A STUDY ON THE MANAGEMENT OF HYPERPIGMENTATION IN SKIN TYPES IV TO VI AT AESTHETICS CLINICS IN ETHEKWINI, KWAZULU-NATAL

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PREFACE

This study represents original work by the author and has not been submitted in any other form to another university. Where use was made of the work of others, it has been duly acknowledged in the text. The research described in this dissertation was carried out in the Department of Somatology, Faculty of Health Sciences at the Durban University of Technology in Durban, South Africa, under the supervision of Dr S. Ghuman.

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DECLARATION OF AUTHORSHIP

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Date

DEDICATION

This dissertation is dedicated to my family and most importantly, my late grandmother, Elizabeth - for the continued guidance, support and encouragement to obtain my qualification and to always work to the best of my ability.

I thank God, the Father Almighty, for getting me through these years to obtain my qualification and giving me the strength to persevere.

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- The participants that took part in my research.

ABSTRACT

Hyperpigmentation is a skin disorder caused by the increase of melanin production in the skin, caused by different internal (e.g. hormones) and external (e.g. UV exposure) stimuli. Different types of hyperpigmentation, namely melasma, post-inflammatory hyperpigmentation and solar lentigines, may be found amongst individuals. Persons with darker skin tones (greater melanin production) are more susceptible to hyperpigmentation due to their melanocytes being slightly larger and easily triggered by internal and external stimuli, compared to individuals with the skin type I-III. In relation to the treatment of hyperpigmentation in skin of colour, extra precautions should be taken due to the skin being easily irritated, resulting in the increase of pigmentation as a mechanism of the skin protecting itself from further damage. Therefore, professional treatments would include micro-needling and gentle chemical peels, which have been explored in this study during treatment, in addition to tyrosinase inhibitors which were used during treatments, as well as a home supportive treatment regime. With the use of an appropriate treatment plan and home-care regime, the individual noticed improvement in their skin with reduced pigmentation, an evened-out skin tone and reduced fine lines and wrinkles as an additional benefit. The tool used for data analysis was a semi-structured questionnaire and open-ended statements. Questions were developed by the researcher in line with the objectives employed to gather qualitative data. The questions were based on the hyperpigmentation typologies, current skin treatment, as well as homecare. These were distributed to the participants to complete during Phase (1), and Phase (2) entailed the researcher conducting the qualitative component. The study was conducted within eThekwini, in KwaZulu-Natal. The study constituted 30 participants who were undergoing hyperpigmentation management programs, who consented to participate in the study. Census sampling was implemented as every participant's responses were utilised during data collection and analysis. The study explored the different hyperpigmentation treatment approaches that were offered to individuals with Fitzpatrick Skin Types IV to VI. The treatment approaches proved to be a success as participants were satisfied with their results. The participants did point out that it is a gradual process that needs patience from the professional as well as from the individual that is on the journey.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

TERMINOLOGY

Chemo-exfoliation: also known as chemical peels, this process allows for exfoliation to occur on the skin. This treatment may affect the epidermis as well as the dermis and targets the problem area. The treatment allows for epidermal turnover as well as decreasing epidermal and dermal pigmentation, resulting in improved skin texture and a brighter and even skin tone (Bard, 2021).

Fitzpatrick Scale: was and has been typically utilized in Dermatology mainly to determine the skin's reaction towards UV exposure. The tool ranges from Photo Type I to Photo Type VI, and is utilised by dermatologists and skincare therapists during skin treatment approaches, as well as treatment and product recommendations (Banfield *et al*. 2021).

Hyperpigmentation: is caused by the increase of melanin production in the skin. It is brought on by different internal (e.g. hormones) and external (e.g. UV exposure) stimuli. Different types of hyperpigmentation such as melasma, post-inflammatory hyperpigmentation and solar lentigines may be found within individuals.

Melasma: is a form of hyperpigmentation where the skin appears with symmetrical, blotchy, uneven skin tone, as well has having irregular borders on the discoloured areas of the face (Sarkar, 2014: 5).

Melanogenesis: This is a crucial process for melanin deposition in distributing pigment within the skin (Lambert *et al.* 2019: 37).

Mesotherapy: a non-invasive as well as non-surgical form of micro-needling whereby it increases the permeability of the stratum corneum by small, superficial micro injections so that the active ingredients from the skin care product or agent work on the targeted, problem area (Stieber, J. 2020).

Micro-needling: is also known as Collagen Induction Therapy (CIT), a form of treatment in which a device is used that creates micro channels in the skin without causing controlled wound healing. It allows for active ingredients from products to penetrate effectively as well as deeper into the skin, allowing for results to be achieved faster (Singh *et al*. 2016: 7).

Post-Inflammatory Hyperpigmentation: occurs in individuals who are prone to acne breakouts, eczema as well as psoriasis. This form of hyperpigmentation occurs following cutaneous inflammation from acne, eczema, psoriasis as well as invasive aesthetic treatments, resulting in darkened lesions on the skin creating an uneven skin tone and sometimes scarring (Kaufman, 2018: 19).

Solar Lentigines: are brown, flat lesions found on the areas on the body that are highly exposed to the sun frequently, such as the face, shoulders as well as the back of the hands. This is a delayed-type hyperpigmentation as it shows up later in an individual's life (Nakamura, 2015: 24).

Somatologist: is a person who is interested in assisting others in improving their general wellness and aesthetic appearance through information and the practice of healthy lifestyle habits, product use and clinic treatments. The therapist activities include treatments such as massage, reflexology, aromatherapy, electro-therapy, hydrotherapy, exercise, nutritional guidance, hand, foot, facial care, epilation and electrolysis treatments (Durban University of Technology, 2013).

Somatology: addresses an individual's overall health, well-being and appearance in a holistic manner (Isa Carstens, 2019).

SPF: Sun Protection Factor.

Tyrosinase: an enzyme responsible for the production of melanin.

Tyrosinase Inhibitors: are used to aid in the reduction of hyperpigmentation in the skin.

ABBREVIATIONS AND ACRONYMS

AHA – Alpha Hydroxy Acids

BHA – Beta Hydroxy Acids

CIT – Collagen Induction Therapy

DT – Delayed Tanning

FGF – Fibroblast Growth Factor

IPD – Immediate Pigment Darkening

IV – Four

PIH – Post-Inflammatory Hyperpigmentation

PPD – Persistent Pigment Darkening

PRP – Platelet Rich Plasma

SPF – Sun Protection Factor

TCA - Trichloroacetic Acid

UV – Ultraviolet

UVA – Ultraviolet A, longer wavelength

UVB – Ultraviolet B, shorter wavelength

UVR – Ultraviolet Radiation

VI – Six

CHAPTER ONE

INTRODUCTION

1.1 INTRODUCTION

This chapter provides an insight and a brief overview of the research conducted, which consists of the rationale, the scope of practice, aims and objectives.

1.2 BACKGROUND TO THE STUDY

Hyperpigmentation is a common skin disorder on all skin types and photo-types, and different types of hyperpigmentation can be found on the human tissue, namely:

Localised hyperpigmentation, also referred to as post-inflammatory hyperpigmentation (PIH), may be found on only one or some areas of the face of the individual. This is referred to as post- inflammatory hyperpigmentation (PIH), which occurs after an injury to the skin, breakout or from an inflammatory disorder such as psoriasis and eczema. Another cause of localised hyperpigmentation may be from melasma, which manifests from hormonal changes in most cases (Desai, 2014: 7), as well as solar lentigines from excessive sun exposure without a broad sun protection factor. Diffuse hyperpigmentation tends to be more complex as it is caused by metabolic causes, autoimmune or infectious diseases, as well as certain medication (Desai, 2014: 7). Desai (2014: 7) acknowledges that hyperpigmentation cases are more prominent on individuals who are categorised under the Fitzpatrick scale skin types IV to VI. In South Africa, there are 79.4% Black Africans, 8.8% Coloureds and 2.6% Indians or Asians (Statistics South Africa. 2021), but there are no accessible statistics on pigmentary disorders. “Little is known about the spectrum of pigmentary disorders in South Africa’s second largest province, Kwa-Zulu Natal” (Dlova, 2019: 5). Some suitable professional skincare treatment options are as follows: chemical peels with the use of glycolic acid, mandelic acid, salicylic acid, trichloroacetic acid (TCA) peels and Jessner peels in lower percentages to avoid irritating and/or burning of the skin (Rattan, 2020). Products containing tyrosinase inhibitors, retinol (vitamin A), L-ascorbic acid (pure vitamin C), arbutin, kojic acid, glutathione and N-Acetyl Glucosamine in appropriate quantities could be used to treat hyperpigmentation as well as to limit melanin production for a more even-toned skin appearance (Rattan, 2020). Micro-needling as well as meso-therapy can be implemented to allow for the active ingredients found in the product to work deeper in the skin, as well as aiding to systemically break down the hyperpigmentation bonds with persistent hyperpigmentation disorders.

A broad-spectrum sun protection factor with SPF50 protecting the skin from UVA and UVB rays was advised as the skin would be more sensitive to UV rays when on the mentioned ingredients, as well as to prevent the exacerbation of hyperpigmentation (Nazarian, 2020). The focus for this research study was to educate the Somatologist on how to determine the process of hyperpigmentation and its impact on individuals that categorised under the Fitzpatrick scale of IV to VI, as well as to implement treatment options to treat hyperpigmentation effectively, as it is beneficial to the Somatology scope of practice, which is evolving continuously and improving by incorporating different modalities to meet the client's needs.

1.3 RATIONALE

When it comes to the treatment of hyperpigmentation, it is imperative to find the cause, how long the individual has been experiencing adverse effects from hyperpigmentation, as well as their current homecare treatment to aid and treat hyperpigmentation, before conducting a professional as well as homecare hyperpigmentation management program. Treating hyperpigmentation on skin types IV to VI may become slightly intricate as opposed to skin types I to III as the proposed treatment methods may be too invasive (which worsens the hyperpigmentation together with compromising cutaneous integrity), otherwise the proposed treatment under-performs and does not deliver the desired treatment outcome on the individual's skin. According to Rattan (2020), when it comes to the treatment of hyperpigmentation in skins of colour, extra precaution should be taken due to the skin being easily irritated, resulting in the increase of pigmentation as the skin is trying to protect itself from further damage. Therefore, professional treatments included micro-needling, superficial as well as medium-depth chemical peels were used during treatment in addition to tyrosinase inhibitors as well as at home. With the use of an appropriate treatment plan and homecare regime, the individual may notice improvement in their skin with reduced pigmentation, an evened-out skin tone and reduced fine lines and wrinkles as an added benefit (Rattan, 2020).

1.4 RESEARCH PROBLEM

Currently, information related to hyperpigmentation treatment is sparse with less information and data available on individuals with skin types IV to VI affected by hyperpigmentation within South Africa. The rationale behind conducting this study is to highlight the suitable, yet effective treatment approaches for Fitzpatrick scale IV to VI skin types to obtain desired effects safely and effectively when treating different skin types and their challenges observed.

1.5 RESEARCH AIM AND OBJECTIVES

1.5.1 Aim of the study

The aim of the study is to assess the safety and efficacy of the treatment regimen in managing hyperpigmentation, particularly in Fitzpatrick skin types IV to VI.

Objectives

i. To identify the main typologies of hyperpigmentation that affect Fitzpatrick skin types IV to VI;

ii. To determine suitable and effective treatment options for skins that categorised under Fitzpatrick skin type of IV to VI and explore different chemical peel types and evaluate different strengths that could be used with the addition of the micro-needling technique; and

iii. To determine whether the hyperpigmentation management program and corresponding homecare was advised/provided to the participant.

1.6 OUTLINE OF RESEARCH PROJECT CHAPTERS

Chapter 1 – Introduction

Chapter 1 provides a brief overview of the research conducted, which includes the rationale, the scope of practice, aims and objectives.

Chapter 2 - Literature Review

This chapter reviews literature explaining in depth Fitzpatrick scale types IV to VI skin types, different hyperpigmentation types that affect these skin types, and the different treatment approaches and benefits.

Chapter 3 – Methodology

The methodology chapter provides the comprehensive processes. In addition, the chapter discusses the research approach, sampling and the tool used to gather and evaluate the data obtained.

Chapter 4 - Results

The chapter presents the research findings as well as data analysis interpretation.

Chapter 5 - Discussion

This chapter presents the study's findings and discussions.

Chapter 6 - Conclusions and Recommendations

The chapter provides the conclusions of the study as well as recommendations for further studies to be conducted.

1.7 LIMITATIONS

- In terms of ethical considerations, participants participated on a voluntary basis and could withdraw from the study at any time.
- Clinics may not allow the researcher to review patient/client files due to confidentiality.

1.8 CONCLUSION

This chapter of the study provided information on the introduction, background, rationale, aim and objectives, outline and conclusion. The following chapter provides a literature review of relevant information on the topic under study.

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter provides an in-depth literature review explaining the Fitzpatrick scale type IV to VI skin types, different hyperpigmentation types that affect these skin types, the different treatment approaches and benefits.

2.2 INTRODUCTION TO THE SKIN

The human skin is the largest organ found on the body (Byrd, 2018: 16). The skin's main functions are:

- To act as a physical barrier to protect the body from foreign pathogens, UV radiation as well as dehydration.
- To maintain thermoregulation
- Sensation.

Figure 2.1 provides a cross-section of the skin where the skin, being the epidermis, is made up of different layers. The epidermis, which comprises the stratum corneum, stratum lucidum, stratum granulosum, stratum spinosum, stratum basale and the dermis, is found beneath the five epidermal layers. Each layer consists of different organelles that play important parts in the skin's function (Lawson, 2019: 115).

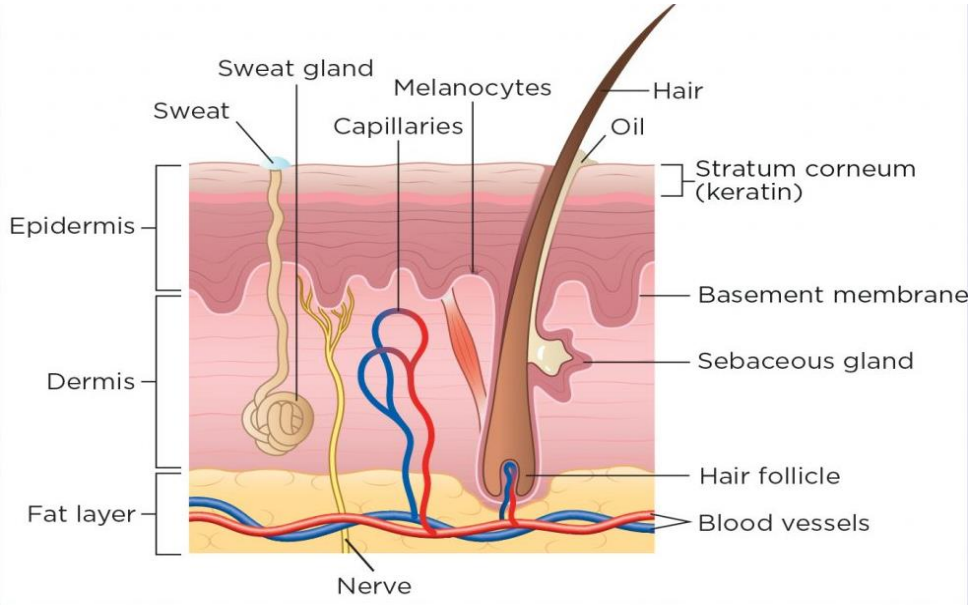

Figure 2.1: A Cross-section through the Skin (Lawson, 2019)

2.2.1 Melanin distribution and deposition in the skin

The pigmentation of the epidermis is dependent on the production as well as the deposition of the pigment known as melanin within the epidermis by organelles known to be melanocytes. The pigment melanin is a multifaceted biopolymer which is fashioned within specialised organelles known as melanosomes, which are located in the melanocytes (Lambert *et al.* 2019: 37). Melanin deposition (Figure 2.2) takes place in all skins, except for individuals who suffer from skin conditions such as albinism as well as vitiligo, whereby the skin is unable to produce melanin in the latter skin conditions. *The physiology of melanin deposition in health and disease* (Lambert *et al.* 2019: 37) stated that during the melanin deposition process, there are crucial emphasized steps when it comes to the distribution of melanin within the epidermis, as shown below.

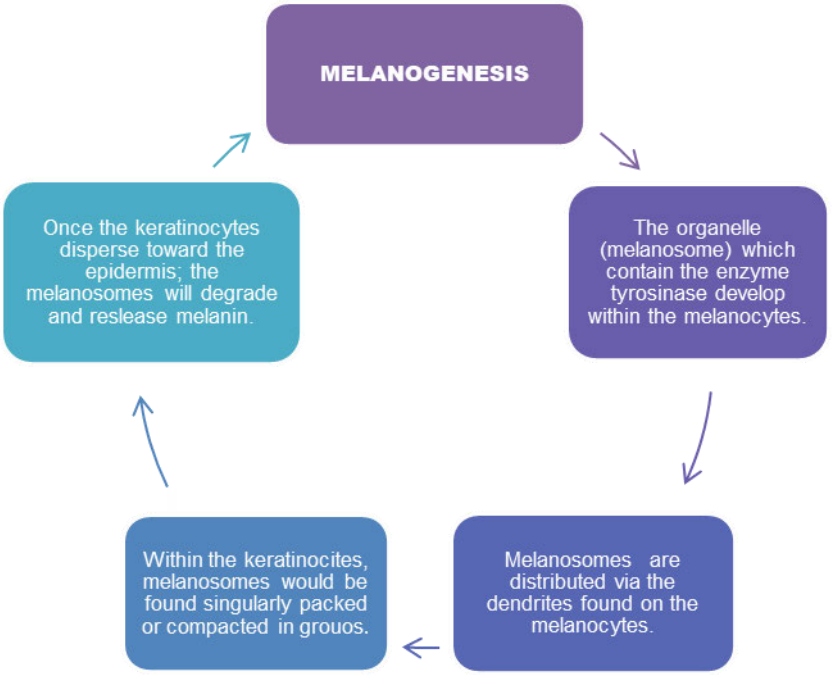

Figure 2.2: Melanogenesis Process

Melanogenesis is a crucial process for melanin deposition in distributing pigment within the skin. However, the melanogenesis process may be predisposed as well as impacted by hormones, genetics and environmental predispositions whereby all these factors are responsible for the melanin distribution in human skin, which could result in hypo or hyperpigmentation (Lambert *et al.* 2019: 37). Melanin provides the skin and hair with colour, along with added benefits such as photo protection against harmful UVR (Ultraviolet Radiation) from the sun which can lead to skin cancer when the skin is constantly being exposed to sun rays without a broad-spectrum SPF (Sun Protection Factor) (Fajuyigbe *et al*. 2016: 29). In relation to UV-induced hyperpigmentation, the following is known to occur: UVR-induced melanogenesis, also referred to as tanning, is the skin's response to UVR exposure. It is categorised into three types, namely:

- Immediate Pigment Darkening (IPD);
- Persistent Pigment Darkening (PPD); and
- Delayed Tanning (DT).

Immediate Pigment Darkening (IPD) presents as a grey-brownish colour which occurs immediately after UVA exposure, lasts for a maximum of two hours and then can fade to leave long-lasting PPD at exposures ≥10 J/cm2UVA.These changes are thought to be the consequence of the re-distribution, oxidation and polymerization of pre-existing pigmentation, but neo-melanogenesis may also be involved. Delayed Tanning (DT) is associated with increased melanocyte activity and proliferation" (Fajuyigbe *et al*. 2016). A pigment that is dark brown to black, known as eumelanin, is greatly responsible for providing the human skin with its natural photo-type. Eumelanin is localised within the melanosomes, which are also found within melanocytes in the basal layer of the epidermis. The human epidermis is differentiated in various skin photo types, which are grouped within the Fitzpatrick Scale. The Fitzpatrick Scale was developed by an American dermatologist, Thomas B. Fitzpatrick, in 1975. The Fitzpatrick Scale (Figure 2.3) is greatly utilised in Dermatology mainly to determine the skin's reaction towards UV exposure. Figure 2.3 ranges from Photo Type I to Photo Type VI and is mostly used by dermatologists and skincare therapists during skin treatment approaches as well as treatment and product recommendations (Banfield *et al*, 2021).

