THE APPLICATION OF TISSUE ENGINEERING IN DEGENERATIVE DISC DISEASE: AN ISLAMIC PERSPECTIVE

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Introduction

Degenerative disc disease is a major public health problem that affects a large number of the human population. About 25% to 80% of adults over the course of their life will experience an episode of significant low back pain [1]. If left untreated, it can lead to spinal stenosis, herniated disc or even osteoarthritis; the major causes of pain and disability in the elderly. The incidence is rising exponentially with the demographic changes and an increased aged population [2].

The existing treatments targeted the relief of pain and quality of life improvement without properly addressing the underlying biologic alterations of the intervertebral discs [3].

At the moment, most surgical and clinical techniques were extirpative (to completely destroy or get rid of something), for example, removal of tumours, bypass of the bowel in the case of intestinal obstruction, urinary catheterization and repair of life-threatening injuries. This life maintenance without regard to the unwanted effects of tissue loss or the psychological and

Discussion pertaining to the application of Tissue Engineering in general, and more specifically, in degenerative disc disease from Islamic perspectives have yet to gain the necessary attention in literature. This paper serves to address that gap. Primarily, the deliberations took into account the role of Tissue Engineering in meeting the principles and objectives of the present healthcare scenario. It begins with an overview of Tissue Engineering, leading to the understanding of Regenerative Medicine. Special emphasis is given to discussions pertaining to the tissue engineering principles, and their characteristics, that are used in this technology. These are followed by brief discussions of four Islamic perspectives, namely; Concept of the Islamic Worldview, principles (Qawa’id) and objectives (Maqasid) of the Shari’ah and Islamic Jurisprudence. Attempts were made to align Tissue Engineering with respect to those Islamic perspectives. These efforts were undertaken to address some concerns with respect to Islamic viewpoints pertaining to the application of the technology in Muslim individuals. The paper distances itself from providing an ultimate Islamic decree in the application of Tissue Engineering in healthcare. The work could provide some foundations for Islamic theologians to formulate a decree to the effect. It is also hoped that the highlighted areas can provide some insights and further deliberations towards the understanding of the technology in relation to what Islam champions.
the social impact of disfigurement, however, was not an acceptable goal in human therapy.

Within the last two decades, there has been a surge of interest in applying Tissue Engineering principles to treat spinal problems associated with the intervertebral discs. The emerging field of Tissue Engineering may provide promising alternatives to the current therapy. The characteristics of this approach are the use of cellular transplantation and biomaterial scaffolds to repair lost or damaged tissue. Ultimately, the pre-degenerative state of the intervertebral disc is restored.

However, ethical concerns are quite common with the development and application of new technologies or procedures on human. For Muslims, those ethical concerns will have a far reaching implication when viewed from the religious point of view. Issues involving abortion, genetic engineering, organ transplant and euthanasia are some of those issues that have received a lot of attention from the Muslim communities. Effectively, those issues have had their fair share of discussions and concerns from the Islamic legal rulings have somewhat considered settled. A holistic understanding that underlines the Islamic Worldview and the principles and objectives of the Shari’ah as well as Islamic Jurisprudence should be presented in relation to these issues. The conceptualisation of Islamic perspectives to contemporary issues should provide the Muslim communities the right foundation in addressing those issues to Islamic beliefs and practices.

It is felt that the application of Tissue Engineering in degenerative disc disease has yet to be examined from the above Islamic perspective. This paper attempts to fill that gap. Beginning with an overview of Tissue Engineering, it then highlights degenerative disc disease with respect to the intervertebral discs, followed by briefs of Islamic Worldview, principles (Qawa’id) and objectives (Maqasid) of the Shari’ah and Islamic Jurisprudence. Subsequently, emphasis is given to the possible alignment or harmonisation of the application of this technology, disease manifestation, disease management and complications to those Islamic perspectives.

### Tissue Engineering and Regenerative Medicine

Increase in life expectancy demands improved treatment for tissue degeneration. The current treatment with the use of artificial implants has a limitation in their limited lifetime and less efficient clinical results. These led to the advent of tissue engineering and regenerative medicine. Tissue engineering approaches are designed to repair lost or damaged tissue with cellular transplantation and biomaterial scaffolds [4]. There has been a surge of interest in applying tissue-engineering principles based on three predominant constituents namely cells, scaffold materials and signalling factors [5].

The term ‘Tissue Engineering’ was introduced in 1984 by Wolter and Meyer [6]. It is defined as the application of the principles and methods of engineering and life sciences toward the fundamental understanding of structure-function relationships in normal and pathologic mammalian tissue and the development of biological substitutes to restore, maintain, or improve function [7]. Tissue Engineering serves to facilitate regeneration of tissues damaged by disease or trauma and even to the extent of replacing failing or malfunctioning organs [8].

