COMPANY DO?

NeoDerm Inc. falls under the general category of tissue engineering and regenerative medicine due to our artificial skin graft technologies. Tissue engineering and regenerative medicine, or TERM, are two growing fields in the realm of engineering, each with similar target initiatives. These initiatives within TERM originally sought to create and maintain efficient treatments for both prosthetic implants and living tissue grafts or cadaveric transplants. Despite the current success found in tissue engineering, many of the options and technologies available are only able to serve as temporary solutions: a patient who receives an engineered implant or graft must undergo removal and replacement surgeries on a semi-regular basis due to the deterioration of the artificial material. While autografts, or tissue taken directly from one part of the patient’s body and inserted into the damaged portion, experience no rejection rate, the fact that the graft is being taken from an already-injured patient creates a serious flaw in the system. Tissue engineers within the field of reconstructive surgery, such as myself, are motivated to create prosthetics and artificial grafts to eliminate the flaws within the system, making each surgery and procedure successful [1].

Skin Engineering

Tissue-engineered dermo-epidermal skin substitute (DESS) has been proposed as an alternative to autografts, the current clinical gold-standard; traditional skin-grafting methods are severely limited by donor-site shortage, shrinkage, and scarring. Although DESS has the potential to solve all the problems faced by current clinicians, DESS has its own set of challenges. These major challenges, according to current researchers, include, “insufficient initial vascularization, resulting in a kind of nutritional crisis early after transplantation, and impaired regeneration due to the initial lack of oxygen and nutrients...this crisis cannot be avoided by any kind of the presently used skin grafts with the exception of full-thickness skin... However, full-thickness skin grafts can only be used to cover relatively small surfaces, due to the severe trauma that goes along with its preparation” [2]. NeoDerm uses DESS methods in conjunction with stem cell engineering, creating the DESS samples using embryonic stem cells from anonymous sources. However, the company is currently attempting to advance the field of artificial skin grafting and begin utilizing other techniques being developed from other research institutions around the world.

The Swedish military is currently investigating devices that can be used with individualized kits for the transplantation of bone and soft tissue. By creating a kit that is adapted to closed-system tubes for bodily fluid collection, the kits could be used directly at the site for patient care. According to the study, “The autologous platelet gel that is obtained has the intention of use to improve skin graft acceptance and adherence with supposed action of providing beneficial growth factors and antimicrobial protection for graft survival” [3]. In the research and development of these kits, scientists have observed fewer adverse side effects.
Massachusetts General Hospital has been developing bioengineered ears over the past four years for soldiers who have lost this appendage in combat. Researchers crafted titanium framework covered in collagen and the patient’s own cartilage cells through auto grafting to seed into the ear scaffold. Massachusetts General has also utilized an extracellular matrix derived from pig intestine to prepare soft tissue grafts for patients in need [3].

An organization known as AFIRM is attempting to spread a technique developed in Australia: “with a special sprayer device and kit that allows to take a 2–4 cm skin biopsy from the patient and process it in the operating room directly within less than one hour and then to apply the patient cells by spraying onto burns and wounds” [3]. Foreskin sources have also been found to provide the same end result, without having to take a biopsy; researchers have immortalized these cells to use in the making of artificial skin.

**GENERAL CODE OF ETHICS**

The National Society of Professional Engineers (NSPE) and the Engineering in Medicine and Biology Society (EMBS) have put forth certain codes of ethics for engineers to follow in ethically-strained situations, such as the one I am currently in due to my boss and his decisions. In the preamble of the NSPE’s code of ethics, it is proclaimed, “As members of this profession, engineers are expected to exhibit the highest standards of honesty and integrity. Engineering has a direct and vital impact on the quality of life for all people. Accordingly, the services provided by engineers require honesty, impartiality, fairness, and equity, and must be dedicated to the protection of the public health, safety, and welfare” [4].

In section II, point 1, sub point 5, the NSPE also states, “Engineers shall not aid or abet the unlawful practice of engineering by a person or firm” [4]. An unlawful act, in this case, includes the presentation of false information to a potential client, which is what my current boss intends to do in an attempt to gain more support for NeoDerm. In the same section, point 3, sub point 1, the code clearly claims, “Engineers shall be objective and truthful in professional reports, statements, or testimony. They shall include all relevant and pertinent information in such reports, statements, or testimony, which should bear the date indicating when it was current.” [4].