Skin type	Image	Ethnic group	Hair colour	Colour of eyes	Skin colour	Tanning ability
Type 1		Albinos, same redheads	red, blond	blue, grey, green	very pale white, pale white with freckles	Burns very easily, never tans
Type 2		People of northern European origin, such as Scandinavians or Celts	blond, red, light brown	blue, grey, green, hazel	pale white	Burns easily, rarely tans
Type 3		People of Mediterranean and Middle East origin	chestnut, dark blond	brown, blue, grey, green, hazel	white, light brown	Sometimes burns, gradually tans
Type 4		People of East Asian origin, such as Chinese, Japanese and some Indians and Pakistanis	brown, medium brown, dark brown	hazel, brown	medium brown, dark brown	Hardly ever burns, tans very easily
Type 5		People of African origin, South East Asians and some Indians, Pakistanis and Latin	dark brown	brown	dark brown	Really burns, tans easily and quickly
Type 6		People with blue-black skin of African origin, Aborigines and dark-skinned Asians such as Tamils	black	brown	black	Never burns, tans very dark

Figure 2.3: The Fitzpatrick Scale Chart (Zielinska-Dabkowska, 2014)

Individuals categorised as photo type IV to VI are “Skin of Colour” individuals. According to Taylor *et al* (2016), “The term *skin of colour* identifies individuals of particular racial and ethnic groups who share similar cutaneous characteristics and disorders, as well as reaction patterns to those disorders. In general, these individuals have darker skin hues”. These individuals have unique skin disorders, reaction patterns, cutaneous as well as hair characteristics. Additionally, considering as well as understanding structural and functional skin difference inspires researchers to research extensively on the aetiology of disease and therapeutic interventions (Iwuala *et al,* 2021: 47).

2.3 PATHOPHYSIOLOGY OF HYPERPIGMENTATION

Melanocytes are specialised cells found in the skin, hair and eyes which are responsible for producing melanin. These cells are found within the stratum basale layer of the skin amongst the keratinocytes (Lawson, 2019: 115). Melanin is produced by epidermal melanocytes through a process of enzymatic oxidation of tyrosinase, a process also recognised as melanogenesis (Nayek *et a,.* 2016: 61). Hyperpigmentation (Figure 2.4) is caused by the increase of melanin production in the skin brought on by different internal (e.g. hormones) and external (e.g. UV exposure) stimuli (Hollinger *et al,* 2018: 11). Kramer (2019) and Harth (2020) state that there are different types of hyperpigmentation, such as melasma, post-inflammatory hyperpigmentation and solar lentigines.

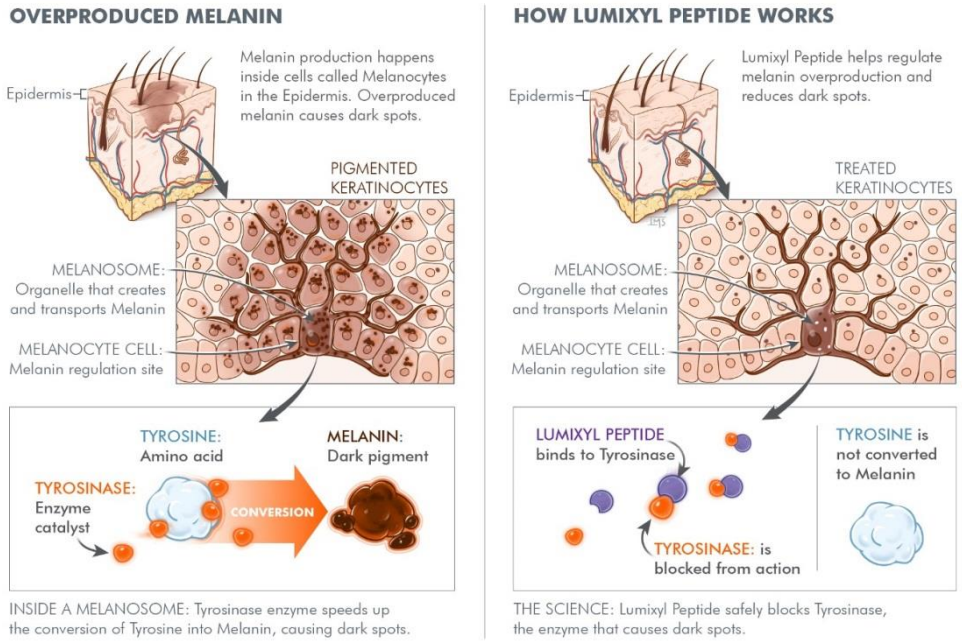

Figure 2.4: Can you really get rid of dark spots? (Envy Medical, 2019)

According to Nouveau *et al.* (2016: 61), hyperpigmentation in the skin is becoming one of the most reported dermatological skin concerns amongst individuals with highly pigmented skin

photo types (skin types IV to VI). Individuals with skin of colour are generally categorised as Fitzpatrick types IV-VI and belong mainly to the African, Asian, Hispanic, Indian as well as Middle Eastern groups. These individuals are commonly susceptible to hyperpigmentation (greater melanin production) due to their melanocytes being slightly larger and easily triggered by internal and external stimuli, compared to individuals with the skin type I-III (Perkins. 2020).

Skins with a darker photo type are known to have a higher eumelanin to pheomelanin ratio, alongside having higher melanin disposition (Vashi *et al.*, 2013).

“Melanocytes responsible for the tegument colour in skin is produced embryonically from neural crest cells. These are melanosome-producing cells present in the basal layer at the dermal and epidermal junction (Duval *et al.*, 2014). Melanosomes are intracellular, lysosome-like organelles that host the production and storage of skin pigments like melanin. These pigments are further distributed to the neighbouring keratinocytes, thus providing the skin with its colour (Yamaguchi and Hearing, 2009). The amino acid L-Tyrosine acts as the precursor for melanin biosynthesis and produces melanin through various spontaneous enzymatic reactions, also known as the Raper Mason pathway. The melanogenesis pathway depicted in Figure 2.5 occurs within a melanosome leading to the production of black–brown Eumelanin and/or the yellow–red Pheomelanin. L-Tyrosine increases melanosome production and L-Dopachrome increases tyrosinase activity. Thus, regulating the L-Tyrosine and L-DOPA levels plays a major role in homeostasis of melanogenic systems (Yamaguchi and Hearing, 2009).

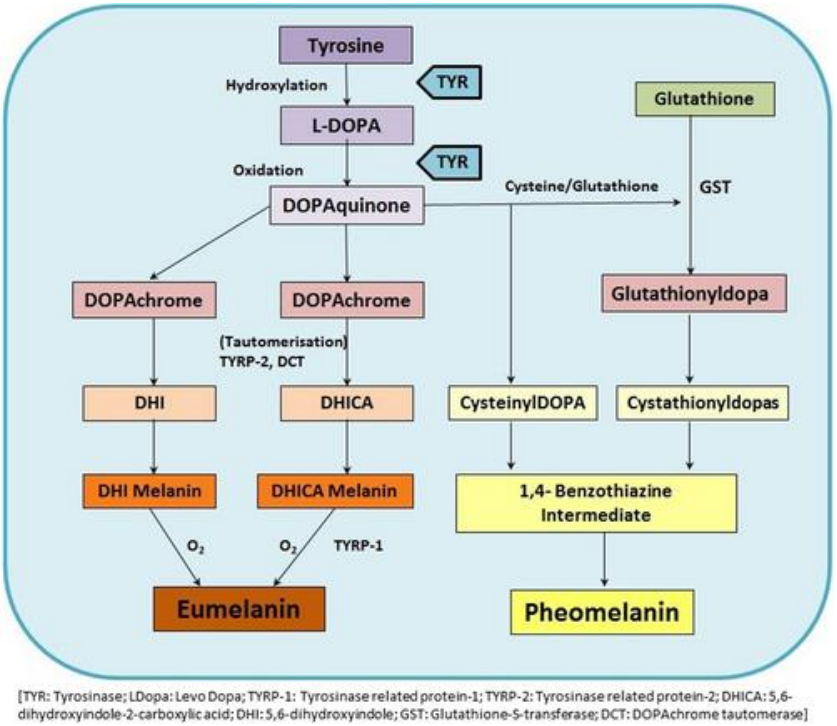

Figure 2.5: The melanogenesis pathway (Yamaguchi, 2009)

Tyrosinase, a glycoprotein (60–70 kDa), contains copper and acts as the rate-limiting enzyme of the melanin biosynthesis pathway, and is therefore considered as a potential target for several therapeutic agents. The tyrosinase TYRP-1 and TYRP-2 enzymes involved in melanogenesis are regulated by the master transcription factor known as the microphthalmia transcription factor (MITF). The α-melanocyte-stimulating hormone (α-MSH) and the adrenocorticotropic hormone (ACTH) are present in the epidermis and dermis and act as major regulators of the melanogenesis pathway. Melanosomes undergo degradation differently in diverse skin types during the keratinocyte differentiation process. These intracellular organelles either reach the outermost epidermal layers intact, as seen in darker skin, or form melanin dust as in fairer skin types. (Yamaguchi and Hearing, 2009).The vast variations in skin colour and complexions seen in humans are thus a result of these complex processes (D'Mello *et al*., 2016). Various factors, intrinsic or extrinsic, can be responsible for disrupting the normal melanogenesis process and result in many hyperpigmentation disorders. Signals and factors such as UV, cAMP and IL1 can enhance and regulate the pro-opiomelanocortin (POMC) peptides, which act as precursors of alpha-MSH (Duval *et al*., 2014). Upon UV exposure, melanosomes are distributed to the surrounding keratinocytes and the upper epidermis for DNA photoprotection.

The process results in the apoptosis of melanin-containing keratinocytes in the upper epidermis to prevent cell growth with unrepaired DNA damage. Keratinocytes further release several growth factors such as alpha-MSH and Endothelin-1 (ET-1), and aid in UV-induced hyperpigmentation (Eichner *et al*., 2014; Yamaguchi and Hearing, 2009). Various intrinsic factors involved in hyperpigmentation include signals from fibroblasts, endothelial cells, keratinocytes, several hormones, inflammatory cells, and the nervous system. These cells may release ET-1 and NO (Nitric oxide) which potentiate melanogenesis (Yamaguchi and Hearing, 2009). Inflammation brings about an increase in the release of arachidonate-related chemical mediators such as PGs (PGE2, PGF2a), leukotrienes (LTC4, LTD4) and thromboxanes, which are known to enhance tyrosinase activity. Additionally, muscarinic and alpha and beta oestrogen receptors have been found to be involved in adenyl cyclase and cAMP production. The elevated estrogen levels in pregnancy can thus contribute to hyperpigmentation disorders such as melasma and areolar hyperpigmentation (Eichner et al., 2014; Nautiyal *et al*., 2021: 34). The skin condition hyperpigmentation is a broad and widely used term to define the skin's ability to produce more melanin than usual, resulting in different types of pigmentation such as melasma, Post-Inflammatory Hyperpigmentation (PIH), Solar lentigines, maturational dyschromia, periorbital hyperpigmentation as well as Riehl melanosisThere is currently an increasing demand for the recognition of ethnic dermatology due to underrepresentation amongst skins of colour, especially since hyperpigmentation affects skins of colour more frequently.

2.3.1 Melasma

Melasma is a form of hyperpigmentation where the skin appears as symmetrical, blotchy, uneven skin tone, as well has having irregular borders on the discoloured areas of the face (Sarkar, 2014: 5) Melasma is commonly found on the malar and mandibular areas of the face (Figure 2.6.) The significant causes of this condition are hormones, pregnancy genetic predisposition, sun exposure, certain medications (e.g. contraceptive pill), as well as invasive aesthetic procedures (Sarkar, 2014: 5). Nautiyal *et al.,* (2021: 34) state that the histopathological features of melasma include epidermal thinning and rete ridge flattening. Increased melanin content in both the epidermis and dermis and mild perivascular lymphohistiocytic infiltrate is observed here. Immunohistochemistry analysis suggests enlarged melanocytes with prominent dendrites, a larger number of dermal melanophages, and their melanin deposition (Nautiyal *et al*., 2021:34).

Electron microscopy studies reported increased melanosomes in the melanocytes and keratinocytes. However, the exact pathological process of melasma remains unknown, although it is hypothesized that it may be due to an elevated amount of biologically active melanocytes within the affected areas.

Melasma is categorised in two different forms, subject to where the melanin is located within the epidermis. Within the epidermal layer of the skin, a brown hue pigment with well-defined borders is observed, while in the dermal layer, a grey-brown hue pigment with poorly defined borders is notable. Mixed type melasma is when melanin is localized in the epidermis layer as well as the dermis layer, and when it becomes too difficult to classify the type of melasma present on the skin, then it would be classified as an indeterminate type of melasma.

Common treatment for melasma involves the following treatment regimen: a broad-spectrum sun protection factor (SPF) and topical tyrosinase inhibiting agents, and should there be very little improvement, chemical peels could be considered as a second line of therapy (Vashi *et al*. 2019: 169).

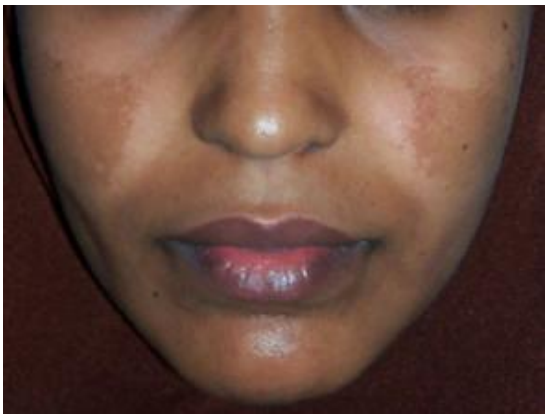

Figure 2.6 Melasma (Oakley, 2020)

2.3.2 Post-Inflammatory Hyperpigmentation (PIH)

Post-Inflammatory Hyperpigmentation (PIH) commonly occurs in individuals who are prone to acne breakouts, eczema as well as psoriasis. This form of hyperpigmentation (Figure 2.7) occurs following cutaneous inflammation from acne, eczema, psoriasis as well as invasive aesthetic treatments; resulting in darkened lesions on the skin creating an uneven skin tone and sometimes scarring (Kaufman, 2018: 19). Nautiyal *et al.* (2021: 34) as depicted in Figure 2.7 state that within PIH mainly, increased epidermal melanin content is observed in the lymphocytes surrounding blood vessels in dermal papilla and dermal melanophages.

Perifollicular, perivascular lymphocytic infiltration and dermal fibrosis can also be observed with the increased expression of several markers such as [CD]-68, c-kit and MMP-2 emphasizing the role of skin inflammation. Two histopathological patterns of PIH can be distinguished as epidermal type and dermal type. In prior, increased melanogenesis, melanin deposition in the epidermis is observed, whereas the latter is characterized by enhanced pigment deposition in the dermis in spite of enhanced melanogenic activity in the epidermis.

Post-inflammatory transitions may take place within the epidermal layer as well as the dermal layer of the skin. Within the epidermal layer hyperpigmentation occurs when there is a surge of the production of melanin where it is then transferred to neighbouring keratinocytes, within the dermal layer an impaired basement membrane allows melanin to seep into the dermis where it is phagocytosed by the melanophages present in the dermis. Melanophages migrate towards the epidermis to continue to phagocytose melanosomes then deposit back into the dermal layer of the skin. Melanin present within the melanophages may persist for years and are difficult to treat. Treatment approaches involve tyrosinase inhibiting agents as well as careful use of chemical peel. Treatments should be monitored in order not to exacerbate the PIH (Vashi *et al*. 2019: 169).

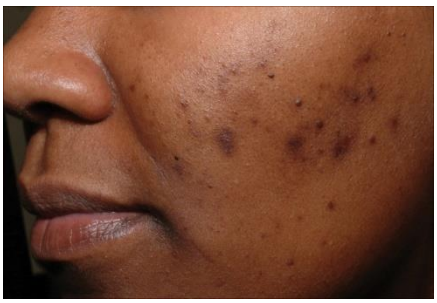

Figure 2.7: Approach to the Treatment of Medical and Cosmetic Facial Concerns in Skin of Colour Patients in Collaboration with the Skin of Colour Society (Callender, 2020)

2.3.3 Solar Lentigines

Solar lentigines are brown, flat lesions found on the areas on the body that are highly exposed to the sun frequently, such as the face, shoulders as well as the back of the hands, as depicted in (Figure 2.8). This is a delayed-type hyperpigmentation as they show up later in an individual's life (Nakamura, 2015: 24).

Treatment approaches are a broad-spectrum sun protection factor (SPF), chemical peels as well as topical tyrosinase inhibiting agents.

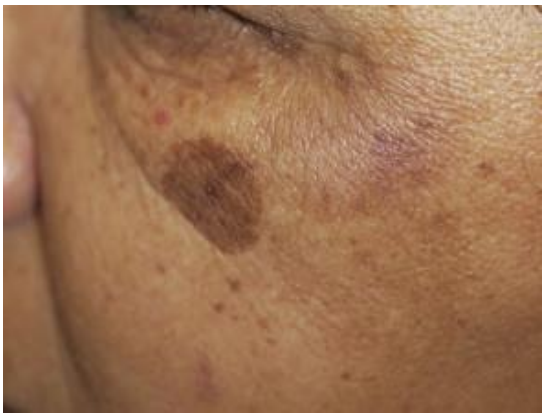

Figure 2.8: Solar Lentigo (Chan, 2014)

2.3.4 Exogenous Ochronosis

Exogenous Ochronosis (Figure 2.9) is a form of hyperpigmentation that is not genetically inherited as it occurs within the dermal layer of the skin. It develops when foreign affluences cause the enzyme known as homogentistic acid to be transferred into the dermal layer, resulting in macular as well as papular hyperpigmentation. On the skin, ochronosis shows up as a glossy, blue - black hue, which denotes the deposition of a polymerized enzyme homogentistic acid within the structures of the dermis that contain collagen. This type of hyperpigmentation is a rare occurrence that can be located on the face, the back, the lateral as well as the posterior neck. Clinically and histologically, Exogenous Ochronosis is comparable to Endogenous Ochronosis (Alkaptonuria). The cause of this skin disorder is the use of harmful products that are banned from numerous countries but which still find their way into the black market. These topical products contain high amounts of hydroquinone, mercury, phenol, resorcinol as well as picric acid. In relation to the treatment approaches of Exogenous Ochronosis, treating this condition proves to be difficult, but it can be improved with glycolic acid peels, micro-dermabrasion as well as carbon dioxide laser (Vashi *et al*. 2019: 169).

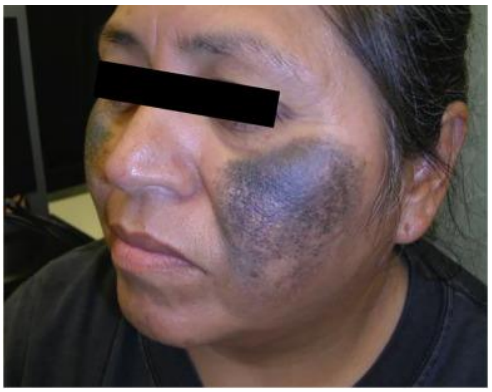

Figure 2.9: The colour of skin- black diseases of the skin, nails and mucosa (Connie, 2019)

2.3.5 Acanthosis Nigricans

Acanthosis nigricans, depicted in (Figure 2.10), are localised on the intertriginous areas of the body, such as the groin, inner thighs, as well as posterior neck. This form of hyperpigmentation appears as hyperpigmented blotches that are velvety to the touch and are a result of obesity as well as insulin resistance. According to Kudu *et al.* (2013: 169), treatment approaches would entail mainly topical agents that consist of a broad-spectrum sun protection factor (SPF), urea, salicylic acid as well as keratolytics, which are the following: topical tretinoin 0.05% and ammonium lactate 12% cream. Triple combination depigmenting cream includes the following: tretinoin 0.05%, hydroquinone 4% and flucinolone acetonide 0.01%.