The concept and principles of Tissue Engineering is closely related to its popular synonym i.e. ‘regenerative medicine’. The term was first coined in 1992 by Leland Kaise who wrote short paragraphs on technologies that will impact hospitals with one such paragraph have bold print the word ‘regenerative medicine’ [9]. The United States National Institutes of Health (NIH) defined regenerative medicine as rapidly growing multidisciplinary field involving the life, physical and engineering sciences that seeks to develop functional cell, tissue, and organ substitutes to repair, replace or enhance biological function that has been lost due to congenital abnormalities, injury, disease, or ageing. It includes both the regeneration of tissues in vitro for subsequent implantation in vivo as well as regeneration directly in vivo [10]. Both ‘Tissue Engineering’ and ‘Regenerative Medicine’ may be used interchangeably by researchers although the term regenerative medicine is less defined in literature compared to tissue engineering. Most biologist and physicien relate regenerative medicine specifically on stem cell induction of reforming damaged tissues and organs in human [7].

The general principles of tissue engineering involve combining living cells with a natural or synthetic scaffold to build a three-dimensional living construct that mimic the tissue that is to be replaced structurally and functionally. Sufficient numbers of cells that performs biological functions such as producing extracellular matrix, secreting cytokines and signalling molecules is important for the success of tissue engineering. Cells can be further classified based on the types and source. The source of cells utilized in tissue engineering can be autologous (from the patients themselves), allogeneic (from a human donor but not immunologically identical), or xenogeneic (from a different species donor) [11]. The types of cells are primary cells and stem cell. Primary cells are mature cells specific to tissue type that are harvested from patients own tissue by surgical procedure. Advantage of primary cells is due to its capability to overcome immune rejection. However, the yield and proliferation of some tissues
tend to be low causing it may not be an option for some tissues [12].

Selection of appropriate scaffolding material is important in tissue engineering. Scaffold guides the organization, growth and differentiation of cells. General classes of scaffolds are natural (e.g. collagen and alginate), acellular tissues (e.g. bladder submucosa and small intestinal submucosa) and synthetic polymers [e.g. poly(lactic-co-glycolic acid) and poly-caprolactone]. Each class of scaffold possesses its own advantages and disadvantages. For instance, biological recognition is a major advantage for natural and acellular tissue matrices. Synthetic polymers are able to be reproduced on a large scale with controlled properties of strength, degradation rate, and microstructure [13]. The performance of scaffold in clinical use depends on one or more of six characteristics: bulk material, three-dimensional architecture and porosity, surface chemistry, mechanical properties, initial scaffold environment (osmolarity and pH), and late scaffold environment (degradation characteristics) [14]. Scaffolds must be appropriately designed in order to meet both nutritional and biological needs for the specific cell population.

In degenerative disc disease, the main goal in to reinstate the properties of the disc to its pre-degenerative state [15]. This can be achieved by restoring disc height and maintaining extracellular matrix production within the intervertebral disc. Incorporation of autologous nucleus pulposus, annulus fibrosus cells or bone marrow mesenchymal stem cells into potential synthetic and/or naturally derived biodegradable polymer scaffolds is essential to re-engineer the intervertebral discs.

**Intervertebral Discs and Degenerative Discs Disease**

Intervertebral discs are soft, compressible structures that separate the bony vertebrae that make up the spine. Classified as symphyses joint, intervertebral discs act as shock absorbers and allow the spine to flex, bend, and twist. It has two distinct anatomic layers, the inner nucleus pulposus region and the outer annulus fibrosus capsule, each containing an extracellular matrix surrounding cells [16]. The nucleus pulposus has an extracellular matrix – a jellylike material, composed of type II collagen, large aggregating proteoglycans, and a low concentration of chondrocytes. The nucleus pulposus made up of a series of 15 to 25 concentric rings with the collagen fibres lying parallel within each lamella. The outer region of annulus fibrosus consists of cells which tend to be fibroblast-like, elongated, thin, and aligned parallel to the collagen fibres. The other morphologically distinct structure is the cartilage endplate, a thin horizontal layer; usually less than 1 mm thick mostly consists of hyaline cartilage [17].

As people age, loss of water content can cause the intervertebral discs to break down, or degenerate, that can subsequently result in degenerative disc disease. Other than aging, the underlying causes of disc degeneration may include genetic inheritance, nutritional compromise, and loading history. These changes are more likely to occur in people who smoke cigarettes, obese and those who do heavy physical work such as repeated heavy lifting. In some people, a sudden or acute injury such as a fall leading to a herniated disc may also begin the degeneration process. Degenerative disc disease may occur throughout the spine, but it often take place in the lumbar region (lower back) and the cervical region (neck). Other than back pain or neck pain, the changes in the intervertebral discs can result in osteoarthritis, herniated disc and spinal stenosis. The loss of fluid in the intervertebral discs makes the discs thinner and reduces its ability to act as shock absorbers. The intervertebral discs also become less flexible due to the narrowing of the distance between the bony vertebrae. As the space between the vertebrae becomes smaller, there is less padding between them and the spine becomes less stable. As a result, the body reacts to this by constructing bony growths known as bone spurs or osteophytes. Tiny tears or cracks can occur in the capsule or the outer annulus fibrous layer of the disc. The jellylike material of the nucleus pulposus may be forced out through the tears or cracks in the capsule, which causes the intervertebral discs to bulge, rupture or break into fragments. These conditions may put pressure on the spinal cord and nerves, leading to pain and possibly affecting nerve function [1].