According to the NSPE code of ethics, every issue relating to the current situation is unethical and should immediately be stopped, regardless of the consequences to me or my career. The code explicitly states that what my boss is attempting to do is unethical in the eyes of the NSPE, giving me direction on how to handle the situation, despite the negative effects in might have on me, my boss, and NeoDerm as a company.

Furthermore, the EMBS code of ethics states that engineers, “Avoid or properly disclose conflicts of interest” [5]. In this case, the conflict of interest at hand is that between NeoDerma and the potential clients: many of the potential clients do not agree with our use of stem cells, and therefore refuse to support NeoDerma and purchase our products. However, the company believes stem cells to be a viable option when creating artificial skin grafts, needs the money that the potential clients have to offer, and aims to give the public what it deserves. While the conflict of interest is known by both parties, deception is being used to avoid it, rather than directly addressing the issue. NeoDerma could attempt to change practices, but instead, misinformation will be used to gain outside support and gain funding from more traditional organizations. Other than conflict of interest, the EMBS code of ethics gives me no direction when dealing with my current issue. The code does not discuss what an engineer should do when information is purposely compromised in attempt to gain more funding, and it does not discuss the ethical consequences for blatantly lying to potential clients.

**SOURCES TO MAKE A DECISION**

Fraud is defined as “an intentional deception made for personal gain or to damage another individual...Fraud is a crime and also a civil law violation. Defrauding people or entities of money or valuables is a common purpose of fraud, but there have also been fraud-ulent ‘discoveries,’ [for example] in science, to gain prestige rather than immediate monetary gain” [6]. What the boss of NeoDerma is trying to accomplish is an act of fraud, which, according to the ethics for bioengineers, disputes the principals of the code of ethics for engineers. Fraud is never okay, especially when it unknowingly compromises another individual’s or entities’ moral values.

The ethical decision-making process and the engineering design process parallel each other, which made determining a solution to my problem easier than expected. In engineering, the design process follows a set standard of steps: “Identify the problem, identify the constraints, brainstorm options to solve the problem, develop design alternatives (preliminary design of several alternatives), [select] final design and completion of design, and implement the design” [7]. In determining an ethical decision, an individual must follow a similar process: “Identify the problem, identify relevant moral factors (normative, conceptual and factual), identify conflicting moral responsibilities and dilemmas, consider moral theories and rank, consider alternate courses of action (full implication of each), and make decision” [7]. Because the processes are so similar, and I am familiar with the engineering design process, making a decision proved to be fairly simple. I identified that my boss’s request was the issue at hand; lying to the general public and presenting false information was the moral issue; my moral duty is to be honest with potential clients, yet it also includes obeying...
WHAT I CHOSE TO DO AND WHAT FUTURE ENGINEERS SHOULD DO

Based on the explicit instructions stated in the NSPE code of ethics, the information presented in sources discussing the ethics of lying, and my other sources, I chose to not change the description of our technology, providing potential clients with all of the information we have available. Although this decision cost me the trust and support of my boss, and may result in the termination of my position, honesty and integrity is more important than the amount of money that potential clients could have contributed to NeoDerma. Ethics must take precedence over monetary gain, and my decision reflects the fact that information must not be compromised.

My decision cost the company funding which could have been used to advance our services to include artificial skin grafts that do not use embryonic stem cells, which, in turn, would appease our clients and eliminate the current problem. However, the ends do not justify the means, since the means include misinformation and dishonesty. Because the means are not justified, the method is not ethically sound, and I will not support my boss’ decision.

If future engineers are faced with a similar situation, they should remember the code of ethics presented by the NSPE, as well as the code of ethics presented by their specific field of engineering. Lying to a client and committing fraud in the process is never okay no matter what the outcome, and no engineer should follow an individual who intends on presenting false information to a client. The ends do not justify the means and therefore the situation is unethical. Even if disobeying authority means the loss of a job, ethics must always be the precedent for any action, both within the realm of engineering and within life in general.

REFERENCES


ADDITIONAL SOURCES


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