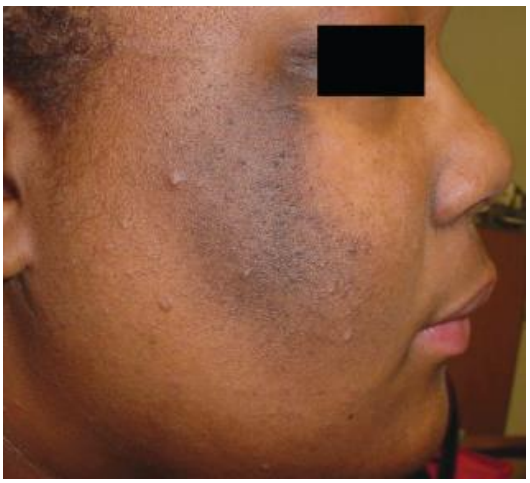

Figure 2.10: Facial Acanthosis Nigricans (Click, 2011)

2.4 HYPERPIGMENTATION TREATMENT APPROACHES

In terms of the treatment of hyperpigmentation, it is imperative to find the cause before conducting a hyperpigmentation management program. Treating hyperpigmentation on skin types IV to VI may become slightly intricate as opposed to skin types I to III. The proposed treatment methods may be too invasive (which worsens the hyperpigmentation, together with compromising cutaneous integrity), or the proposed treatment under-performs and does not deliver the desired treatment outcome. According to Rattan (2020), in relation to the treatment of hyperpigmentation in skins of colour, extra precaution should be taken due to the skin being easily irritated, resulting in the increase of pigmentation as the skin is trying to protect itself from further damage. Therefore, professional treatments would include micro-needling, and gentle chemical peels will be used during treatment in addition to tyrosinase inhibitors, which will be used during treatments as well as at home. With the use of an appropriate treatment plan and home care regime, the individual could notice improvement in their skin with reduced pigmentation, an evened-out skin tone, and reduced fine lines and wrinkles as a bonus (Rattan, 2020). “The potential targets for the depigmenting and hyperpigmentation control agents include various cell receptor antagonists, inhibitors of melanocyte stimulation, tyrosinase enzyme inhibitors, inhibitors of melanosome transfer, and degraders of formed melanin in keratinocytes, as described in Figure 2.11 The widely targeted approach includes the inhibition of tyrosinase, a most important rate-limiting enzyme of the melanogenesis pathway” (Nautiyal *et al*., 2021: 34).

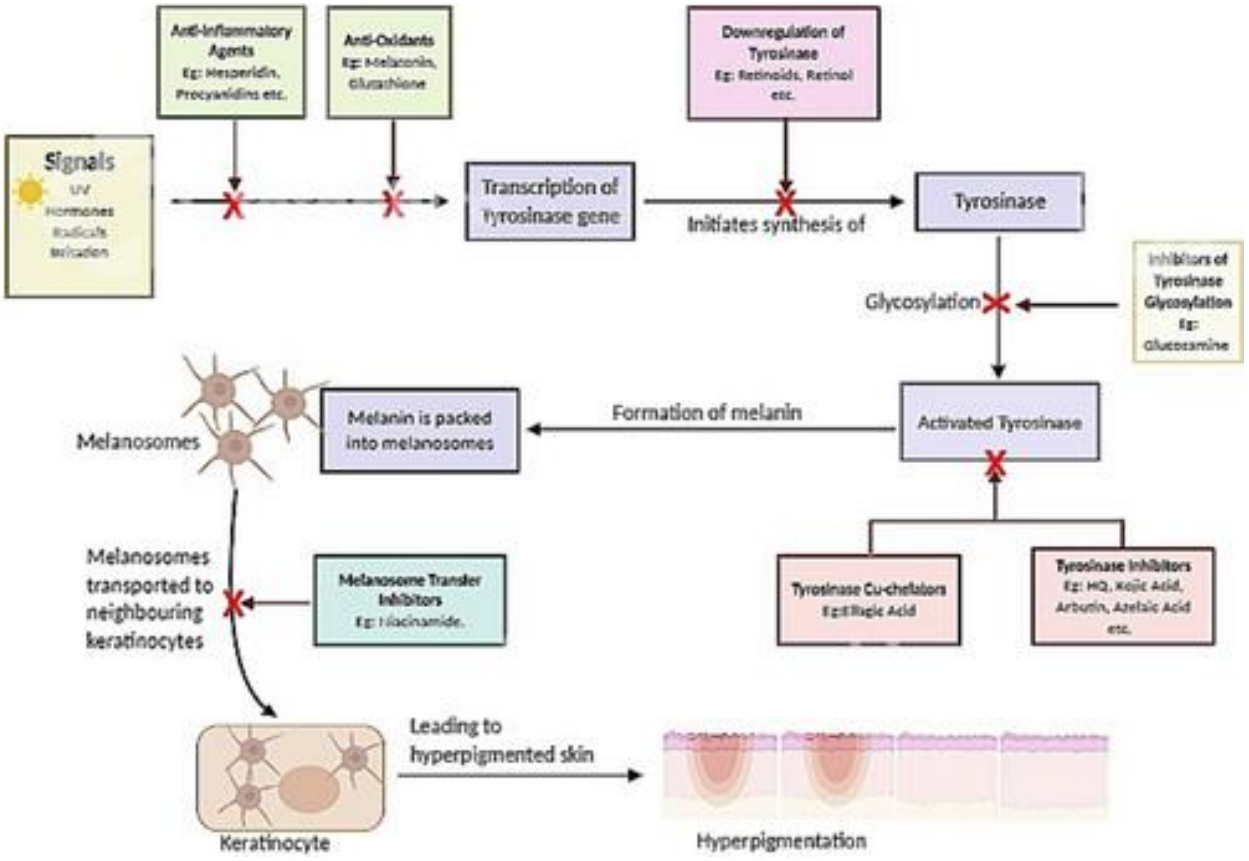

Figure 2.11: Process of Hyperpigmentation (Nautiyal, 2021).

In some cases, with hyperpigmentation treatment approaches, the results may be slow. There may also be poor compliance from the individual that is being treated as the melanin synthesis pathway has proven to be an intricate process which consists of different as well as multiple steps. For effective results, different topical agents would have to be used in combination with each other in most cases. Two most significant treatment approaches are followed when treating hyperpigmentation, as discussed below.

2.4.1 The First Line of Treatment for Hyperpigmentation

During the first line of treatment for hyperpigmentation, the individual would be advised on topical as well as oral agents, which are tyrosinase inhibitors that slow down and stop the excess formation of melanin in the skin (Nautiyal *et al*., 2021: 34). Topical agents in the form of creams, gels as well as serums are applied on the skin, and are used for the treatment and management of site-specific skin hyperpigmentation (Nautiyal *et al*., 2021: 34).

Examples of topical agents are:

Arbutin: a derivative of hydroquinone that inhibits the production of tyrosinase as well as melanosome maturation, with little to no melano-toxic effects on the cutaneous layer (Figure 2.12). A synthetic form of arbutin (Deoxyarbutin) has proven to cause greater inhibition of tyrosinase. Side-effects comprise paradoxical hyperpigmentation (Chaowattanapanit *et al*., 2017: 77; Nautiyal *et al*., 2021: 34).

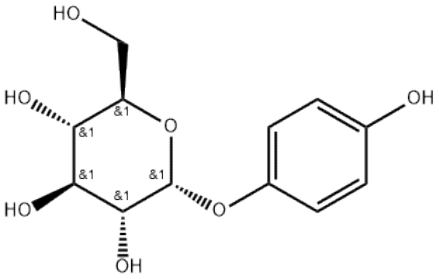

Figure 2.12 alpha-Arbutin Chemical Structure (Chemical Book, 2022)

L-Ascorbic Acid: formally known as Vitamin C, illustrated in Figure 2.13 reduces the conversion of L-DOPA to L-DOPA-quinone when it interacts with copper, which is essential for the reduction of melanogenesis (Chaowattanapanit *et al*., 2017: 77).

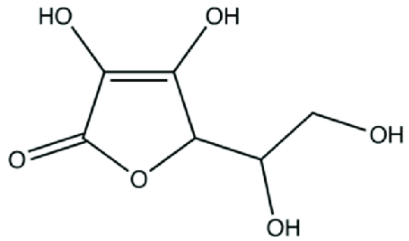

Figure 2.13: Ascorbic Acid Chemical Structure (Chemical Book, 2022)

Azelaic acid: a natural derivative from *Pityrosporum ovale,* which is a tyrosinase inhibitor that provides an anti-proliferated outcome within the cutaneous layer Figure 2.14. Side-effects consist of mild burning as well as pruritus (Chaowattanapanit *et al*., 2017: 77; Nautiyal *et al*., 2021: 34).

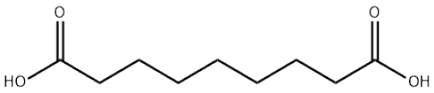

Figure 2.14: Azelaic Acid Chemical Structure (Chemical Book, 2022)

Kojic Acid: Figure 2.15 provides a chemical structure of kojic acid, an inhibitor of tyrosinase production that hinders the catecholase activity of tyrosinase within the cutaneous layer. Side-effects entail contact dermatitis (Chaowattanapanit *et al*., 2017: 77).

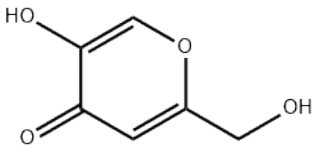

Figure 2.15: Kojic Acid Chemical Structure (Chemical Book, 2022)

N-*acetyl* glucosamine (NAG): an aminomonosaccharide (Figure 216) that inhibits the glycosylation of the tyrosinase, resulting in pigment lightening. NAG is produced using the addition of an amino acid to glucose (Chaowattanapanit *et al*., 2017: 77).

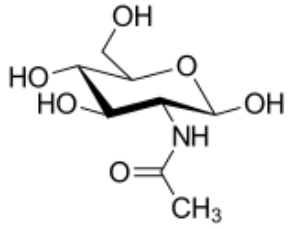

Figure 2.16: N-*acetyl* glucosamine Chemical Structure (Chemical Book, 2022)

Retinoids: increasing keratinocyte cell turnover retinoids can inhibit melanogenesis as well as tyrosinase transcription by the MSH (melanocyte-stimulating hormone) or L-tyrosine enzyme. Retinoids consists of retinol (Vitamin A). There are currently three main types of retinoids, namely a natural derivative of retinol Tretinoin (Figure 2.17) that is known to be a first-generation retinol, as well the third-generation synthetic retinol Adapelene (Figure 2.18) and Tazarotene (Figure 2.19) (Chaowattanapanit *et al*., 2017: 77; Nautiyal *et al*., 2021: 34).

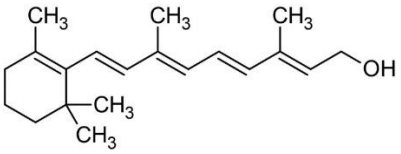

Figure 2.17: Retinol/Tretinoin Chemical Structure (Chemical Book, 2022)

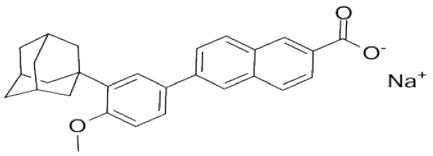

Figure 2.18: Adapalene Chemical Structure (Chemical Book, 2022)

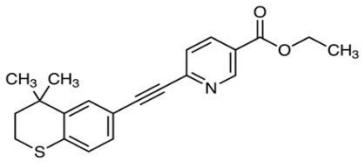

Figure 2.19: Tazarotene Chemical Structure (Chemical Book, 2022)

Tranexamic acid: This is formally a plasmin inhibitor that has shown to be effective within hyperpigmentation disorders. Tranexamic acid (Figure 2.20) inhibits UV-induced plasmin activity within the keratinocytes, which then aids in reducing the rate of free arachidonic acid as well as prostaglandins, resulting in reduced melanogenesis activity (Chaowattanapanit *et al*., 2017: 77).

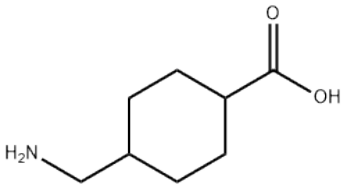

Figure 2.20 Tranexamic acid Chemical Structure (Chemical Book, 2022)

2.4.2 The Second Line of Treatment for Hyperpigmentation

In relation to the second line of treatment for hyperpigmentation, the individual would be advised on oral treatments that aid in the inhibition of melanocyte tyrosinase activity within the cutaneous layer (Chaowattanapanit *et al*., 2017: 77; Nautiyal *et al*., 2021: 34). Tranexamic acid is one of these oral treatments since it is a plasmin inhibitor. Hence in its oral form it is shown to be effective within hyperpigmentation disorders compared to its topical form. **Tranexamic acid** (Figure 2.20) inhibits UV-induced plasmin activity within the keratinocytes, which then aids in bringing down the rate of free arachidonic acid as well as prostaglandins, resulting in reduced melanogenesis activity (Chaowattanapanit *et al*., 2017: 77).

Glutathione: is a powerful tripeptide antioxidant found within the human body that starts to decline as one grows older. This antioxidant boosts the immune system and allows for the detoxification of the liver and is a tyrosinase inhibitor (Figure 2.21). Glutathione has the ability to convert eumelanin to pheomelanin (Nautiyal *et al*. 2021: 34).

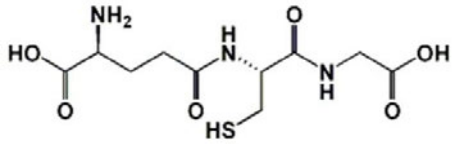

Figure 2.21: Glutathione Chemical Structure (Chemical Book, 2022)

2.4.3 The Procedural Treatment for Hyperpigmentation

During the treatment of hyperpigmentation, there are various procedural treatment options that will aid in decreasing the hyperpigmentation and prevent the skin condition from recurring or worsening. These treatments are performed by an experienced Somatologist, Skin Therapist or an Aesthetic Physician. The most popular and preferred procedural treatment options are chemical peels (Chemo-exfoliation), micro-needling and mesotherapy.

2.5 Chemical Peels (Chemo-exfoliation)

A chemical peel is an aesthetic treatment involving the use of different Alpha Hydroxy Acids (AHAs), Beta Hydroxy Acids (BHAs) as well as Trichloroacetic acid (TCA). Chemical peels allow for exfoliation to occur on the skin. This treatment may affect the epidermis as well as the dermis, thus targeting the problem area. The treatment allows for epidermal turnover as well as decreasing epidermal and dermal pigmentation, resulting in an improved skin texture as well as a brighter and even skin tone (Bard, 2021). The most popular indications for a chemo-exfoliation would be chronic photoaging and hyperpigmentation such as Post Inflammatory Hyperpigmentation (PIH), Melasma, Solar Lentigines, Exogenous Ochronosis, as well as Acanthosis Nigricans pigmentary conditions. Chemical peeling is not only limited to skin rejuvenation, as it further allows wound healing within the treated area while minimizing scarring as well as undesirable pigmentary change.

“The caustic agents used for chemical peels cause controlled kerato-coagulation and denaturation of the proteins within the epidermis and dermis, resulting in the release of pro-inflammatory cytokines and chemokines. Such targeted inflammation activates the normal healing signal cascade, including the stimulation, development and deposition of new dermal collagen and elastin; re-organization of structural scaffold proteins and dermal connective tissue; and regeneration of new keratinocytes (Soleymani *et al*., 2018: 11). This results in rejuvenation and thickening of the epidermis and an increase in dermal volume. Simultaneously, the kerato-coagulation and subsequent exfoliation result in an improvement in superficial and medium-depth dyspigmentation. While there might be subtle variability between the types of chemical agents used and their intended cosmetic outcome (i.e. the reduction of redness vs. dyspigmentation vs. scarring), the primary goal of a chemical peel is to improve the clinical appearance of skin by decreasing the quantity and quality of rhytides and/or acne scars; reducing inflammatory and non-inflammatory acne lesions; improving dyspigmentation; and producing an overall more youthful appearance” (Soleymani *et al*., 2018: 11).

Chemical peels are categorised into three groups as follows:

- Superficial Peels;
- Medium-depth Peels; and
- Deep Peels.

2.5.1 Superficial Chemical Peels

Superficial peels are the safest since very little to no risks of side-effects can be observed within the skin. As a result, the skin recovers quicker compared to other peels. These peels affect the epidermis whereby epidermal pigmentation may be treated. Superficial peel treatments may be done every two to four weeks depending on skin integrity. Acids that may be used during a superficial peel are mandelic acid, glycolic acid, lactic acid, pyruvic acid, salicylic acid, retinoic acid, resorcinol as well as trichloroacetic acid (TCA) in lower concentrations (Phillip *et al*., 2020). Some potential side-effects would include erythema, pruritis, burning, superficial exfoliation/epidermolysis, as well as post-inflammatory hyperpigmentation (Soleymani *et al*., 2018: 11). Glycolic Acid is an Alpha Hydroxy Acid (AHA) that derives from sugarcane. This agent is a well-known, first-line choice and the safest AHA to use during chemical peels. Glycolic acid treats superficial hyperpigmentation as well as mild to moderate photo-aging from prolonged sun exposure without the use of a Sun Protection Factor (SPF).

Lactic Acid: An AHA that is similar to glycolic acid that has a lower potential of Hydrogen (pH) than glycolic acid. Therefore, lower concentrations are recommended when this chemical peeling agent is used. Lactic Acid is also safe for sensitive skins and it can be used to treat superficial hyperpigmentation as well as photo-damage from prolonged sun exposure without the use of a Sun Protection Factor (SPF).

Mandelic Acid: An AHA that is suitable in treating excess sebum production in the skin, as well as dyspigmentation and erythema within individuals. Mandelic acid is not as potent or aggressive as glycolic acid, deeming it to have fewer complications.

Salicylic Acid: A Beta Hydroxy Acid (BHA) that mainly aids in the decrease of sebum production within the skin. Salicylic acid reduces Post-Inflammatory Hyperpigmentation (PIH) discolouration due to its anti-inflammatory effects on the skin.

Pyruvic Acid: this chemical peeling agent possesses the properties of both glycolic as well as salicylic acid. It treats superficial hyperpigmentation, photo-aging, decreases sebum production in the skin, as well as having anti-inflammatory effects (Rattan, 2021).

2.5.2 Medium-Depth Chemical Peels

Medium-depth peels are more invasive compared to the superficial peels. Medium-depth peels penetrate the epidermis and work within the papillary dermis. For increased efficacy, medium-depth peels may be combined with superficial peels, and the skin's tone as well as texture is improved drastically as the individual will shed/peel off the keratinised and damaged skin cells to allow for improved texture and tone (Storm *et al*., 2021). Acids used in this study were glycolic acid (medium to high concentration) combined with a Jessner's Solution (salicylic acid, resorcinol, lactic acid and ethanol). In addition, TCA (low to medium concentration) combined with a Jessner's Solution was explored in this study (Soleymani *et al*., 2018: 11). Potential side-effects of medium-depth chemical peels include acneiform dermatitis eruption, milia, scarring, post-inflammatory hyperpigmentation, superficial bacterial or fungal infection, as well as accelerated exfoliation/epidermolysis (Soleymani *et al*., 2018: 11).

2.5.3 Deep Chemical Peels

Deep peels are very invasive and require an aesthetic physician to carry out the treatment due to its strength. These peels are not recommended and should be avoided for individuals who fall under the Fitzpatrick scale IV to VI as they result in dyschromia as well as scarring. Deep chemical peels aid in improving moderate to severe hyperpigmentation, sun damage, as well as wrinkles. Deep peels allow for more of a controlled cutaneous tissue injury towards the mid-reticular dermis level (Figure 2.22). However, should these peels not be used properly with caution, they will migrate to the subcutis layer and the damage may be irreversible (Soleymani *et al*. 2018: 11). Side-effects related to deep chemical peels include scarring, hypopigmentation, exacerbated hyperpigmentation, acneiform dermatitis eruption, secondary bacterial or fungal infection and in extreme cases due to the systemic absorption of phenol seen in 30-50% individuals' cardiotoxicity, hepatotoxicity as well as nephrotoxicity (Soleymani *et al*., 2018: 11).