The clinical complications that can result from degenerative disc disease include pain, tingling and numbness in the legs and buttocks. The pain has been associated with emotional upsets that include depression, anxiety, irritability and stress. These affect one’s daily living and in more intense scenario leads to a phenomenon called catastrophizing. In this situation a sufferer imagines his condition becoming so debilitated and painful that he has to quit his job and stay at home. He may even envision a future in which he’s confined to a wheelchair. Stress and anxiousness can result in fear of movement and avoidance of movement to the spine [18]. It can safely be concluded that, degenerative disc disease involving intervertebral disc is not directly related to mortality. However due considerations must be given to the possibility of ensuing morbidity, psychological imbalance and reduced quality of life on the sufferer. The socio-economic implications that follow could compound the situation future. Efforts have to be taken not only in providing relieve towards the pain and other negative consequences, including the
prevention of deterioration in the mental capacity that may result.

**Treating Degenerative Discs Disease**

Current strategies to treat disc degeneration involve a variety of non-surgical methods such as physical therapy, anti-inflammatory medication steroid injections. Surgical treatment remains the best option for alleviating pain that not subdue by non-surgical method. Surgical treatment options range from partial discectomy to spinal fusion, disc arthroplasty and dynamic stabilization techniques. Unfortunately, these techniques are restricted to symptomatic therapies and may lead to further degeneration of the disc. The limitation of current treatment may call for paradigm shift in treating degeneration of discs.

**Risks in Tissue Engineering**

While it can be appreciated that the use of Tissue Engineering to treat degenerative discs disease can provide positive results, it is should be based on the analysis of the risk-benefit equation. Furthermore, the ethical and socio-economical implications need to be analysed. Williams [19] outlines some of the possible risks associated with Tissue Engineering. They include the possibilities of contamination, process errors, unknown cell substrate interactions that could have serious consequences, risks of mix-up and risks associated with the performance of the final product that may result in life-threatening episodes. Following established Good Manufacturing Practice (GMP), some of these risks can be eliminated or reduced.

**Islamic Worldview**

The term “worldview” is derived from the German word “Weltanschauung”. It is described as “the overall perspective from which one sees and interprets the world” and “a collection of beliefs about life and the universe held by an individual or a group” [20]. The basic premises of the Islamic Worldview are preceded by the principle of Tawhid which relates to the submission to the Oneness or Unity of Allah. This principle is fully crystallised in the primary declaration of faith, the Shahadah, “There is no god but (one) God and Muhammad (may peace be upon him; PBUH) is the messenger of God.” This principle lays the foundation of Islamic social order, which teaches man that his socio-economic activities must be guided by the principles set by the Creator, through two sources of Revealed Knowledge that is the Holy Qur’aan and the Hadith or traditions of Prophet Muhammad (PBUH) [21]. Muslims are required to refer to these two sources for directions in his daily activities. The aspect of Tawhid also relates to one’s attachment to Allah, the Creator. By submission to Allah means Man acknowledges all his actions and deed in the pursuit of achieving the pleasures of Allah and nothing else. This particular commitment lies in the Holy Qur’aan, Chapter 6, Verse 162, “Say: “Truly, my prayer and my service of sacrifice, my life and my death, are (all) for Allah, the Cherisher of the Worlds” [22]. This is a strong conviction in the life of a Muslim, though it might not be easily carried out.

The second premise is the acknowledgement of the authorisation that Allah has bestowed upon Man as a Vicegerent on earth. Whilst Allah honours Man with the Vicegerency, that attribute is expected to run parallel to remain submissive to Him, in thought, word and deed.

Besides the physical characteristics, Man is given the ‘aql (the intellect) which is to be used to develop his spiritual self. This characteristic that differentiates Man from other creatures is also to facilitate for decisions; differentiating between the acceptable and those that are not. The intellect is also to be utilised to bring out the best in an individual in appreciating those that only bring good to self, fellow human beings and the environment. A true Muslim will use the God-given intellect to enjoin what is good and forbidding those that are bad. It is the responsibility of a Muslim individual to utilise all available resources as well as the knowledge gained from scientific endeavours to benefit self and Mankind. These activities need to be guided by Islamic values, ethics and theological standards [23].