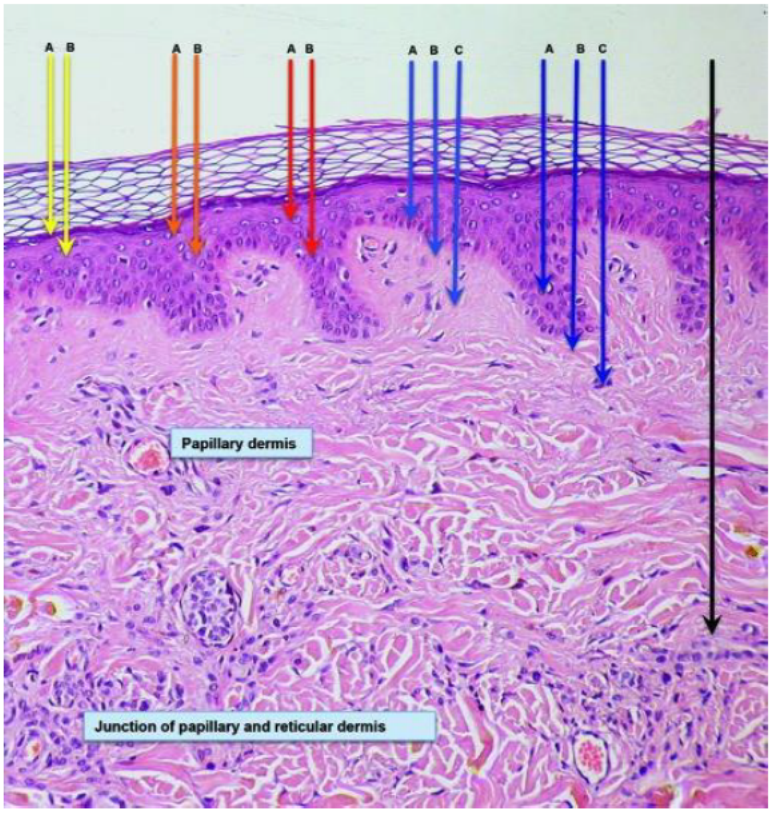

Figure 2.22: Visual interpretation of the depth that different acids penetrate during chemo-exfoliation (Soleymani, 2018)

2.5.4 Chemical Peel Strengths and Penetrative Abilities in the Skin

A	• 40% Mandelic Acid single layer application.
B	• 40% Mandelic Acid multiple layer application.
A	• 30% Lactic Acid or 50%Pyruvic Acid single layer application.
B	• 30% Lactic Acid or 50% Pyruvic Acid multiple layer application.
A	• 30% or less Salicylic Acid single layer application.
B	• 30% Salicylic Acid multiple layer application.
A	• <50% low to medium Glycolic Acid concentration single layer application.
B	• >70% high Glycolic Acid concentration single layer application. • Low to medium Glycolic Acid concentration multiple layer application.
C	• >70% high Glycolic Acid concentration together with Jessner's Solution.
A	• <35% low TCA concentration single layer application.
B	• 35% medium TCA concentration together with Jessner's Solution.
C	• >40% higher TCA concentration together with Jessner's Solution.
	• 50-55% concentration of phenol-based peel.

Figure 2.23: Tabulated peel depth between different chemical peels

During chemo-exfoliation, a few factors are taken into consideration for a successful treatment. In terms of deep chemical peels, an aesthetic physician should consider the type of acid that will be used during the treatment, the concentration of the acid, number of layers applied on the skin, how long the peel is left on the skin, the individual's photo type, as well as their concern. For individuals who are within Fitzpatrick Scale IV to VI, it would be recommended to do superficial as well as medium-depth peels. Extra precautions are advisable when using medium-depth peels to avoid adverse effects. The participant's skin would need to be pre-conditioned with a course of superficial chemical peels, and tyrosinase inhibitors with an addition of a broad-spectrum sun protection factor of 50 before commencing with medium-depth peels. During post chemo-exfoliation treatment, considerations would include the downtime, the side-effects the individual may encounter, as well as the healing rate. The deeper the peel, the more the individual is susceptible to side-effects as the healing rate between the three different peels is not the same and differs extensively (Soleymani *et al*., 2018: 11).

2.6 Micro-needling

Micro-needling is also known as Collagen Induction Therapy (CIT). A form of treatment device is used which creates micro channels in the skin without causing controlled wound healing. It allows for active ingredients from products to penetrate effectively as well as deeper into the skin, which allows for results to be achieved faster than just to apply the product topically. There is also the release of platelet-derived growth factor (PGF), transforming growth factor alpha and beta (TGF-α and TGF-β), connective tissue activating protein, connective tissue growth factor, and fibroblast growth factor (FGF), which are growth factors that allow for skin rejuvenation (Singh *et al*., 2016: 7). Different types of micro-needling devices are used, as described below.

2.6.1 Mechanical Micro-needling

A pen-like device (Figure 2.24) with a cartridge (Figure 2.25) that has needles all around it is used during the treatment. These needles create micro-channels in the skin that can go up to 2.5 millimetres deep. Examples of mechanical micro-needling are the following devices: DermaPen (Figure 2.26), Dr. Pen, SkinPen (Stieber, 2020).

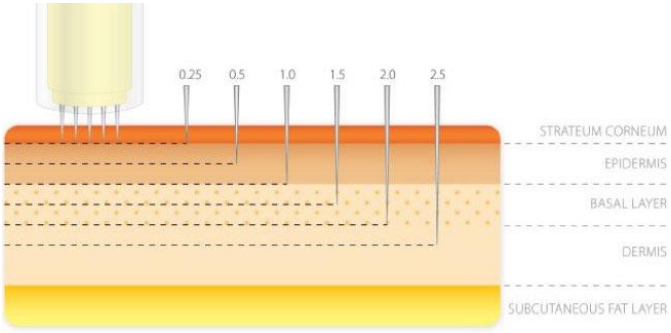

Figure 2.24: Different micro-needling depths into the skin (Versagli, 2022)

Figure 2.25: DermaPen 4, micro-needling device (DermaPenWorld, 2022)

Figure 2.26: © DermaPen 4 micro-needling cartridge (DermaPenWorld, 2022)

2.6.2 Micro-needling procedure

During treatment, the Somatologist prepares the skin by means of cleansing, exfoliation and applying a serum that would allow for the micro-needling device to glide effortlessly on the skin to prevent dragging and damage to the skin. Micro-needling of the skin would then take place whereby the device would create micro channels on the skin. The Somatologist would then use a transdermal drug delivery approach whereby a superficial chemical peel acid in low to moderate concentrations such as glycolic acid, as well as other de-pigmenting serums which contain tyrosinase inhibitors such as alpha arbutin, kojic acid, glutathione, N-*acetyl* glucosamine, tranxnemic acid as well as Vitamins A and C, would be applied afterwards.

The serum would absorb into the skin, targeting and breaking down the hyperpigmentation bonds. A soothing masque and/or serum would be applied after the procedure, together with a moisturiser and SPF50. Aftercare as well as homecare would then be given to the client and a follow up appointment booked. The researcher applied this technique as she had learnt it in her training and working in the medical aesthetics industry.

2.7 MESOTHERAPY

This is the non-invasive as well as non-surgical form of micro-needling thagt increases the permeability of the stratum corneum by small, superficial micro injections (Figure 2.27) so that the active ingredients from the skincare product or agent work on the targeted, problem area. Active ingredients popularly used with mesotherapy are de-pigmenting agents, as well as drugs such as Cyklokapron/tranxnemic acid, vitamins and minerals from active topical agents (Stieber, 2020). When treating hyperpigmentation with the use of mesotherapy, the Somatologist would firstly cleanse and prepare the skin for the procedure, then use a 30G 4mm mesotherapy needle to inject 0.5 ml of the Cyklokapron/tranxnemic acid, or any other desired depigmenting agent, on the area being treated. This process will aid in breaking up the stubborn hyperpigmentation.

Figure 2.27: Mesotherapy (Mesoestetic, 2021)

2.8 CONCLUSION

This chapter reviewed relevant literature on the different skin types, the melanogenesis process, as well as pathways and various ingredients that are safe to use on skin types IV to VI to treat hyperpigmentation. The different treatment modalities performed during treatments were also discussed. The next chapter describes the methodology used in this study.

CHAPTER THREE

METHODOLOGY

3.1 INTRODUCTION

This chapter discusses the explanatory sequential mixed methodological approach that was utilised for this study. The findings from both the qualitative and quantitative phases were triangulated. The research design, sampling, procedure and the tool used to gather and evaluate the data obtained are explained. The method of data analysis is also described.

3.2 RESEARCH DESIGN

The study utilised a mixed methodology approach, specifically an explanatory sequential design. This study began with the collection and analysis of the quantitative data, followed by the subsequent gathering and analysis of the qualitative data. Importantly, the qualitative results build on the initial quantitative findings (Creswell and Clark 2011: 69-70). By using a combination of quantitative and qualitative approaches, a pragmatic approach was adopted.

The study involved two different phases. During Phase I, a quantitative approach utilised survey questionnaires, followed by one-on-one interviews in Phase II. Maruyama and Carey (2014: 446) concluded that this sequence of mixed methods reflects the higher significance of the quantitative approach in investigating the objectives addressed by the study.

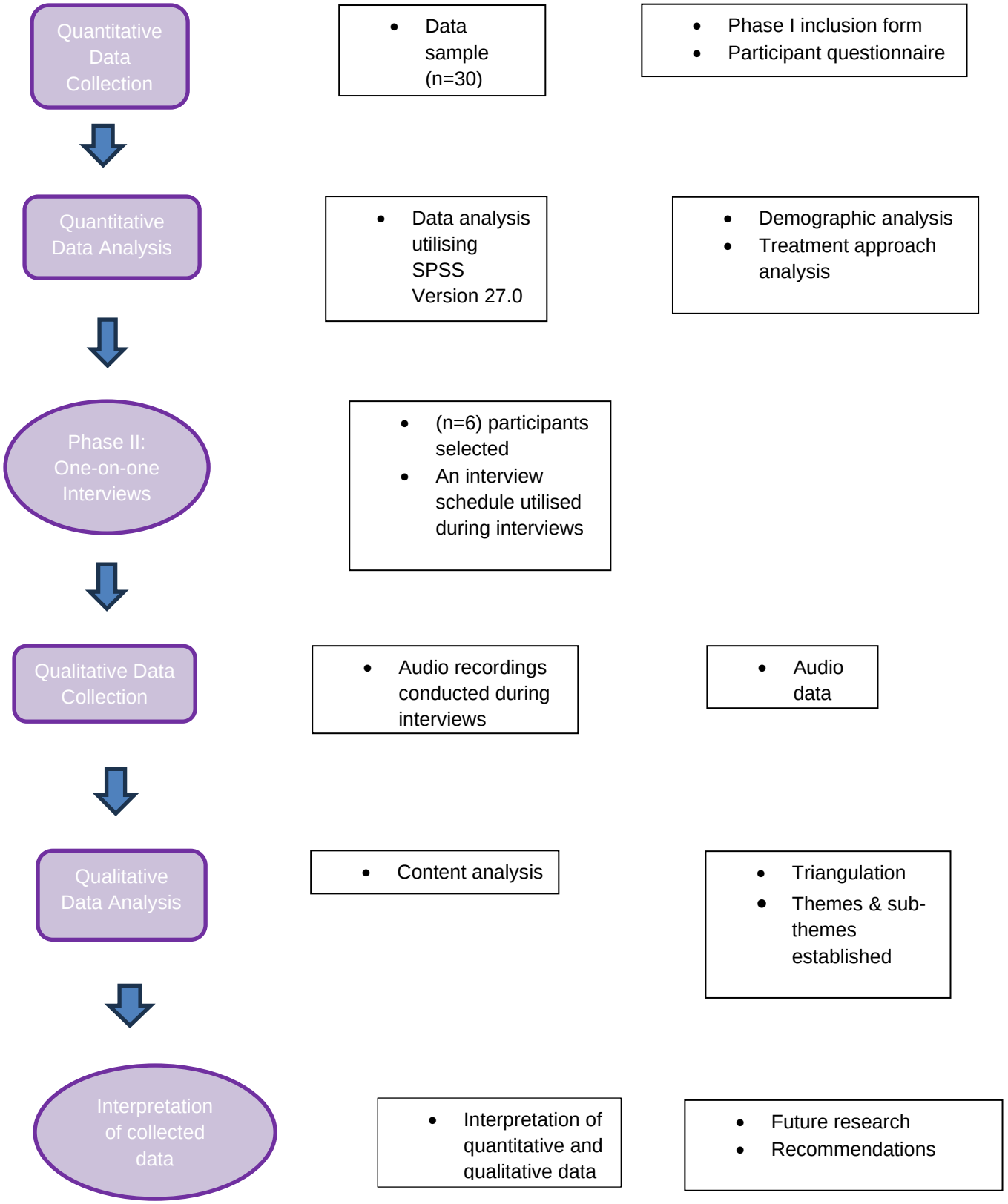

Figure 3.1: Visual Representation of an explanatory sequential mixed methodological approach (adapted from Creswell, 2013: 40).

3.2.1 TRIANGUALTION

Triangulation involves the conscious combination of quantitative and qualitative merits that were operationalised to strengthen the study (Laher, 2009). By adopting triangulation techniques, the study identified the advantages of the quantitative approach corresponding to the disadvantages of the qualitative approach, and vice versa (Miller, 2005).

The use of the triangulation technique allowed the researcher to use the strengths of the research tools, which ensured a cohesive study. Survey questionnaires were used to collect data from the (n=30) participants. This was followed by one-on-one interviews where open ended questions were utilised to gather information.

3.3 RECRUITMENT

A Letter of information (Appendix A) as well as a letter requesting permission to conduct the study (Appendix B) was distributed between two to six aesthetic clinics in eThekwini, KwaZulu-Natal, and (*n*=30) participants were recruited. These participants were already undergoing hyperpigmentation management programs. An advertisement was distributed to aesthetic clinics (Appendix D). Thirty (n=30) participants were selected to be part of the study.

3.4 STUDY POPULATION AND SAMPLING

The study utilised the Convenience sampling technique, which is a non-probability sampling method whereby the participants were selected due to them being easily accessible to the researcher (Nikolopoulou, 2022). Once permission was granted to conduct the study, participants were selected by the clinic manager/owner to take part in the study. The proposed participants were briefed by the clinic manager/owner on the purpose of the study and what would be required should they agree to take part in the study. Once suitable participants were selected, the clinic manager/owner contacted the researcher to inform her of the number of participants acquired for the study.

Questions addressing the objectives were used to gather the qualitative data. The questions were based on the demographics and the hyperpigmentation treatment approaches that the participants were undergoing. A questionnaire was provided to the participants during Phase I, and Phase II was conducted for the qualitative aspect of the study project utilising one-on-one interviews.

3.4.1 Sample Characteristics

This study took place in the eThekwini Municipal area of KwaZulu-Natal. The following were the inclusion and exclusion criteria:

Inclusion Criteria

Inclusion criteria for participants undergoing hyperpigmentation treatment:

- Participants under types IV to VI on the Fitzpatrick scale;
- Participants already undergoing hyperpigmentation treatment in an aesthetic clinic and using home care products;
- Participants aged 25 - 45 years;
- Participants not on any autoimmune or hormonal medication;
- Participants in the eThekwini municipal area;
- Those who have signed the informed consent letter; and
- Participants that are fluent in English.

Exclusion Criteria

The following were the exclusion criteria for participants as they not meet the requirements:

- Participants that do not fall under Fitzpatrick scale types IV to VI;
- Participants not on a hyperpigmentation treatment program in an aesthetic clinic and/or home care product;
- Participants on autoimmune or hormonal medication;
- Participants over 45 years old;
- Participants residing outside of the eThekwini municipal area
- Participants who are not fluent in English; and
- Participants who have not signed the informed consent letter.

3.5 PROCEDURE

The researcher contacted aesthetic clinics within eThekwini, KwaZulu-Natal via email, requesting permission to conduct the study within their aesthetic clinic as well as providing the letter of permission (Appendix C). When permission was granted, the researcher sent through an advertisement (Appendix D) to the aesthetic clinics. The aesthetic manager/owner also selected candidates who would be best suited for the study, apart from individuals that saw the advertisement and wanted to participate in the study.

Firstly, a pilot study was conducted by the researcher with (n=2) individuals who were not part of the study, prior to conducting the study with the research participants. The purpose of the pilot study was to pre-test the tool used for data collection during a study to ascertain whether it will be a success or not (Lowe, 2019). During the pilot study, the researcher implemented some minor changes in the final questionnaire used during Phase I.

When (n=30) participants agreed to join the study, they were presented with an informed consent form (Appendix C) as well as a non-disclosure agreement (Appendix G) to be signed prior to participation in the study.
Once Phase I was completed, the researcher then selected the (n=6) participants who would take part in the one-on-one interviews, which included open-ended questions that were recorded by the researcher in Phase II, pending the findings of Phase I.

3.6 DATA COLLECTION AND TOOL

During Phase I, closed-ended questions were developed by the researcher in line with the objectives. From the coded data, patterns were identified to establish themes and sub-themes that were used to analyse the data. The purpose of a closed-ended questionnaire during phase I was to ensure that the responses are analogous, therefore allowing for a speedy response, and the communication skills of the respondent are less critical (Hymen, 2016). The questions were based on the hyperpigmentation typologies, current skin treatment, as well as home care (Appendix E). The questionnaire was distributed and completed by all participants.

3.6.1 Description of Questionnaires

Section A: This section comprised the demographics, which aided in establishing information such as ethnicity, age group, as well as gender.

Section B: This section focused on the treatment history, as well as details whereby the participants indicated the following: which type of hyperpigmentation they were being treated for; how often the treatments would be conducted; which chemical peel and strength they were given; whether the treatment benefits were communicated to them; the duration of treatments to address their concerns; whether the treatment was performed by a Somatologist or an aesthetic professional; were there any other treatment modalities, including homecare. These were incorporated within the current regime to maintain consistent results.

Phase II (Appendix F) employed one-on-one interviews with the use of a questionnaire consisting of open-ended questions, which had a duration of 15 minutes. These interviews were conducted with (*n*=6) participants. One-on-one interviews were conducted and recorded with permission to gather information (Appendices E and F). Data was gathered and analysed from the interview sessions until saturation was reached. During this phase, open-ended questions were utilised to allow the participants to provide more information, as well as to elaborate further and qualify their responses during Phase II.

3.6.2 Description of One-on-one Interviews Utilising an open-ended questionnaire (Appendix F), (n=6) participants were selected to be part of the one-on-one interviews, and these participants were presented with a coded questionnaire. Additional information was gathered by the researcher to establish the duration of the concern and included the following: what the participants would consider when approaching an aesthetic clinic to ensure that trained professionals were carrying out the advanced treatment. Moreover, they were requested to specify the treatments they were exposed to to improve their condition, as well as whether they were exposed to any other treatment before approaching the aesthetic establishment.

3.6.3 Coding of Questionnaires After developing a category scheme, the researcher read the data in its entirety and coded it for correspondence with the categories. To fully comprehend the underlying meaning of some aspect of the data, the researcher read the categories and went over it multiple times. The researcher and the statistician coded the entire data set and achieved the highest possible coding consistency across the interviews.

Questionnaires have been coded throughout the study, during Phase I with the questionnaires and in Phase II with the one on one interviews. Each question of the survey questionnaire were numbered. The answers that were given to any question were also coded. This ensured the data collected from the participants was analysed using SPSS Version 27.0. The answers were analysed using a data processing programme that obtained information during the study.Closed-ended questions and fixed responses were conducted in Phase I, and were simpler to code than the open-ended questions in Phase II. Open-ended questions had no predetermined number assigned to any answer as the researcher conducted the one-on-one interviews with open-ended questions to ensure the safety of the treatments performed by a Somatologist or trained aesthetic professional. The participants' satisfaction during the treatments they had receive from the aesthetic clinics were also considered.

Data analysis was conducted following the two steps of data analysis listed by Polit and Beck (2008: 508), as follows:

Transcribing Qualitative Data

The researcher personally transcribed the data from the audiotapes and field notes, ensuring that the transcriptions were accurate, reflected the totality of the interview experience, and facilitate analysis. To ensure the reliability of data coding, the researcher utilised the services of a co-coder who confirmed the data from the audiotape. To facilitate analysis during the transcription process, the researcher indicated who is speaking in the written text. For example, “R” for the researcher and “P” for the participants.

Developing a category scheme

After transcribing the data, the researcher read and organised it carefully, identifying underlying concepts and clusters of concepts. These assisted in informing a strategy for classifying and indexing the data and developing a high-quality category scheme. The researcher converted the data into smaller and more manageable units that could be reviewed and retrieved.

3.7 DATA ANALYSIS

3.7.1 Phase I: Survey Questionnaire

Surveys were conducted by the researcher on (n=30) participants with the use of a coded, closed-ended questionnaire. The tool gathered the participants’ demographics, as well as treatment history with the aesthetic clinic.Data collected from the participants was analysed using SPSS Version 27.0. Statistical tests were run to examine the association or differences in responses between the participants who participated in the study. The SPSS software programme enabled frequency distributions, cross-tabulations, means and summaries to analyse data. Frequency distributions are descriptive statistics and provide a summary of the patterns found in the information.

3.7.2 Phase II: One-on-one Interviews

During Phase II, (n=6) participants were selected to be part of the one-on-one interviews. The participants were given a different questionnaire that included open-ended questions. This allowed for further discussion amongst the researcher and the participants. The researcher proceeded to record the sessions with the participants. Analysis of the data generated from the in-depth interviews involved transcribing of the tape-recorded discussions, generating common categories, themes and patterns within the data and coding (De Vos, 2005).

3.8 VALIDITY AND RELIABILITY

Reliability refers to how consistently a method measured something, whilst validity refers to how accurately a method measures what it is intended to measure (Middleton, 2020). Validity and reliability were maintained by designing questions according to the criterion defined by Mohajan (2017). The questions were accurately and carefully phrased to avoid ambiguity and leading participants to answer. The data provided was maintained and backed up with the researcher referring to the participant record cards in order to confirm that the answers given correlated with the questions during the interview.

To ensure that validity and reliability were considered, the researcher conducted interviews with individuals with skin types IV to VI who were already undergoing hyperpigmentation treatment regimens to correct and control their concerns. A pilot study was conducted by the researcher to confirm the validity of the data collection tools.

Upon gathering the necessary intel on the ideal participants for the focus groups, questionnaires were conducted in order to identify the common types of hyperpigmentation the participants had, including the treatment protocols for these.

Treating hyperpigmentation on skin types IV to VI may become slightly intricate as opposed to skin types I to III as the proposed treatment methods may be too invasive (which worsens the hyperpigmentation, together with compromising cutaneous integrity) or the proposed treatment under-performs and does not deliver the desired treatment outcome (Rattan, 2020).

3.9 ETHICAL CONSIDERATIONS

Certain ethical principles were maintained to ensure that the rights of the participants were upheld, namely:

- Ethical clearance was obtained from Durban University of Technology, where the researcher was registered. Ethical Clearance number IREC 289/21 (Appendix H).
- Each participant received A letter of information and consent (Appendix A) and informed consent (Appendix C) to sign for approval of participation. Participants were informed that participation is voluntary and that they may withdraw at any time without penalties.
- In terms of confidentiality and complete anonymity of participants, their identities were coded and these codes were only available to the researcher. Only participants' coded identities appeared on the questionnaires and only the researcher, supervisor and co-supervisor had access to the completed questionnaires and taped recordings. The images submitted to the researcher had the eyes of the participants blacked out.

- The questionnaires and tape-recordings are kept in a locked area and will be stored in the Somatology Department for a period of five years, after which they will be shredded and discarded.
- All electronic data was password locked, accessible to only the researcher.

3.9.1 BENEFIANCE

Beneficence is one of the most important ethical principles in research. It outlines the researcher's responsibility to minimise harm or increase the benefits of the participants (Polit and Beck, 2006:87). Participants had a right to be protected from any type of harm, such as physical, psychological, emotional, social and legal harm. If participants showed signs of distress during data collection, the researcher must debrief the participant or even offer counselling services (Brink *et al*, 2012:36). The researcher ensured that the participants understood the benefits of the study by providing detailed explanations. The researcher also ensured that no harm came to participants during the process of data collection. However, sensitive information around the ENA scope of practice would lead to a heightened show of emotion. Debriefing of participants will be held should they show signs of distress.

During Phase I and Phase II, the researcher held the questionnaires and the one-on-one interviews with the aesthetic clinic owner in the room to ensure that the participants were comfortable, and they were assured that only the researcher and the supervisor would have access to the data that was gathered.

3.10 LIMITATIONS

During the study, the researcher encountered the following scenarios:

- Participants not being available on the days the researcher selected for Phase I of the study;
- One of the participants had to be replaced during Phase II due to a family emergency; and
- The researcher was restricted to one area of eThekwini municipality because that is where the established aesthetic clinics are located.

3.11 CONCLUSION

In this chapter, the methodology of the study was discussed. The chapter aimed at highlighting the importance of the following: the research method, design and sampling, as well as the methodology on how the data was collected and analysed.

The discussion of the ethical issues and challenges that confronted the study brings the chapter on research methodology to its conclusion. The following chapter of this dissertation focuses on the results, findings and discussion of the research study.

CHAPTER FOUR

RESULTS

4.1 INTRODUCTION

This chapter presents the findings obtained from the questionnaire provided to the participants at the aesthetic clinics. The questionnaire was the primary tool used to collect data and was distributed amongst 30 participants. The data collected from the participants were analysed using SPSS Version 27.0 and presented using relevant graphs and tables.**4.2 SOCIO DEMOGRAPHIC CHARACTERISTICS**

The research instrument consisted of 15 items with a level of measurement at a nominal level. The questionnaire was divided into two sub-sections:

Section A: Demographics of the participants

Section B: Participant treatment history

4.2.1 Biographical Information of the Participants

A total of 30 questionnaires were disseminated to a group of (*n=30*) participants. Out of the 30 questionnaires, they were all fully completed by the participants. Table 4.1 below reports on the gender, age group, as well as ethnicities of the research participants in this study.

Table 4.1: Biographical Information of Participants

Biographical information of participants			
		n	%
Gender	Male	5	16.7%
	Female	25	83.3%
	Total	**30**	**100%**
Age group	25-30	13	43.3%
	30-35	8	26.7%
	35-40	6	20.0%
	45 Years Old	3	10.0%
	Total	**30**	**100%**
Ethnicity	African	12	40%
	Coloured	6	20%
	Indian	12	40%
	Total	**30**	**100%**

Within the **40** gender category, the highest number of participants were female (*n*=25) (83.3%), whilst male participants were (*n=5)* (16.7%). The highest number of participants within the age group was individuals aged 25-30 years old (*n*=13) (43.3%) and the least number of participants were 45 years old and older (*n*=3) (10%). As different ethnicities participated in the study, the highest number was from participants of African descent (n=12) (40%), as well as participants of Indian descent (n=12) (40%). The least number was from Coloured participants (n=6) (20%).

4.2.2 Types of Pigmentation

During the study the researcher focused on the common types of hyperpigmentation that affect skin types IV to VI. These types of hyperpigmentation were Post Inflammatory Hyperpigmentation (PIH), melasma, solar lentigines as well as any other form of pigmentation that the participants presented and are undergoing treatment for. Figure 4.1 reports on different types of pigmentation. Only specific types were considered during the study as they are more prevalent within skin types IV to VI.

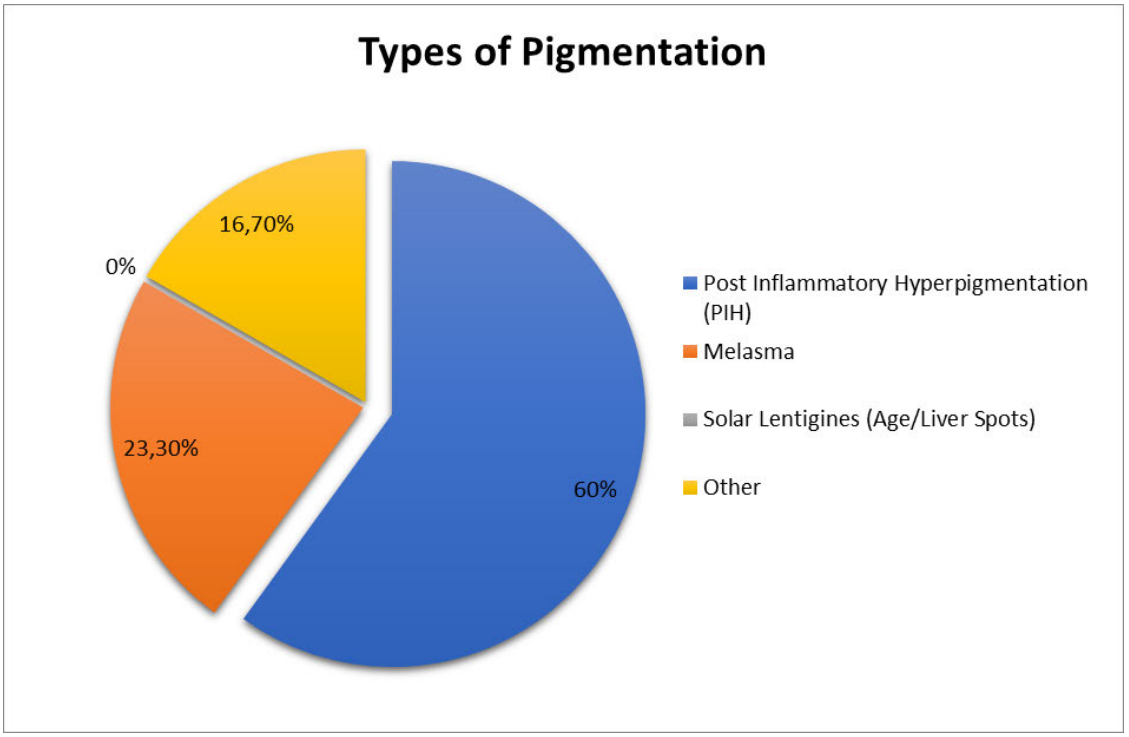

Figure 4.1: Types of pigmentation amongst participants

According to the pie-chart, the most common form of pigmentation amongst the participants is Post-Inflammatory Hyperpigmentation (PIH) (60%). Other forms of pigmentation are 16.70%.

4.2.3 Types of pigmentation according to age groups

During the study the researcher focused on the common types of hyperpigmentation that affect skin types IV to VI. These types of hyperpigmentation were Post Inflammatory Hyperpigmentation (PIH), melasma, solar lentigines as well as any other form of pigmentation that the participants presented and are undergoing treatment for. Table 4.2 reports on which type of pigmentation is more common amongst the different age groups within the study.

Table 4.2: Types of pigmentation amongst age groups

Age Group and Type of Pigmentation						
			Type of Pigmentation			
			Post Inflammatory Hyperpigmentation (PIH)	Melasma	Other	Total
Age Group	25 – 30 Years	Count	10	0	3	13
		% within Age Group	76.9%	0.0%	23.1%	100.0 %
	30 – 35 Years	Count	4	3	1	8
		% within Age Group	50.0%	37.5%	12.5%	100.0 %
	35 – 40 Years	Count	2	3	1	6
		% within Age Group	33.3%	50.0%	16.7%	100.0 %
	45 Years Old	Count	2	1	0	3
		% within Age Group	66.7%	33.3%	0.0%	100.0 %
Total		Count	18	7	5	30
		% within Age Group	60.0%	23.3%	16.7%	100.0 %

Participants (*n*=10) (76.9%) aged 25-30 years old were experiencing mainly Post-Inflammatory Pigmentation (PIH). Other participants (*n*=4) (50%) aged 30-35 years old were experiencing Post-Inflammation Hyperpigmentation (PIH). A few participants (*n*=3) (50%) aged 35-40 years old were mainly experiencing Melasma and participants (*n*=2) (66.7%) aged 40 years old and older experienced Post-Inflammatory Hyperpigmentation (PIH).

4.2.4 Types of pigmentation affecting different genders

Hyperpigmentation affects genders differently; females are more susceptible to having hyperpigmentation due to hormonal changes and being on medications such the contraceptive pill. Table 4.3 shows which type of pigmentation is most common amongst male and female participants.

Table 4.3: Types of pigmentation amongst genders

Gender and Type of Pigmentation						
			Type of Pigmentation			
			Post Inflammatory Hyperpigmentation (PIH)	Melasma	Other	Total
Gender	Male	Count	5	0	0	5
		% within Gender	100.0%	0.0%	0.0%	100.0 %
	Female	Count	13	7	5	25
		% within Gender	52.0%	28.0%	20.0%	100.0 %
Total		Count	18	7	5	30
		% within Gender	60.0%	23.3%	16.7%	100.0 %

Males (*n*=5) (100%) mainly experienced Post-Inflammatory Hyperpigmentation (PIH). Females (*n*=13) (52%) mainly experienced PIH.

4.3 AESTHETIC TREATMENTS PERFORMED IN CLINICS

4.3.1 Frequency of Skin Treatments

Due to the participants being on different treatment plans at the aesthetic clinics, they were required to avail themselves for their professional aesthetic treatments in the clinic at certain times. Figure 4.2 reports on how frequently the participants would have skin treatments in the clinic.

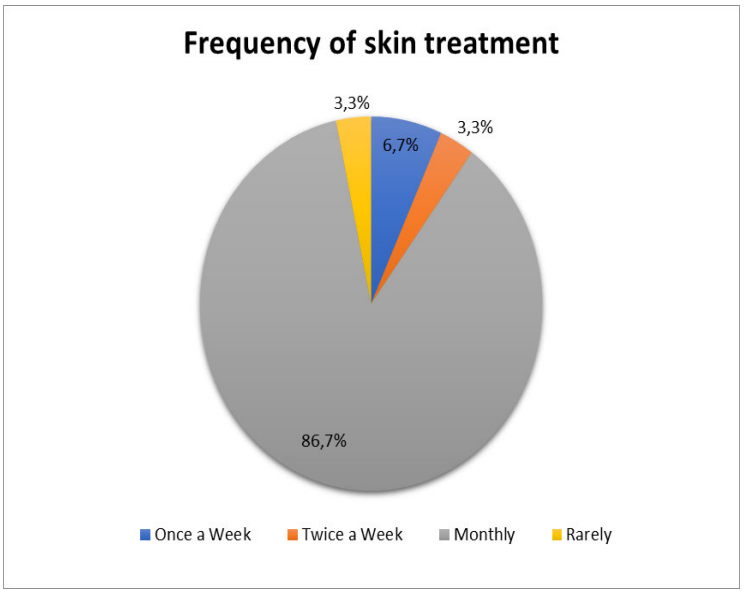

Figure 4.2: Frequency of Skin Treatment

Eighty-seven percent (86.7%) reported having treatments monthly; 6.7% have treatments once a week; 3.3% have treatments twice a week; and 3.3% reported rarely having treatments.

4.3.2 Frequency of skin treatments amongst age groups

The frequency of professional skin treatments at the aesthetic clinic differed slightly, participants who were in the beginning stages of their treatment plans would be required to undergo additional treatments compared to the other participants in the study. Table 4.4 reports on how frequently skin treatments would be had amongst the different age groups.

Table 4.4: Frequency of skin treatment amongst age groups

Age Group and Frequency of Skin Treatment							
			Frequency of Skin Treatment				
			Once a Week	Twice a Week	Monthly	Rarely	Total
Age Group	25 – 30 Years	Count	2	1	10	0	13
		% within Age Group	15.4%	7.7%	76.9%	0.0%	100.0%
	30 – 35 Years	Count	0	0	8	0	8
		% within Age Group	0.0%	0.0%	100.0%	0.0%	100.0%
	35 – 40 Years	Count	0	0	5	1	6
		% within Age Group	0.0%	0.0%	83.3%	16.7%	100.0%
	45 Years Old	Count	0	0	3	0	3
		% within Age Group	0.0%	0.0%	100.0%	0.0%	100.0%
Total		Count	2	1	26	1	30
		% within Age Group	6.7%	3.3%	86.7%	3.3%	100.0%

Participants aged 25-30 years old (*n*=10) (76.9%) would have monthly treatments. Participants aged 30-35 years (*n*=8) (100%) would have monthly treatments. Participants aged 35-40 years old (*n*=5) (83.3%) would have treatments monthly. Participants aged 40 years old and older (*n*=3) (100%) would have treatments monthly.

Participants mainly had treatments monthly (*n*=26) (86.7%).

4.3.3 Frequency of skin treatments according to the type of hyperpigmentation

The participants presented different forms of hyperpigmentation for the study, as a result these types of hyperpigmentation disorders were treated differently from each other. In Table 4.5, one observes the frequency of skin treatments according to the different types of hyperpigmentation.

Table 4.5: Frequency of skin treatment according to the type of pigmentation

Type of Pigmentation and Frequency of Skin Treatment							
			Frequency of Skin Treatment				Total
			Once a Week	Twice a Week	Monthly	Rarely	
Type of Pigmentation	Post Inflammatory Hyperpigmentation (PIH)	Count	2	1	15	0	18
		% within Type of Pigmentation	11.1%	5.6%	83.3%	0.0%	100.0%
	Melasma	Count	0	0	7	0	7
		% within Type of Pigmentation	0.0%	0.0%	100.0%	0.0%	100.0%
	Other	Count	0	0	4	1	5
		% within Type of Pigmentation	0.0%	0.0%	80.0%	20.0%	100.0%
Total		Count	2	1	26	1	30
		% within Type of Pigmentation	6.7%	3.3%	86.7%	3.3%	100.0%

Inflammatory Hyperpigmentation (PIH) indicates () (83.3%) monthly. Melasma shows (*n*=7) (100%) monthly. Other forms of hyperpigmentation are highest at (*n*=4) (80%) monthly. Overall, all the types of hyperpigmentation are commonly treated monthly (86.7%).

4.3.4 Acids used during chemical peel skin treatments

During skin treatments, different types of acids suitable for the type of hyperpigmentation the participant presented were used for the chemical peels at the aesthetic clinics. Figure 4.3 reports on the different types of acids used, as well as the combination of acids used during treatment.

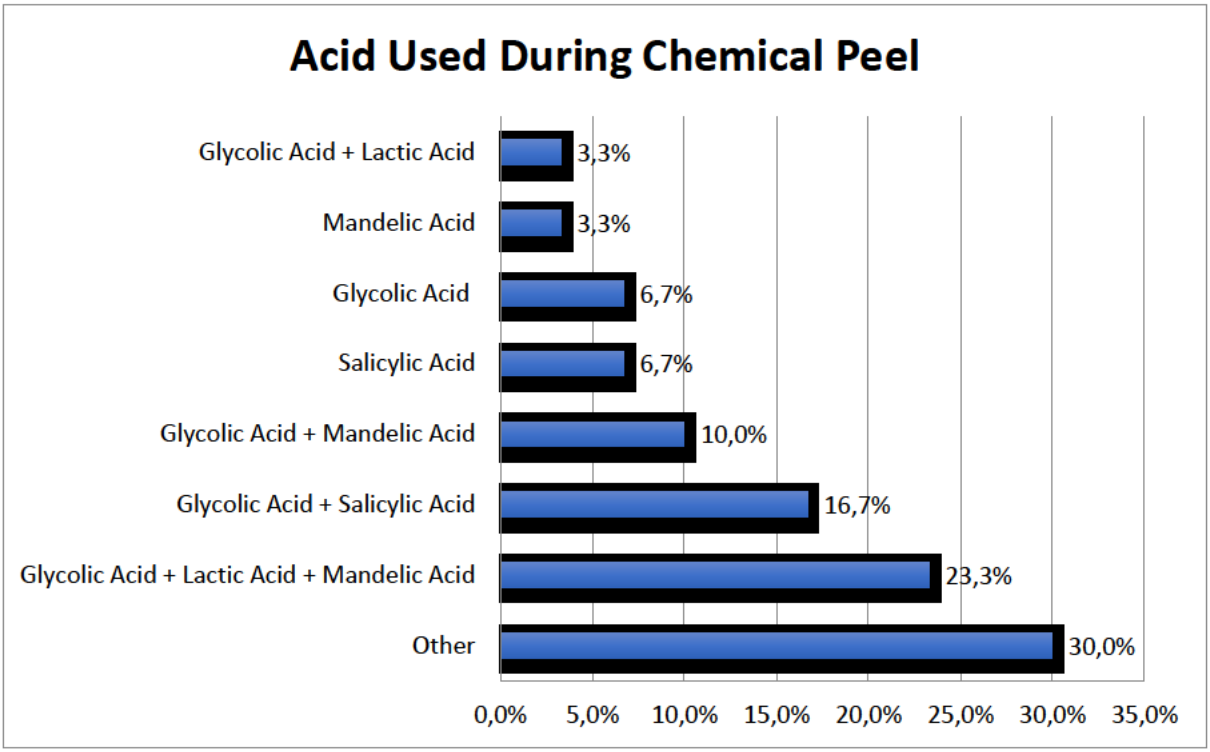

Figure 4.3 Acid used during a chemical peel

During chemical peel treatments in the clinic, 30% would have a different type of acid during the chemical peel; 23.3% would have a combination of glycolic acid + lactic acid + mandelic acid; 16.7% would have a combination of glycolic acid + salicylic acid; 10% would have a combination of glycolic acid + mandelic acid; 6.7% would have salicylic acid; 6.7% would have glycolic acid; 3.3% would have mandelic acid; and 3.3% of individuals would have a combination of glycolic acid + lactic acid.