The third foundation as identified by Abdullah and Nadvi [24] is the concept of justice. The authors highlighted justice is placing things in their rightful place as well as equal treatment to all. Allah says in the Holy Qur’aan, Chapter 16,Verse 90, “Allah commands justice, the doing of good, and liberality to kith and kin, and He forbids all shameful deeds, and injustice and rebellion: He instructs you, that ye may receive admonition.” This verse is just one of the many that Allah commands pertaining to the application of justice. It brings to the mind the question about the accessibility of Tissue Engineering to all, irrespective of socio-economic background. It is not misleading to argue that present day access to healthcare technologies or services are now dictated by the ability to meet the healthcare costs. As such, there are individuals within our environment are actually deprived of these new advancements in health technologies due to economic insufficiencies. Healthcare services are now akin to business ventures that even health insurance policies have yet to be able to respond. These are in contrast to the healthcare services made available during the Caliphatates of Umayyahs and Abbasids. Nagamia [24] recalls the first true Islamic hospital was established by Caliph Harun Al-Rashid (170-193AH) (786-809 AD). The hospitals were known as Bimaristan / Maristan. They operated on Waqf

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Whatever you do, I will not prescribe for you what is hateful to me. I am a Muslim, and I follow the religion of my Prophet. Allah has taught me the knowledge through His mercy, and I do not want to benefit from it except for the preservation of the creation. Allah's Messenger said, "Whoever does not act upon what he knows, he is an ignorant person."" [21] The utilization of the intellect by individuals is the obligation of all Muslims. The blessing in the form of the mental faculty could be abused if the individual has other forms of interests other than to fulfill the expectations of a Vicegerent. The blessing is not only on the sufferer, but also on those who have the knowledge to seek the treatment through research and application.

While it is presented that Tissue Engineering serves to reduce the effects of degenerative disc disease on its sufferers, the Islamic approach towards providing relief to others has been documented in the primary sources of Islam. Hamdan [29] quotes a hadith: Prophet Muhammad said, “Look at those who are less fortunate than yourselves, not at those who are better off than yourselves, so that you will not belittle the blessings that Allah has bestowed upon you”. Perhaps this hadith challenges the Muslim intellectual as not to embrace his intellect and knowledge for personal gains, but to use to provide relief of others. The blessing in the form of the mental faculty could be abused if the individual has other forms of interests other than to fulfil the expectations of a Vicegerent.

The application of Tissue Engineering thus has its basis from Islamic perspectives. From the acknowledgement of the Islamic way of life (Shari‘ah) placed a special emphasis on the preservation of life and this will be discussed later. Being in the state of health is a highly rated virtue. A Hadith narrated by Mujahid: ‘Abdullah bin ‘Umar said, “Allah’s Apostle took hold of my shoulder and said, ‘Be in this world as if you were a stranger or a traveller.’” The sub-narrator added: Ibn ‘Umar used to say, “If you survive till the evening, do not expect to be alive in the morning, and if you survive till the morning, do not expect to be alive in the evening, and take from your health for your sickness, and (take) from your life for your death” [26]. And in another hadith narrated by Ibn ‘Abbas: The Prophet said, “There are two blessings which many people lose: (They are) Health and free time for doing good.” [27]. Both these hadiths describes the virtues of good health, a condition that sometimes test an individual.

There are several Islamic perspectives when one views ill-health. There are verses in the Holy Qur’an that associate ill-health to a test from Allah (Chapter 2: 155 – 156, 64:11, 47:31 and 29:2 ) and a medium makes amends sins (kaffarah) as outlined in a hadith narrated by ‘Aisha: (the wife of the Prophet) Allah’s Apostle said, “No calamity befalls a Muslim but that Allah expiates (makes amends) some of his sins because of it, even though it were the prick he receives from a thorn.” [28]. However, based on the fact that Islam values life and champions the sanctity of life, it enjoins seeking of treatment. In the Holy Qur’an, Chapter 2,Verse 195, Allah says, “And spend of your substance in the cause of Allah, and make not your own hands contribute to (your) destruction; but do good; for Allah loveth those who do good.” [22]. In a hadith narrated Jabir ibn Abdullah: Allah’s Messenger said: “There is a remedy for every malady, and when the remedy is applied to the disease it is cured with the permission of Allah, the Exalted and Glorious”. The obligation to seek treatment thus has its implication not only on the sufferer, but also on those who have the knowledge to seek the treatment through research and application.

There are differences between the Islamic Worldview and the Secular Worldview. The major difference is the segregation or dichotomy of the concept of Creator from human activities in the Secular Worldview. It can be argued that present day technological advancements have predominantly been attributed to those from the Secular environment. Hence, this raise questions about Islam’s position in accepting those technologies from the same people who dissociate themselves from the Creator. It is already a common practice within the Muslim circle that Islam does not reject current or beneficial practices or technologies irrespective of the origin of the said practice or technology. This holds true as long as those practices or technologies are not contrary to the Islamic worldview of the unity of Allah and the basic beliefs as outlined by the religion.

Another principle of the Islamic Worldview to be examined within the context of Tissue Engineering is the Islamic worldview on health and healthcare. Islam values life. The
Divine Being and fulfilling the concept of Vicegerency bestowed upon Man, the application of the given intellect can be extended to those in need. However, the concept of justice is still an area to be negotiated; primarily the elements of materialism, individualism and secularisation are still evident within certain individuals in the various communities. With the correct exposures, these negative domains can be further reduced and eliminated, making the application of Tissue Engineering a reality in the actual sense. A thorough understanding of the Islamic Worldview should be the foundation in the study of Tissue Engineering from Islamic perspectives. This should prepare the professionals with the right approaches in order to position themselves in associating what they are practising to what Islam champions.

Islamic Jurisprudence

Islamic Jurisprudence or Fiqh is also closely associated with the Shari‘ah, the Muslim way of life. Islamic jurisprudence covers practically all aspects of a man’s life. Simply, it outlines the do’s and the don’ts and the implications on one’s final abode in the Hereafter. It provides the basis on how to behave or act when confronted with certain situations or matters, be it personal or otherwise. Primarily it informs the Muslim on how to address issues that are related to worship, marriage, inheritance, rights of self, family, neighbours, business transactions, etc. Islamic jurisprudence is based on the two sources of Islamic revealed knowledge (the Holy Qur’an and Hadith) and the consensus (‘ijma) and opinions of renowned Islamic scholars (Qiyas / Ijtihad). While, rulings that are mentioned in the Holy Qur’an and Hadith are taken as definitive and not opened for deliberations, matters not mentioned in these sources are opened to be deliberated. For example, Tissue Engineering is not mentioned in these sources, Muslim theologians are required to come to a consensus on how best to face the issues from the religious point of view. This can be seen in practice when a religious decree is needed in Organ Transplant in Malaysia [30]. The Committee responsible for this consisted of experts in related fields of Medicine, Shari‘ah Law and Islamic Law from universities and health authorities. This committee referred to the opinions (ijithad) of renowned Islamic scholars such as Dr. Yusof Al-Qaradawi, to finalise and issue a decree of the permissibility of organ transplantation and donation in Islam.

The use of analogy (Qiyas) is another methodology to derive a religious ruling. Qiyas is defined as analogical reasoning as applied to the deduction of juridical principles from the Holy Qur’an and the hadith [31]. The authors cautiously would like to inform readers that the concept of ijtihad is sometimes not included as a source of Islamic Jurisprudence. It is also highlighted that those without the necessary religious knowledge are cautioned to place their actions based on personal inferences in face of contemporary issues.

There five Islamic legal rulings namely; obligatory (Wajib), desirability or recommended (Sunnah), simple permissibility (Haraus), undesirability or offensive (Makruh) and prohibition (Haraam). They serve to guide man in dealing with their day-to-day activities and problems. They directly or indirectly remind Man on the obligation to enjoin good and forbidding evil, outlining clear indications on the repercussions on doing bad / evil and the virtues of doing good. The application of these legal rulings is to achieve the benefits, preventing harm and maintaining order and justice to mankind. There exist some differences in interpreting certain religious rulings among the four main sects (Mazhab) within the Muslim community, namely the Hanafi, the Maliki, the Shafie and the Hambali sects. Thus, no single Mazhab can claim to represent Islam as a whole instead all have been important instruments for the clarification and application of the Shari‘ah (Islamic jurisprudence) [32]. An important lesson for the Muslims: Respect for each other’s opinion as long as it does not transgress the basic beliefs or act in a way that could nullify the articles of faith (Shahadah).

The application of Fiqh in Tissue Engineering has among others to answer to some of the probable questions that call for Islamic opinions:

1. Is Tissue Engineering permissible in Islam?
2. Is Tissue Engineering involving cell sources other than the patient himself permissible in Islam?
3. Are the individual steps involved in Tissue Engineering along the principles of the Shari‘ah?
4. Are the chemicals or biomaterials used in the technology permissible in Islam?
5. Will there be any Islamic rituals to be observed during the harvest of the cells?
6. What to do with the harvested tissues in situations of failed procedures?

It is envisaged that the approach to arrive at the decree on the permissibility of organ transplantation in Malaysia be replicated for Tissue Engineering. Issue of risks in Tissue Engineering, including possible contamination as well as other possible dangers or lessons learnt throughout these years be aptly presented to enable a decree that is valid will be derived.

Maqasid (Purpose / Objectives) Al-Shari‘ah

Muslims are guided by the concept of Shari‘ah. Literally, this means the Islamic way of life. The Shari‘ah is basically based on two fundamental sources in Islam namely the Holy Qur’an and the Hadith. In determining the permissibility of certain actions, including the adoption of new technologies or treatment options, it would be more practical to apply the concept of objectives and principles of the Shari‘ah.
The Maqasid (objectives) and Qawa'id (principles) Al-Shari'ah came into existence to complement the Shari'ah. The Maqasid Al-Shari'ah primarily addresses five purposes of Islamic Law that include protection of life, religion, progeny, mind and wealth. Each of these five elements has their own individual relevance in the life of a human being. From the historical perspective the formulation of the Maqasid Al-Shari'ah became prominent during the life of Imam al-Ghazali (450-505 A.H/ 1058-1111 A.D.), followed by Al-Shatibi (d. 790H). Other Muslim scholars deliberated further on the Maqasid and a sixth purpose in the protection of honour or dignity was accepted as part of the Maqasid [33]. It is important to take note that there is no consensus by the Muslim scholars on which particular purpose is of a higher priority than the rest. Due consideration is given with respect to the given scenario under question.