4.3.5 Treatment benefits

It was established that the treatments the participants were undergoing at the aesthetic clinics were effective and there was improvement in the skin. Figure 4.4 reports on whether or not the aesthetic treatments were beneficial.

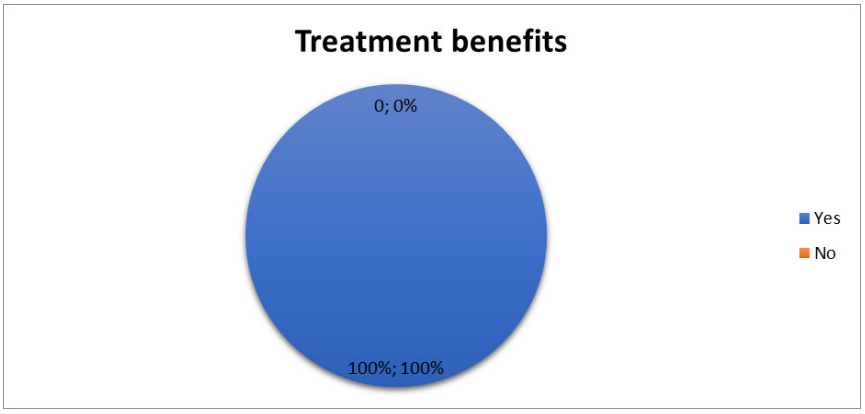

Figure 4.4: Treatment benefits

All the participants (*n*=30) (100%) undergoing hyperpigmentation treatment programs as well as being on homecare mentioned that they found their treatment programs to be effective in treating their concerns.

4.3.6 Treatment duration

Each participant had their unique treatment plan to treat their hyperpigmentation to achieve satisfactory results. Figure 4.5 shows how long the participants have been on the programs designed to treat their hyperpigmentation.

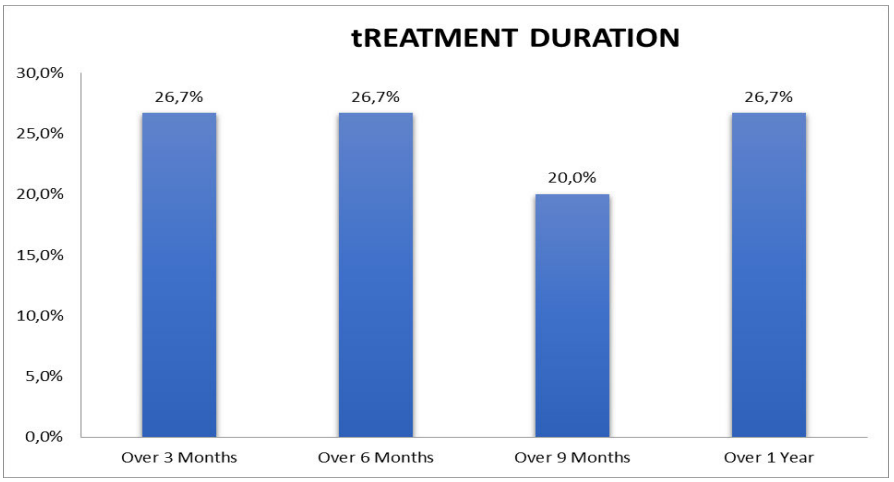

Figure 4.5: Treatment duration amongst participants over certain periods

The results show that 26.7% of the participants have been undergoing treatment for over 3 months; 26.7% of the participants have been undergoing treatment for over 6 months; 26.7%

have been undergoing treatment for over a year; and 20% have been undergoing treatment for over 9 months.

4.3.7 Frequency of skin treatments according to the treatment duration The frequency of skin treatments among the participants was dependent on how long they have been undergoing treatment at the aesthetic clinics. The longer they have been on the program, the less frequently they will go to the aesthetic clinic for skin treatments. Table 4.6 shows how frequently the participants have skin treatments according to the treatment duration.

Table 4.6: Frequency of skin treatment according to treatment duration

Treatment duration and Frequency of Skin Treatment							
			Frequency of Skin Treatment				
			Once a Week	Twice a Week	Monthly	Rarely	Total
Treatment duration	Over 3 Months	Count	2	0	6	0	8
		% within Treatment duration	25.0%	0.0%	75.0%	0.0%	100.0 %
	Over 6 Months	Count	0	1	6	1	8
		% within Treatment duration	0.0%	12.5%	75.0%	12.5%	100.0 %
	Over 9 Months	Count	0	0	6	0	6
		% within Treatment duration	0.0%	0.0%	100.0 %	0.0%	100.0 %
	Over 1 Year	Count	0	0	8	0	8
		% within Treatment duration	0.0%	0.0%	100.0 %	0.0%	100.0 %
Total		Count	2	1	26	1	30
		% within Treatment duration	6.7%	3.3%	86.7%	3.3%	100.0 %

In the duration of over 3 months, (*n*=6) (75%) would have treatments monthly. In over 6 months, (*n*=6) (75%) would have treatments monthly. In over 9 months, (*n*=6) (100%) would

have treatments monthly and in over a year, (*n*=8) (100%) would have treatments monthly. Therefore, (*n*=26) (86.7%) participants would have treatments monthly.

4.3.8 Professionalism

The researcher wanted to ensure that the skin treatments were conducted by a qualified Somatologist, aesthetic therapist or doctor as these are invasive treatments. Figure 4.6 shows whether the treatment was conducted by an appropriate professional.

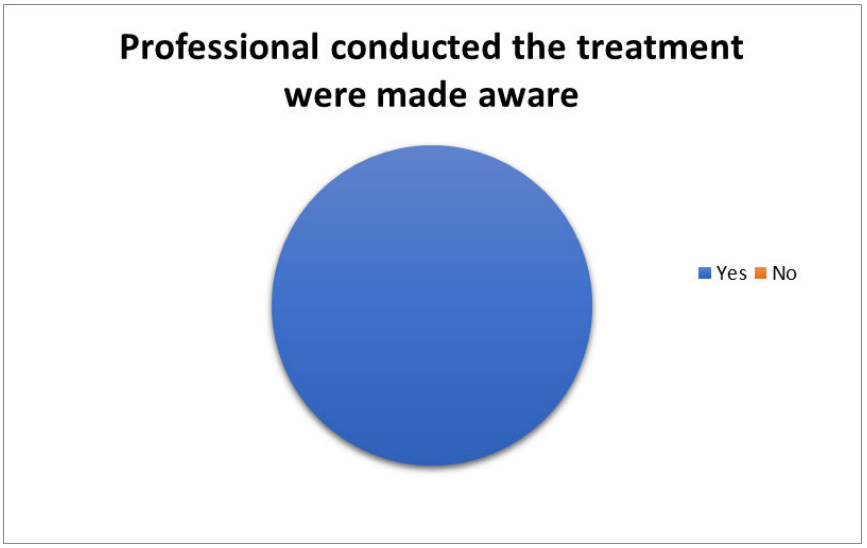

Figure 4.6: Participant was made aware of the professional conducting treatment

All (*n*=30) (100%) of the participants were made aware of the profession of the individual conducting the treatment. Participants had either a Somatologist, an aesthetic doctor or skin therapist to carry out the treatment.

4.4 Homecare use and recommendations

4.4.1 Other forms of therapy used in conjunction with chemical peel treatments

As the participants progressed in their skin treatment plans, other forms of therapy were introduced to work in conjunction with chemical peels. This was done to further improve the treatment results. Figure 4.7 shows us the other forms of therapy used with chemical peels during treatments in the clinic.

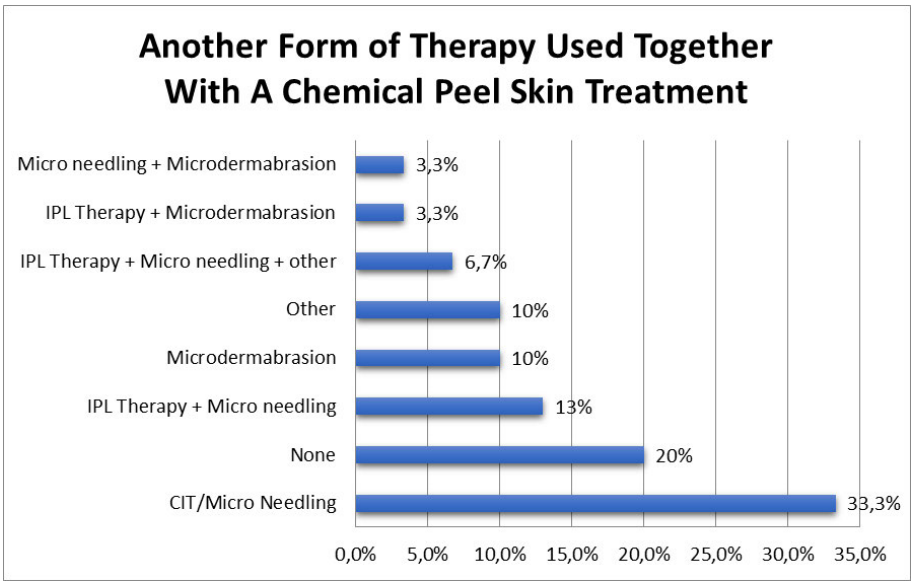

Figure 4.7: Other forms of therapy used together with a chemical peel treatment

During data collection, 33.3% of participants reported having Micro-needling with their chemical peel treatment; 20% reported not having any other therapy with their chemical peel; and 13% reported having IPL Therapy together with Micro-needling with their chemical peel. A further 10% reported having Microdermabrasion together with their peel;10% reported having other forms of therapy with their chemical peel; and 6.7% reported having IPL Therapy + Micro-needling + Other form of therapy with their chemical peel. Furthermore, 3.3% reported IPL Therapy + Microdermabrasion with their chemical peel and 3.3% have Micro-needling + Microdermabrasion with their chemical peel.

4.4.2 Treatment recommendations

The researcher wants to investigate whether the participants would recommend advanced skin treatments to further individuals because the participants have discovered them to be successful in treating their hyperpigmentation. Figure 4.8 indicates how many of the participants have recommended the treatments to others who have the same skin problem as theirs.

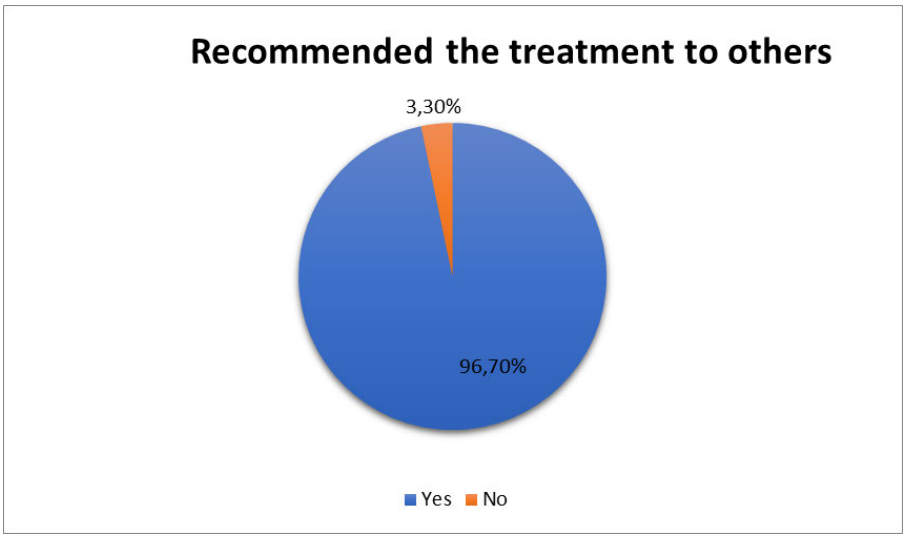

Figure 4.8: Recommended the treatment to others

(96.7%) of participants responded to recommending the treatments to others during data collection.

4.4.3 Use of homecare products

Homecare was suggested to the participants at the aesthetic clinics to further improve and maintain the results they have obtained during the skin treatments performed in the aesthetic clinic. Figure 4.9 shows how many of the participants use home-care products that were recommended to them to help maintain their results.

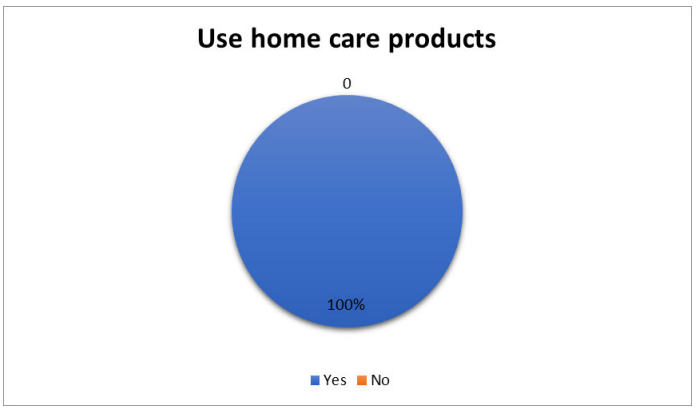

Figure 4.9: Home-care products use

All n=30 (100%) of the participants are on homecare products that were recommended to them to use.

4.4.4 Key product ingredients in home-care products

Within the home-care products recommended to the participants, they all contained more than one tyrosinase inhibitor, which is crucial in minimizing and managing hyperpigmentation in the skin.The following Figure 4.10 shows how many of the participants' home-care products contain the key ingredients used to treat and maintain hyperpigmentation.

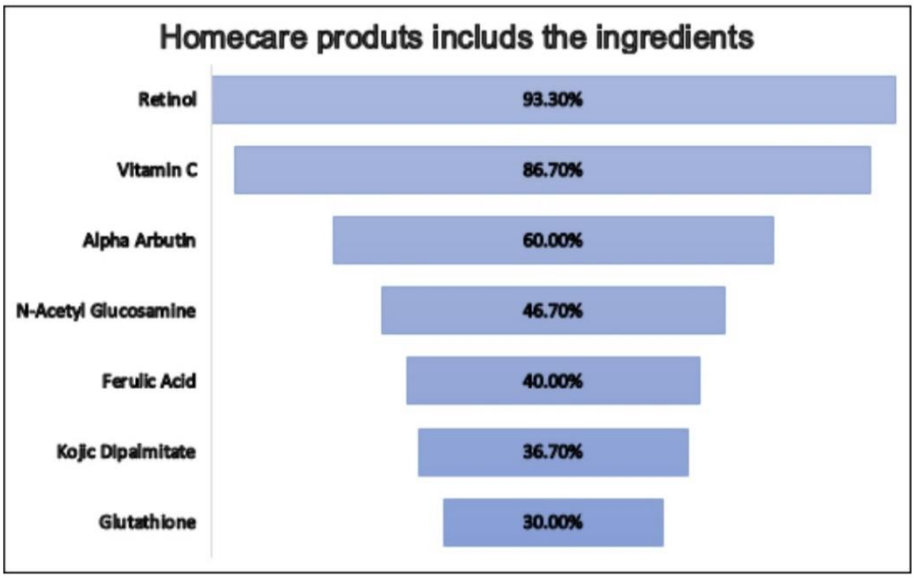

Figure 4.10: Key ingredients in home-care products

Among the (*n*=30) participants, 93.3% have retinol; 86.7% have Vitamin C; 60% have Alpha-Arbutin; 46.7% have N-Acetyl Glucosamine; 40% have Ferulic Acid; 36.7% have Kojic Dipalmitate and 30% have Glutathione.

4.4.5 SPF used daily

The use of a Sun Protection Factor (SPF) was encouraged to be utilised by the participants to protect their skins from the sun and avoid the exacerbation of hyperpigmentation. Figure 4.11 shows how many of the participants use SPF (Sun Protection Factor) daily.

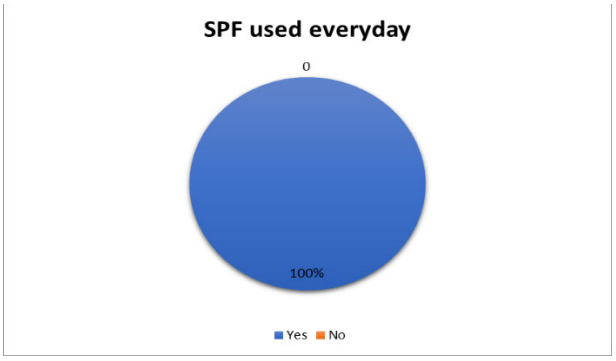

Figure 4.11: SPF Used daily

All n=30 (100%) of participants utilised the SPF daily.

4.4.6 Form of SPF used

There are different forms of SPF, the two different types of SPF are a physical SPF and a chemical SPF. The participants were recommended to use a physical SPF due to less negative interactions that might occur with the use of the provided home-care products as well as sun exposure. Figure 4.12 shows which forms of SPF the participants use daily.

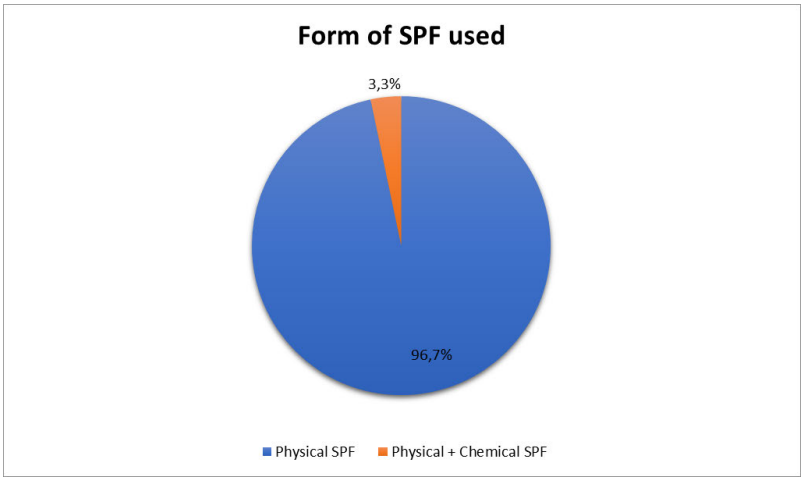

Figure 4.12: Form of SPF used

Results show that 96.7% of participants reported using a physical SPF and 3.3% reported using a Physical and a Chemical SPF.

4.5 Results experienced by participants

Among the participants in the study, each participant received different unique results from the different treatment programs as well as home-care products. Figure 4.13 below shows the different results the participants experienced with their skin treatments and home-care products.

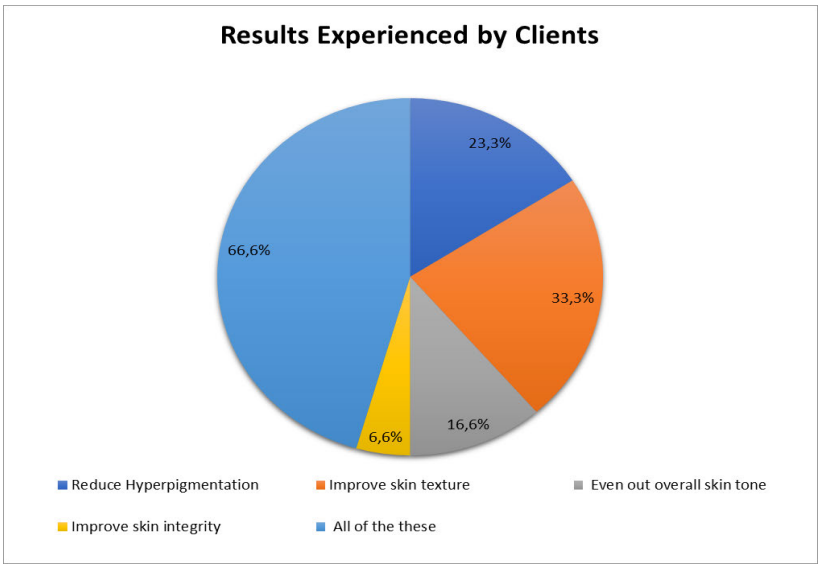

Figure 4.13: Results experienced by clients

Amongst the n=30 participants, 6.6% experienced all the results listed in the questionnaire; 33,3% experienced improved skin texture; 23.3% experienced reduced hyperpigmentation; 16.6% experienced an evened out overall skin tone; and 6.6% experienced improved skin integrity.

4.6 QUALITATIVE DATA ANALYSIS

During the interviews, themes that emerged from the interviews with the 6 participants that were part of the focus group form the basis upon which the analysis is grounded. The themes and sub-themes are presented in the table below and described in more detail in the ensuing discussion.

Table 4.7: Identification of Themes and Sub-themes

Themes	Sub-themes
1. Type of hyperpigmentation.	1.1 How long has the participant been living with the hyperpigmentation and how did it affect their self-esteem
2. Suitable treatment approaches.	2.1 In-house aesthetic treatments performed 2.2 Homecare recommendations
3. Professional that conducted in-house aesthetic treatment.	3.1 Somatologist, aesthetic doctor or advanced skin therapist carried out treatment program

The main underlying motive to conduct interviews with a focus group was to go into depth with the participants' experiences with their treatment journey, as well as the type of pigmentation that was treated, since the participants did not receive generic treatment approaches.

4.6.1 Theme 1 – Type of hyperpigmentation

Participants suffered from different forms of hyperpigmentation, especially the ones mentioned in the study, namely melasma, Post-Inflammatory Hyperpigmentation, Solar lentigines and uneven skin tone.

4.6.1.1 Sub-theme 1.1 - How long has the participant been living with the hyperpigmentation?

"I've had melasma for 3 years and I was always self-conscious about it. I tried different over the counter creams and it did not do anything for me until I went to a place that specializes in skin. I have been on a program for 6 months and there has been so much improvement."

-Participant B.

"After suffering from acne, it leaves dark spots and scars that I did not like. I started having chemical peels and Microneedling after 6 months because I was on acne medication. The results from the two treatments are amazing."

-Participant F.

4.6.2 Theme 2 – Suitable treatment approaches

Ensuring suitable treatment approaches for different skin types is vital due to the fact that all skin is different and should be treated accordingly. Participants received personalized treatment programs that would be suitable for their specific concern, and their skin type was also considered in the process for effective results.

4.6.2.1 Sub-theme 2.1 - In-house aesthetic treatments performed

During in-house treatments at the aesthetic clinics, some participants underwent solely chemo-exfoliation. Other participants underwent chemo-exfoliation together with another aesthetic treatment such as Micro-needling and others would alternate between chemo-exfoliation and another aesthetic treatment to achieve the desired results.

"When I first started treatments at the clinic, I only had chemical peels. I was recommended to alternate my chemical peels with Microneedling after the first month for better results. I am very happy about the outcome."

-Participant F.

4.6.2.2 Sub-theme 2.2 – Home-care recommendations

Home-care was an important aspect within the treatment program to assist in maintaining as well as helping in speeding up the process towards desired effects. Home-care recommendation was different with every participant:

"My main homecare included retinol in the evenings and sunscreen every morning."
-Participant C.

"I was recommended a Vitamin C serum during the day that would be applied before my moisturizer and sunscreen. In the evenings I would apply my night cream that had glutathione and alpha-arbutin."

-Participant A.

4.6.3 Theme 3 - Professional that conducted in-house aesthetic treatment

During the conduction of the in-house aesthetic treatments, it is vital that a Somatologist, aesthetic doctor or an advanced skin therapist performs the treatment because they have the knowledge of the skin, the different skin types, the aesthetic treatments, as well as home-care recommendations to achieve results safely without causing further damage.

4.6.3.1 Sub-theme 3.1 - Somatologist, aesthetic doctor or advanced skin therapist carried out treatment program

"When I visited the skin place there was a doctor who did my consultation on my skin. After that he referred me to his employee who is a Somatologist. She walked me through the treatment plan, what to expect, and what I will need to be using at home. She was very open and honest and I appreciated that."

-Participant D.

4.7 DIFFERENT TREATMENT APPROACHES PERFORMED ON CLIENTS

The participants' documented images were captured using a range of mobile devices, which include Samsung models, as well as Huawei models on two separate occasions. The before images were captured prior to the treatments but during their consultations at the clinics. However, there is inconsistency with the lighting in the images due the treatments not always being carried out in one room.

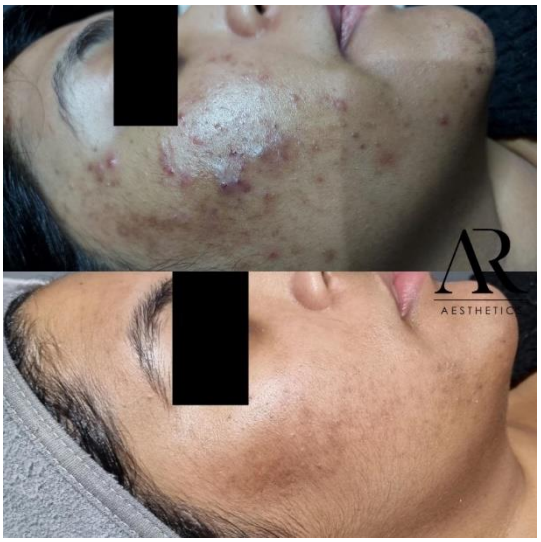

Figure 4.14: Participant during PIH treatment procedure.

4.7.1 Client Skin Concern

The clients' skin presents acne scarring, an uneven skin tone, as well as post-inflammatory hyperpigmentation.

4.7.2 Treatment Plan

The treatment entailed decongesting existing breakouts and bringing down the Inflammation caused by acne using a form of Salicylic Acid. Once the breakouts had subsided and congestion was gone, the researcher started with a light glycolic Acid Peel paired with micro-needling. Skincare was specifically chosen as per ingredient and tailored to the client's skin concerns. Client was given a range of Vitamin C, Retinoid, Hyaluronic Acid, Alpha Arbutin and a healing and repairing Cleanser and Moisturizer. Each of these ingredients was started at different stages of treatment.

The *before* picture on the left was captured before the participant started with her procedures at the clinic. The *after* picture on the right was taken over 8 months into the proposed treatment. A ring light was utilized for a more professional image for the clinic's social media accounts.

Figure 4.15: Participant during hyperpigmentation treatment procedure.

4.7.3 Client Skin Concern

The client's main concerns are severe sun damage, dehydration from excessive sun exposure, acne scarring and uneven skin tone that is presented on the *before* image.

4.7.4 Treatment Plan

Once the skin's barrier was normalized and healthy with home-care, the Somatologist began doing iS Clinical Fire and Ice Facials together with Micro-needling once every 3 to 4 weeks. Home-care consisted of Vitamin C, Retinoid, Alpha Arbutin, Niacinamide and Hydrating Cleanser and Moisturizer.

The *before* picture on the left was captured before the participant started with her procedures at the clinic. The *after* picture on the right was taken 1 month into the proposed treatment, and a ring light was utilized for a more professional image for the clinic's social media accounts.

Figure 4.16: Participant during PIH treatment procedure

4.7.5 Client Skin Concern

The client's main concerns were severe congestion, blackheads and post-inflammatory hyperpigmentation sensitivity from being on previous medication, as presented on the *before* image.

4.7.6 Treatment Plan

A Hydra-facial treatment was conducted to decongest and remove deep set congestion and clogged pores. A few sessions were needed before the client began Platelet-Rich Plasma (PRP) micro-needling to help treat stubborn deep-set scarring that has been there for months to years almost. This was paired with the Fire and Ice Facial to brighten and re-surface the dead layer so that the PRP has maximum absorption.

The *before* picture on the left was captured before the participant started with her procedures at the clinic. The *after* picture on the right was taken 6 months into the proposed treatment, and a ring light was utilized for a more professional image for the clinic's social media accounts.

Figure 4.17: Participant during melasma treatment procedure

4.7.7 Client Skin Concern

The client's concern was the melasma as well as sun damage that are presented on the *before* image.

4.7.8 Treatment Plan

The client initially started doing superficial chemical peels and thereafter moved onto micro-needling on its own, using serums specifically targeting stubborn pigmentation. Ingredients recommended and used with professional and home-care included a Hydrating Cleanser and Moisturizer and a form of Vitamin C, Retinoid and Alpha Arbutin.

The *before* picture on the left was captured before the participant started with her procedures at the clinic. The *after* picture on the right was taken 4 months into the proposed treatment, and a ring light was utilized for a more professional image for the clinic's social media accounts.

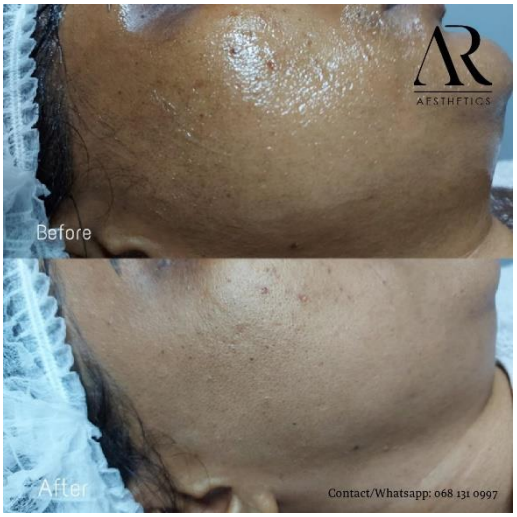

Figure 4.18: Participant during hyperpigmentation treatment procedure

4.7.9 Client Skin Concern

The client's skin presents an uneven skin-tone with peach fuzz as well as sun damage.

4.7.10 Treatment Plan

Glycolic Acid Peels were done once every 3 weeks, together with derma-planning to help re-surface peach fuzz as well as an add on of a Hydro-jelly mask to push products deeper into the skin. Treatments were done separately to avoid sensitivity. Ingredients suggested with home-care were agentle form of Vitamin C, Niacinamide, Alpha Arbutin and Hyaluronic Acid.

The *before* picture on the left was captured before the participant started with her procedures at the clinic. The *after* picture on the right was taken just over 1 month into the proposed treatment, and a ring light was utilized for a more professional image for the clinic's social media accounts.

Figure 4.19: Participant during PIH treatment procedure

4.7.11 Client Skin Concern

Post-inflammatory hyperpigmentation (PIH) from acne and sensitivity was presented on the client's skin.

4.7.12 Treatment Plan

Salicylic Acid Peels to resurface congestion and help treat acne were utilised. Once the acne was treated, the researcher suggested micro-needling to treat scarring immediately and prevent long-term scarring. Ingredients suggested during home-care included Vitamin C, Niacinamide, Hyaluronic Acid and Alpha Arbutin.

The *before* picture on the left was captured by the participant using her Huawei mobile device before she started with her procedures at the clinic. The *after* picture on the right was just over 2 months into the proposed treatment. The participant documented her results on her mobile device.

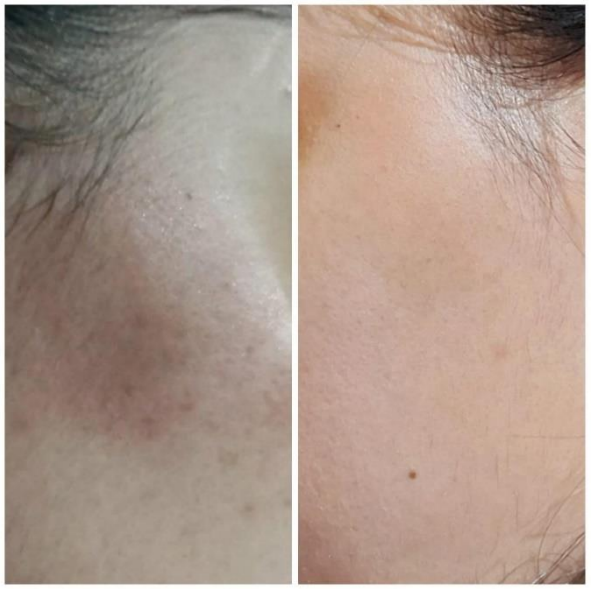

Figure 4.20: Participant during hyperpigmentation treatment procedure

4.7.13 Client Skin Concern

Sun damage due to excessive driving without the use of sun protection is presented on the client's skin.

4.7.14 Treatment Plan

Micro-needling with an iS Clinical Fire and Ice Facial once every 4 weeks was used. Home-care consisted of a healing and repairing facial cleanser and moisturizer due to sensitivity from sun exposure. After 2 weeks, she started her ingredients for home-care, which was Retinoid, Vitamin C, Alpha Arbutin, Hyaluronic Acid, Hydrating Cleanser and Moisturizer to heal sensitivity.

The *before* picture on the left was captured before the participant started with her procedures at the clinic. The *after* picture on the right was taken just over a month into the proposed treatment, and a ring light was utilized for a more professional image for the clinic's social media accounts.

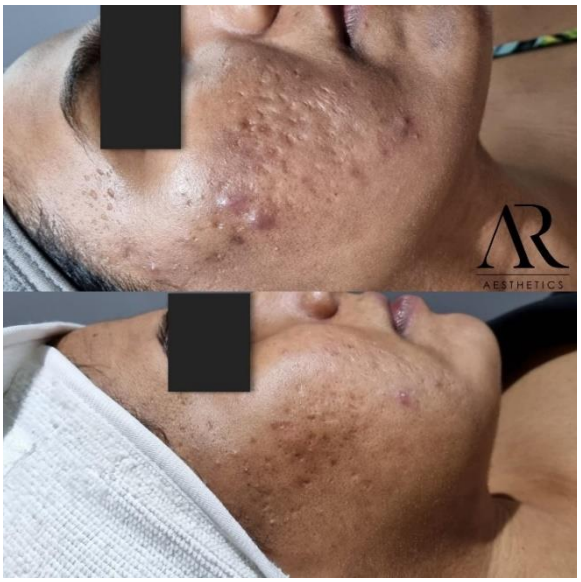

Figure 4.21: Participant during hyperpigmentation treatment procedure

4.7.15 Client Skin Concern

The client presented severe acne scarring, pitted scarring and hyperpigmentation overall from the incorrect use of active ingredients found in home-care products.

4.7.16 Treatment Plan

Micro-needling PRP to treat the deep pigmentation scars and pitted scars was paired with a lower percentage of a Glycolic Acid chemical peel to re-surface dead skin cells for maximum absorption of the PRP. Ingredients suggested included Matrixyl, Hyaluronic Acid, Alpha Arbutin, Retinoid, a form of Vitamin C, Cleanser with Salicylic Acid and a Hydrating Moisturizer.

The *before* picture on the left was captured before the participant started with her procedures at the clinic. The *after* picture on the right was taken 8 months into the proposed treatment, and a ring light was utilized for a more professional image for the clinic's social media accounts.

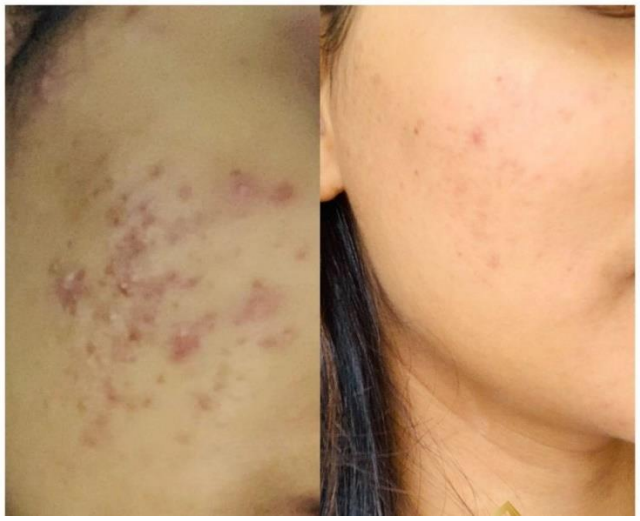

Figure 4.22: Participant during PIH treatment procedure

4.7.17 Client Skin Concerns

Acne scarring, pigmentation, uneven skin-tone as well as post-inflammatory hyperpigmentation (PIH) were the client's main concerns.

4.7.18 Treatment Plan

Micro-needling was paired with a light form of Salicylic Acid Peel to help get rid of the few acne breakouts and micro-needling targeting the stubborn pigmented areas. Ingredients suggested included Niacinamide, Hyaluronic Acid, Alpha Arbutin, Vitamin C with a cleanser than contains low percentage of Salicylic Acid, and a Hydrating Moisturizer.

The *before* picture on the left was captured by the participant using her Huawei mobile device before she started with her procedures at the clinic. The *after* picture on the right was taken just over 3 months into the proposed treatment. The participant documented her results on her mobile device.

4.8 CONCLUSION

Consultation with the participants took place at the aesthetic clinics, where the participant was notified about the research and its purpose. Thereafter, the participants went over the consent form as well as the non-disclosure agreement and signed both before commencing with the questionnaire. All 30 participants completed the questionnaires. Thereafter, focus group interviews with the 6 participants were conducted and the data was collected.

CHAPTER FIVE

DISCUSSION

5.1 INTRODUCTION

The study evaluated the different treatment approaches that were used to treat hyperpigmentation within skin types IV to VI, and explored the safety and efficacy between the in-house aesthetic treatments as well as the recommended home-care. The purpose of the following discussion is to evaluate and assess the results of the study in comparison to similar previous studies. The findings related to the objectives will also be included in the discussion.

5.2 RESULTS DISCUSSED

5.2.1 Demographic Profile

In South Africa, there 79.4% Black Africans, 8.8% Coloureds and 2.6% Indians or Asians (Statistics South Africa. 2021), but there are no accessible statistics on pigmentary disorders. “Little is known about the spectrum of pigmentary disorders in South Africa’s second largest province, *KwaZulu Natal*” (Dlova, 2019: 5). The demographic profile of participants included in this study are males and females with Fitzpatrick skin types VI to VI, aged between 25 to 45 years, with different forms of hyperpigmentation. The gender distribution was n=25 (83.3%) female and n=5 (16.7%) male, and the ethnicity distribution was Black African n=12 (40%), Indian n=12 (40%) and Coloured n=6 (20%).

Justification for the chosen demographics included in the study is as follows:

Skin type: individuals who fall under photo-type IV to VI are “Skin of Colour” individuals. According to Taylor *et al.* (2016), “The term *skin of colour* identifies individuals of particular racial and ethnic groups who share similar cutaneous characteristics and disorders, as well as reaction patterns to those disorders. In general, these individuals have darker skin hues”. These individuals have unique skin disorders, reaction patterns, cutaneous as well as hair characteristics. Additionally, considering as well as understanding structural and functional skin difference will inspire more research concerning the aetiology of disease and therapeutic interventions (Iwuala *et al.*, 2021: 47).

5.2.2 Types of pigmentation

During the study, the types of pigmentation explored were Post-Inflammatory Hyperpigmentation (PIH), Melasma, Solar Lentigines and Other forms of pigmentation that are prevalent within skin types IV to VI. A significant 60% of participants reported having PIH; 23.3% reported Melasma; and 16.7% reported having other forms of pigmentation.