The ensuing discussion on the Maqasid Al-Shari'ah in the application of Tissue Engineering in degenerative disc disease is made based on Kasule [34] who outlined elements in Maqasid Al-Shari'ah in relation to Islamic medical ethics. It is felt that this alignment is justified since the application of Tissue Engineering is within the domain of healthcare.

(1) **Protection of life**

Kasule [34] reiterates that medicine cannot prevent or postpone death since such matters are in the hands of Allah alone. Medicine contributes to the preservation and continuation of life by ensuring the physiological functions are well maintained. Preventive, curative, and rehabilitative measures are taken to maintain as high a quality of life until the appointed time of death arrives. However, degenerative discs disease is not usually associated with mortality (death), but rather morbidity. This is due to the various complications of degenerative discs disease that include herniated disc, spinal stenosis or osteoarthritis. Numbness, tingling sensations in arms and legs as well as loss of bowel control can also manifest with time. In the face of these situations, achieving a higher quality of life would be a more realistic option. Continuing life in a setting where the sufferer can still sustain his attachment with the Creator is highly desirable. There would be opportunities for him to mend his undesirable behaviour, if any, a lead a better way of Islamic life. With the possibilities that Tissue Engineering have in maintaining quality of life, the concept of the Islamic Worldview where Islam values life will be fulfilled.

(2) **Protection of religion**

This section relates to the obligation of the Muslim in all religious matters, including religious rituals, in order to achieve felicity (blessedness) on Earth and in the Hereafter. Kasule [34] recognised the role of medical treatment to those religious matters by protecting and promoting good health. The principal forms of physical religious rituals are prayer, fasting, and pilgrimage. The performance of these rituals is the manifestation of a Muslim’s spiritual being in reinforcing his faith and submission to Allah through the continuous religious rituals as set out by the religion. The five times daily prayers, for example, involves movement of the body as well as a requirement to be free from bodily discharge, prior and during the ritual. Tissue Engineering can have a role in ensuring that such situations that could nullify or reduce the quality of those rituals are reduced, though not completely eliminated. Such would deem the quality of life of the sufferer in relation to his connectedness to Allah is maintained. It is to be remembered that Tissue engineering serves to restore normal structure and function of the tissues. A successful restoration could mean that the sufferer’s spirituality and religiosity can be preserved, sustained or even enhanced. On the part of those with the Tissue Engineering expertise, it should be borne in their minds that their existence and knowledge has benefitted those to remain steadfast in their religious obligations to Allah, the All-Mighty.

(3) **Protection of progeny**

Protection of progeny dwells around treatment of infertility and care to the pregnant woman and the children from birth to adulthood [34]. An area of concern with degenerative discs disease, is the possible negative implication on reproductive capacity of the sufferer. While there is no documented evidence to suggest degenerative discs disease has an influence on the reproductive capability in human, the physical inability that result from degenerative discs disease can be taken into consideration. Physical inability due to severe low back pain and the psychological disturbances associated with degenerative discs disease can affect intimacy between married couples. The reduced intimacy could have a negative effect on the sexual frequency, which eventually can result in decreased chances of bearing a child. It is hopeful that Tissue Engineering can reduce this possibility. Further research should be conducted in this area.

(4) **Protection of mind**

Kasule [34] recognised the positive impact of treatment of physical illnesses in removing stress and restoring intellectual and emotional functions. As discussed earlier, emotional upsets that include depression, anxiety, irritability and stress can be outcomes of the pain suffered in degenerative discs disease. The mental instability could result in decisions that could have disastrous effects in the future undertakings of the sufferer. With the application of Tissue Engineering with its anticipated benefits, the ability to reason could be restored and preserved since elements associated with anxiety, depression and stress has been reduced. Psychologically, the
will to persevere and the level of acceptance in an individual to a certain state of ill-health could be lifted to a new level. Protection of mind could also be achieved through the issuance of a religious decree towards the permissibility of Tissue Engineering. The permissibility when viewed from Islamic Jurisprudence can erase whatever doubts that the prospective recipient and the professionals in Tissue Engineering would have concerning the application of this technology. Going a step further, educating the prospective recipient in the permissibility of Tissue Engineering from Islamic perspectives by the professionals could cement the trust, a psychological dimension, in the recipient-professional relationship. Reducing doubts to others is a good psychological approach towards ensuring recipient’s acceptance and compliance.

(5) Protection of wealth

Economic considerations are important factors in the life of a human being. Daily sustenance, education, and a host of other necessities are depending on the availability of some financial resources. Kasule [34] attributed wealth to the productive activities of a healthy individual. Degenerative discs disease sufferers not only could face problems in their physical and psychological existence but any impairment to those aspects could influence their source of income. Reduced income or changes in job specifications at a reduced pay could result due to the debilitating condition. This inevitably could have a detrimental effect on the lifestyles of the individual and subsequently on their dependents. Other socio-economic and psychological upsets, including non-acceptance and resentment in the dependents can occur following these changes in lifestyles. The application of Tissue Engineering in degenerative discs disease would be an important contribution in the preservation of wealth in an individual. The immediate economic benefits to the sufferer may not be apparent, as the application of Tissue Engineering will require some duration of rehabilitation. However, correctly performed, the long term effects can be worth more than the immediate economic gains.

It is also recognised that degenerative discs disease is an enormous economic burden on society. Per annum, medical treatment of intervertebral degeneration reaches staggering amount of £12 billion and AUS$9 billion in UK and Australia respectively [35]. On the part of the professionals, protection of wealth can be seen in modifying or advancing the technology so as to make it cheaper and easily accessed by sufferers that come from all walks of life. Furthermore, the possibility of reducing the rehabilitation period post Tissue Engineering application can help to reduce the overall healthcare cost substantially. This by itself is a direct responsibility of those with the intellect to contribute in preserving the wealth of the masses. Bear in mind, in medical treatment, the cost of healthcare usually fails to take into consideration the associated cost that includes transportation, lodging and other subsistence when it involves sufferers who live some distance from the centre offering the Tissue Engineering technology.

Qawa’id (Principles) Al-Shari’ah

Meanwhile, the term “Principle” is defined as a fundamental truth or proposition that serves as the foundation for a system of belief or behaviour or for a chain of reasoning; fundamental source or basis of something (oxforddictionaries.com). Hence, Qawa’id Al-Shari’ah relates to the principles of Shari’ah. Kasule [36], a Professor in Medicine and an advocate in integration of Islamic perspectives in Medical curriculum, recognised five major principles as the pillars of Islamic law: intention, (qasid); certainty (yaqeem); injury (dhurar); difficulty (masaqqat) and custom or precedent (urf).

Qawa’id Al-Shari’ah or legal maxims are basically a reiteration of either the Holy Qur’aan or the Hadith, but the formulation of the, were attributed to the Hanafi jurists. They were developed gradually and the history of their development in a general sense is parallel with that of the Islamic Jurisprudence (fiqh) itself [37]. Besides the dependence on the Holy Qur’aan and Hadith, these maxims are also derived from opinions of Islamic scholars (ijtihad).

Again, it is to be understood that ijtihad is only resorted to when there exists issues that are not addressed by the Holy Qur’aan and Hadith. Contemporary issues pertaining to organ transplant, stem cells and a host of other medical interventions require contemporary Islamic scholars to provide opinions or decrees towards the acceptability of these interventions from the Islamic perspective. The application of Tissue Engineering in degenerative discs disease is no exception.

There are five legal maxims that are usually discussed with respect to issues in healthcare. Based on the works of Kasule [34] and Malik [38] concerning the individual meanings and application of the maxims, the discussions in relation to Tissue Engineering in degenerative discs disease is thus presented:

(1) Principle of intention

‘Acts are judged by the intention behind them’ (Al-umuru bi-maqsidiha). In some literature it is taken as ‘matters shall be judged by their objectives’. This maxim is seen within the context of providing relief while balancing the risks associated with Tissue Engineering. The decision to use Tissue Engineering in degenerative discs disease on a given patient shall be driven by pure and sincere intentions on the part of the professional. No other personal agendas such as
material gains, fame or other immoral actions could justify the intention. A professional who is ever-conscious of the presence and his attachment with Allah will only serve to provide relief to the sufferer. While the risks that are associated with Tissue Engineering may not be completely eliminated efforts must be made to reduce those harm through constant vigilance over the procedures. Applying the Concept of Optimisation in balancing of benefits and the possibility of side effects or further harm is another important approach.

(2) Principle of certainty

‘Certainty is not overruled by doubt’ (Al-yaqinu la yazulubish-shakk). Kasule [34] is of the opinion that Medical diagnosis cannot reach the legal standard of absolute certainty (yaqeen). While treatment decisions are based on a balance of probabilities. In other words, diagnosis and treatment decisions are fluid; what is practiced today might be found to be of less importance in the future. But based on this maxim, professionals have to ensure that any element of doubt has to be removed in order to ascertain that whatever that is being practiced has a higher probability of success and benefits. The concept of evidence-based practice is relevant to be brought into discussion.

(3) Principle of injury

‘Harm must be eliminated’ (Ad-dararuyuzal). The other version of this maxim is “harm is not eliminated by harm”. Basically this maxim addresses that the medical intervention should not create additional harm to the sufferer. In other words, the sufferer should not be subjected to another risk other the complications related to the degenerative discs disease itself. However medical interventions are mostly associated with some kind of harm, which is taken as a lesser harm. The introduction of the lesser harm serves to reduce the impact of the bigger harm that is confronting the sufferer. Hence, the lesser harm is a benefit in its essence. Kasule [34] is of the opinion that if the benefit has far more importance and worth than the injury, then the pursuit of the benefit has priority. This is parallel to the concept of ‘benefits against the risks’ as well as the concept of justification. The latter concept relies on informed decision by the professional to conclude what would be best to the sufferer under the given circumstances. The risks in the procedures related to Tissue Engineering can be reduced with the application of GMP (Good Manufacturing Practice) guidelines by National Pharmaceutical Control Bureau (NPCB) [39]. Documents related to those practices can be sourced from World Health Organisation (WHO) [40] and European Medicines Agency [41].

(4) Principle of hardship

‘Hardship begets facility’ (Al-mashaqqatatujlab at-taysir). In other literature ‘necessity makes the unlawful lawful’ (al-durarattubih al-mahzurat). Procedures that are usually not permissible (haraam) is permitted when there is a necessity (dararrah). Kasule [34] defined hardship in as any condition that will seriously impair physical and mental health if not relieved promptly. This hardship seen as a necessity [38] can give rise to a temporary legalization of prohibited action. This prohibited action ends with the end of the necessity that justified it in the first place. Committing the otherwise prohibited action should not extend beyond the limits needed to preserve the purpose of the Law that is the basis for the legalization [34].

Tissue Engineering involves the use of biomaterials that suit a particular application. These biomaterials must have the special properties meet the needs of the chosen application. The major argument in this section is the permissibility factor in using the various sources of biomaterials for the scaffolds. Fibrin is sourced from animal or human’s blood, collagen from rat tail, shark cartilage, bovine tendon and acellular tissue from porcine or bovine. It is evident that based on the principle of hardship it may be permissible to use non-permissible (non-halal) to temporary overcome the constraint in obtaining permissible sources. An analogy to this will be the permissibility to consume swine (pork) as evident in the Holy Qur’aan, Chapter 2,Verse 173 where Allah says “He hath only forbidden you dead meat, and blood, and the flesh of swine, and that on which any other name hath been invoked besides that of Allah. But if one is forced by necessity, without wilful disobedience, nor transgressing due limits, - then is he guiltless. For Allah is Oft-forgiving Most Merciful.” However, the present authors would recommend that a decree should be obtained from the relevant authorities.

(5) The principle of custom or precedent

‘Custom is the basis of judgement’ (Al-`addatumuhakakamatun). For this maxim Kasule [34] refers to the standard of medical care. It is defined by custom and has legal force. It can be seen as a practice that has some legal standing, which is accepted as customary by those in the field. This can also be seen in the establishment, implementation and enforcing accepted standards of practice unique to the field of specialisation. Accepted guidelines and the various Codes of Practice, Code of Ethics or Standards of Practice in Tissue Engineering should guide the practice in Tissue Engineering.

While it can be argued that these various documents are predominantly formulated, structured and disseminated by those who practice secularisation, they should not be readily side-lined or rejected. Bear in mind that all knowledge originates from Allah, the All-Knowledgeable as He teaches
Prophet Aadam things that the Prophet and the angels do not know. Another revelation in the Holy Qur’aan shows that the use technology also originates from Allah, when He ordered Prophet Nuh (Noah) to build the Ark, in Chapter 11, Verses 36 – 37, “It was revealed to Noah: ‘None of thy people will believe except those who have believed already! So grieve no longer over their (evil) deeds, ”But construct an Ark under Our eyes and Our inspiration, and address Me no (further) on behalf of those who are in sin: for they are about to be overwhelmed (in the Flood).”Islam only rejects knowledge that is against the concept of the Shahadah or the Islamic Worldview. Readily available knowledge should be adopted and adapted by Muslims to align them to the principles that Islam champions.

Conclusion

The discussions to relate the application of Tissue Engineering in degenerative disc disease has been presented. It is felt that the discussions could establish some foundations towards understanding of those components to Islam. The approach to examine the application of the technology from the four Islamic perspectives could have settled some concerns pertaining to the permissibility from Islamic viewpoints. However, certain areas need further consultations with the relevant religious authorities. Efforts to provide a more detailed examination of the role of Tissue Engineering in degenerative discs disease with respect to the Islamic Worldview, Islamic Jurisprudence and in the realisation of Maqasid and Qawa’id Al-Shari’ah should be intensified.

References


26. SahihBukhari. Volume 8, Book 76, Number 425

27. SahihBukhari. Volume 8, Book 76, Number 421

28. SahihBukhari. Volume 7, Book 70, Number 544