The different types of pigmentation were looked at according to the age of the participant as well as their gender. Localised hyperpigmentation, which may be found on only one or some areas of the face of the individual, is referred to as post-inflammatory hyperpigmentation (PIH). This occurs after an injury to the skin, breakout or from an inflammatory disorder such as psoriasis and eczema. Another cause of localised hyperpigmentation may be from melasma, which is brought on by hormonal changes in most cases (Desai, 2014: 7), as well as solar lentigines from excessive sun exposure without a broad sun protection factor. Diffuse hyperpigmentation tends to be more complex as it is caused by metabolic causes, autoimmune or infectious diseases, as well as certain medications (Desai, 2014: 7).

5.2.3 Treatment approaches

Within the study, the participants reported receiving both in-house aesthetic treatments as well as home-care for effective results in their skin. In-house aesthetic treatments mainly included chemical peels with different acids with different strengths, as well as Micro-needling. A significant 86.7% of participants responded to receiving in-house aesthetic treatments monthly, which is ideal due to the fact that skin renews itself every 27 days (Gardner, 2020).

According to Rattan (2020), in terms of the treatment of hyperpigmentation in skins of colour, extra precaution should be taken due to the skin being easily irritated, resulting in the increase of pigmentation as the skin is trying to protect itself from further damage. Therefore, professional treatments would include micro-needling, gentle chemical peels will be used during treatment, in addition to tyrosinase inhibitors which will be used during treatments as well as at home. With the use of an appropriate treatment plan and home-care regime, the individual could notice improvement in their skin with reduced pigmentation, an evened-out skin tone and reduced fine lines and wrinkles as an additional benefit.

Safety was maintained during the in-house treatments as all 30 participants responded to having had either a Somatologist, aesthetic doctor or an advanced skin therapist conduct their treatment, which helped them feel more comfortable with the process.

5.2.4 Treatment results experienced by participants

During the study, the participants received similar or different results with their treatment journey. Results were dependent on how long the participant has been undergoing their hyperpigmentation treatment protocol; how long the participant has been suffering with their pigmentation; what type of pigmentation the participant is treating, as well as the participant's skin integrity. All 30 participants were pleased with the outcome of the treatment protocols they were on and went as far as referring others to the aesthetic clinics to get assistance from skin professionals. A notable 66,6% experienced all the results listed in the questionnaire; 33,3% experienced improved skin texture; 23,3% experienced reduced hyperpigmentation; 16,6% experienced an evened-out overall skin tone and (6,6%) experienced improved skin integrity.

5.3 CONCLUSION

The study explored the different hyperpigmentation treatment approaches that were offered to individuals with skin types IV to VI. The treatment approaches proved to be a success as participants were pleased with their results. However, the participants did point out that it is a gradual process that needs patience from the professional as well as from the individual that is on the designated treatment plan.

The final chapter follows on the conclusion and recommendations of this research.

CHAPTER SIX

CONCLUSION and RECOMMENDATIONS

6.1 INTRODUCTION

The purpose of this chapter is to present a summary of the study, to draw conclusions based on the findings made, and to identify any recommendations addressing the research findings for present and future research. Recommendations are specifically related to hyperpigmentation treatment approaches amongst skin types IV to VI and their safety. These will attempt to assist professionals such as Somatologists, aesthetic doctors and advanced skin therapists to safely conduct aesthetic treatments on Fitzpatrick skin types VI to VI. Recommendations for further studies will attempt to assist those who wish to broaden the results of the current study. Conclusions for the present study are derived from an analysis of the literature review and previous studies, as well as from the conclusions obtained from the findings.

6.1.1 Safety concerns

During these popular professional treatment approaches amongst skin types IV to VI, the safety concern is where individuals are concerned about any adverse effects such as the worsening of the pigmentation and irreversible skin traumas if the treatment is not conducted gradually by a professional. The skin and beauty industry has many black-market quick fixes which contain harmful ingredients in them, as well as inexperienced individuals who are less knowledgeable

on the skin who conduct hyperpigmentation treatment approaches aggressively, not looking at the individual's skin integrity, the cause of the pigmentation and how long they have had it. Appropriate regulation of the skin and beauty industry is a major concern as detrimental outcomes can be avoided amongst consumers. Participants in this study were concerned about the educational background of the professional that would conduct their treatment and asked many questions on how the professional will be treating their skin, what they will be using and they use the chosen products. However, the participants felt more confident in the professionals after they learned of their educational background and the recommendations they would receive, which had a positive outcome on their skin.

6.2 RECOMMENDATIONS

The following recommendations are based on the findings and conclusions derived from the study and experiences of the participants who participated in this study.

6.2.1 Recommendations for further study

- It is recommended that more studies as well as clinical trials be conducted on Fitzpatrick skin types IV to VI do determine safe and effective ways for skin treatments in South Africa.
- Long-term effects on skin types IV to VI undergoing hyperpigmentation treatment approaches need to be explored.
- Long-term effects on skin types IV to VI of tyrosinase inhibitors needs further study.

6.3 CONCLUSION

According to previous research and studies, there are different forms of hyperpigmentation that may be caused by different stimuli such as UV exposure, hormones, medications, inflammation and trauma to the skin. As skin is different, it should be treated as such as there is no generic way to treat and get rid of any form of hyperpigmentation on the skin. Individuals who fall under Fitzpatrick skin types VI to VI need to be treated gradually as extra precautions should be taken due to the skin being easily irritated, resulting in the increase of pigmentation as the skin is trying to protect itself from further damage. Within aesthetic treatments, the popular professional treatments would include micro-needling and gentle chemical peels in conjunction with safe tyrosinase inhibitors with a Sun Protection Factor (SPF) that will be used at home for effective results.

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APPENDIX A: LETTER OF INFORMATION

Dear Research Participant

Title of the Research Study: A Study on the Management of Hyperpigmentation in Skin types IV to VI at Aesthetic Clinics in eThekwini, KwaZulu-Natal.
Principal Investigator/s/researcher: Simphiwe Nokwanda Memela

Co-Investigator/s/supervisor/s:

1. Dr S Ghuman (PhD)
2. Mrs. L. C Bellato (MHSc: Somatology)

Brief Introduction and Purpose of the Study:

My name is Simphiwe Memela, I am a student at the Durban University of Technology and I will be doing my research for my MHSc: Somatology. The research topic for my MHSc dissertation is: A Study on the Management of Hyperpigmentation in Skin types IV to VI at Aesthetic Clinics in eThekwini, KwaZulu-Natal.

I would like to invite the participant to participate in the research based on the participant's current hyperpigmentation treatment program as well as the participant's prescribed homecare products from the Somatologist/aesthetic doctor that conducts your treatment. A coded questionnaire will be provided for the potential participants to fill out, as well as recorded focus group interviews with a duration of 15 minutes will be conducted on randomly selected participants. Confidentiality and anonymity will be strictly maintained.

Research is a systematic search or enquiry for generalized new knowledge, the research I will be conducting will aid in providing further knowledge and guidelines when it comes to the treatment of hyperpigmentation, to achieve the desired results safely and effectively.

Kindly note, a copy of the Letter of Information document will be given to the participant to take home.

If the participant requires any further information, please do not hesitate to contact the researcher (068 248 5193 / snmemela95@gmail.com).

Yours sincerely,

Simphiwe N Memela (Miss)
Durban University of Technology

Outline of the Procedures: The aesthetic clinic owner will be briefed on the study during the meeting and a questionnaire will be filled out. The participant will be provided with a code to maintain confidentiality when filling out the questionnaire, the whole process will be 15 minutes long and no treatment will be conducted. Only data will be gathered using the questionnaires filled out as well as the previous treatment records. Thereafter randomly selected participants will be part of one on one recorded interviews for more information, confidentiality and anonymity will be maintained throughout.

Inclusion Criteria:

- Participants under type IV to VI on the Fitzpatrick scale
- Participants already undergoing hyperpigmentation treatment and home care products
- Participants aged 25 - 45 years old
- Participants in eThekwini Municipality

Exclusion Criteria:

- Participants that do not fall under Fitzpatrick scale type IV to VI
- Participants not on hyperpigmentation treatment and/or home care products
- Participants on certain medication (e.g. Contraceptive Pill)

- Participants not in eThekwini Municipality

Study Population Sampling:

- Participants undergoing hyperpigmentation treatment and management.
- For questionnaires; 30 Participants (15 from clinic A and 15 from clinic B).

- For interviews; 6 Participants of random selection will be interviewed.

Risks or Discomforts to the Participant: No harm will be inflicted on the participant.

Explain to the participant the reasons he/she may be withdraw from the Study: The research may be terminated early in particular circumstances e.g. Non-compliance. The participant is entitled to withdraw from the study at any time should they wish to do so. The potential participant may be terminated early in particular circumstances. The researcher may, under certain circumstances, decide to withdraw the participant from the study due to non-compliance.

Benefits: Gain clarity on the suitable treatment approaches when it comes to treating hyperpigmentation safely and effectively.

Remuneration: No remuneration will be awarded.

Costs of the Study: No cost will be required from the participant.

Confidentiality: The filled out questionnaires will be coded to maintain anonymity, only the researcher and the supervisors will have access to these.

Results: Data collected from the questionnaires will be analysed with the software SPSS and used to rule out safe and effective ways to treat hyperpigmentation.

Research-related Injury: No injuries will be expected, as no treatment is conducted.

Storage of all electronic and hard copies including tape recordings: The final dissertation as well as the recordings and questionnaires will be stored in the Department of Somatology. Only the researcher, supervisors and moderators will have access to the dissertation.

Persons to contact in the Event of Any Problems or Queries:

Please Contact:

1. Researcher: Simphiwe N Memela (0682485193 / snmemela95@gmail.com)
2. Supervisor: Dr S Ghuman (0313732807 / shanazg@dut.ac.za)

Or the Institutional Research Ethics Administrator on 031 373 2375. Complaints can be reported to the Director: Research and Postgraduate Support Dr L Linganiso on 031 373 2577 or researchdirector@dut.ac.za.

APPENDIX B: CONSENT FORM

Full Title of the Study: A Study on the Management of Hyperpigmentation in Skin types IV to VI at Aesthetic Clinics in eThekwini, KwaZulu-Natal.

Names of Researcher/s: Simphiwe Nokwanda Memela.

Statement of Agreement to Participate in the Research Study:

 I hereby confirm that I have been informed by the researcher, Simphiwe Nokwanda Memela, about the nature, conduct, benefits and risks of this study - Research Ethics Clearance Number: _____,

 I have received, read and understood the above written information (Participant Letter of Information) regarding the study.

 I am aware that the results of the study, including personal details regarding my sex, age, date of birth, initials and diagnosis will be anonymously processed into a study report.

 In view of the requirements of research, I agree that the data collected during this study can be processed in a computerised system by the researcher.

 I may, at any stage, without prejudice, withdraw my consent and participation in the study.

 I have had sufficient opportunity to ask questions and (of my own free will) declare myself prepared to participate in the study.

 I understand that significant new findings developed during the course of this research which may relate to my participation will be made available to me.

I, Simphiwe N Memela confirm that the participant has been fully informed about the nature, conduct and risks of the above study.

_____ _____ _____ _____

Participant's Full Name **Date** **Time** **Signature**

_____ _____ _____ _____

Witness' Full Name **Date** **Time** **Signature**

APPENDIX C: LETTER TO GATEKEEPER CONDUCT RESEARCH

03 March 18, 2021

Request for Permission to Conduct Research

Dear Doctor/Aesthetic Clinic Owner

My name is Simphiwe Memela, a MHSc: Somatology student at the Durban University of Technology. The research topic is for my MHSc dissertation is: A Study on the Management of Hyperpigmentation in Skin types IV to VI at Aesthetic Clinics in eThekwini, KwaZulu-Natal.

I am hereby seeking your consent to conduct my research study at your aesthetic clinic with your patients/clients who will be asked to give permission and participate voluntarily once informed consent is provided to them, as well as to review their current hyperpigmentation management program. A coded questionnaire will be provided for the potential participants to fill out and confidentiality and anonymity will be strictly maintained. Thereafter randomly selected participants will go in to the focus group interview phase for further information.

I have provided you with a copy of my proposal which includes a copy of the data collection tool and informed consent forms to be used in the research process, and will provide you with a copy of the approval letter which I received from the Institutional Research Ethics Committee (IREC).

If you require any further information, please do not hesitate to contact me (068 248 5193 / snmemela95@gmail.com). Thank you for your time and consideration on this matter.

Yours sincerely,

Simphiwe N Memela (Miss)
Durban University of Technology

APPENDIX D: ADVERT FOR PARTICIPANTS

Are you suffering from uneven skin tone (Hyperpigmentation)? This is for <u>YOU.</u>

[Greenfield, J. 2021. The 6 Best Dark Spot Correctors for Black and Brown Skin (*Image*)]

Are you:

- Currently suffering with hyperpigmentation
- Undergoing hyperpigmentation treatment with a dermatologist
- Not on the contraceptive/hormone medication
- Between 25 and 45 years old

If you answered “YES” to the questions above, please contact me for further information.

Simmi Memela

Cell: 068 248 5193
WhatsApp: 084 015 3246
Email: snmemela95@gmail.com

APPENDIX E: QUESTIONNAIRE

Q01

A Study on the Management of Hyperpigmentation in Skin types IV to VI at Aesthetic Clinics in eThekwini, KwaZulu-Natal

INSTRUCTIONS:

Please answer the provided questions truthfully and objectively as possible, where appropriate kindly explain further. Kindly CROSS ('X') the box that applies to you.

SECTION A: DERMOGRAPHICS

Please mark the appropriate box with a 'X'

1. **Please select your ethnicity:**

0	African	
1	Asian	
2	Coloured	
3	Indian	

2. **Please select the appropriate age box:**

0	25 – 30 Years Old	
1	30 – 35 Years Old	
2	35 – 40 Years Old	
3	45 Years Old	

3. **Please select your gender:**

0	Male	
1	Female	
2	Other	

☐ Other (Please specify):

SECTION B: TREATMENT HISTORY

3. **What type of pigmentation do you suffer from? Kindly elaborate on how long have you had this form of pigmentation and has it worsened or remained the same?**

0	Post Inflammatory Hyperpigmentation (PIH)	
1	Melasma	
2	Solar Lentigines (Age/Liver Spots)	
3	Other (Please specify)	

4. **How often do/did you have a chemical peel/ skin treatment?**

0	Once a Week	
1	Twice a Week	
2	Monthly	
3	Rarely	

5. **Which acid as well as the percentage is used during the chemical peel:**

0	Azelaic Acid	
1	Glycolic Acid	
2	Lactic Acid	
3	Mandelic Acid	
4	Salicylic Acid	
5	Other	

6. **Were the treatment benefits discussed to you? Kindly list the benefits;**

0	Yes	
1	No	

7. **How long has the patient/client been undergoing hyperpigmentation treatment? How often were the treatments conducted? Kindly elaborate;**

0	Over 3 Months	
1	Over 6 Months	
2	Over 9 Months	
3	Over 1 Year	

8. **Did a Somatologist, aesthetic therapist or an aesthetic doctor? If 'No' were you made aware of the profession of the person who conducted the treatment?**

0	Yes	
1	No	

9. **Is there any other form of therapy you use together with a chemical peel/skin treatment? If so, what was the duration and did you find that it was effective?**

0	IPL Therapy	
1	CIT/Micro Needling	
2	Microdermabrasion	
3	None	
4	Other	

10. **Would you recommend undergoing hyperpigmentation treatment program to others? Kindly elaborate why as well as your experience:**

0	Yes	
1	No	

11. **Did you purchase any homecare products and were homecare products recommended? If yes, please list:**

12. **Do the homecare products include any of the following ingredients? Kindly elaborate if you aware of the role of these ingredients:**

0	Alpha Arbutin	
1	Ferulic Acid	
2	Kojic DIpalmitate	
3	Glutathione	
4	N-Acetyl Glucosamine	
5	Retinol	
6	Vitamin C	

13. **Is a SPF50 used every day, if 'No' which other SPF is used:**

0	Yes	
1	No	
2	Other	

14. **Which SPF is used, elaborate on whether you were aware there are two different types of SPF and the differences:**

0	Physical SPF	
1	Chemical SPF	

15. **Did the treatment help with the following (Cross 'X' Yes/No) Kindly elaborated on how you feel the treatment helped:**

a) Reduce Hyperpigmentation.	Yes	0	No	1
b) Improve skin texture.	Yes	0	No	1
c) Even out overall skin tone.	Yes	0	No	1
d) Improve skin integrity.	Yes	0	No	1
e) All of the above.	Yes	0	No	1

Thank You for Participating! ☺

F01

ANNEXURE F: INTERVIEW QUESTIONS

A Study on the Management of Hyperpigmentation in Skin types IV to VI at Aesthetic Clinics in eThekwini, KwaZulu-Natal

INSTRUCTIONS:

The following interview will be recorded. Please answer the provided questions truthfully and objectively as possible, where appropriate kindly explain further.

1. **When did you start noticing the hyperpigmentation on your skin and how long have you been living with the condition?**

2. **What is the most important consideration when selecting an aesthetic clinic/spa?**

3. **Kindly specify the treatment that was performed to manage your hyperpigmentation.**

4. **Are you satisfied with the results from your hyperpigmentation management program, and have the results boosted your self-esteem? Kindly elaborate.**

5. **What other hyperpigmentation management approaches have you tried before consulting with a dermatologist/somatologist?**

ANNEXURE G: NON-DISCLOSURE AGREEMENT

A Study on the Management of Hyperpigmentation in Skin Types IV to VI at Aesthetic Clinics in eThekwini, KwaZulu-Natal

This is a non-disclosure agreement (NDA) between the researcher (Ms. S N Memela), the supervisor (Dr S Ghuman), the co-supervisor (Mrs. L C Bellato) and the research participant.

I, Ms. S N Memela agree to:

1. Maintain confidentiality and anonymity throughout the research study, information will only be shared with the supervisor (Dr S Ghuman).
2. The data collected during the research study will be kept safe and once completed, will be kept at the Durban University of Technology in a safe at the Department of Somatology for five years. Thereafter the data and information will be destroyed.
3. Questionnaires, interview recordings will not be shared with anyone but the supervisor.
4. Participants are required not to share any information regarding the research study, conducted questionnaires and interviews.

Researcher:

_____	_____	_____
(Print Name)	(Signature)	(Date)

Supervisor:

_____	_____	_____
(Print Name)	(Signature)	(Date)

Research Participant:

_____	_____	_____
(Print Name)	(Signature)	(Date)

APPENDIX H: ACKNOWLEDGEMENT OF RECEIPT OF APPLICATION FOR ETHICAL APPROVAL

Institutional Research Ethics Committee
Research and Postgraduate Support Directorate
2nd Floor, Berwyn Court
Gate 1, Steve Biko Campus
Durban University of Technology

P O Box 1334, Durban, South Africa, 4001

Tel: 031 373 2375 Email:
lavishad@dut.ac.za

http://www.dut.ac.za/research/institutional_research_ethics

www.dut.ac.za

3 December 2021

Ms S N Memela
P.O Box 18
Empangeni
3880

Dear Ms Memela

ACKNOWLEDGEMENT OF RECEIPT OF APPLICATION FOR ETHICAL APPROVAL

Title: A Study on the hyperpigmentation in Skin Types to IV to VI at Aesthetic Clinics in eThekwini, KwaZulu-Natal.

The Institutional Research Ethics Committee acknowledges receipt of your research proposal received on 1 December 2021 which is to be reviewed via the expedited process.

PLEASE NOTE THAT THIS IS NOT AN ETHICS APPROVAL LETTER

Yours Sincerely

Prof J K Adam
Chairperson: IREC

APPENDIX I: PROVISIONAL IREC APPROVAL

Institutional Research Ethics Committee
Research and Postgraduate Support Directorate
2nd Floor, Berwyn Court
Gate 1, Steve Biko Campus
Durban University of Technology

P O Box 1334, Durban, South Africa, 4001

Tel: 031 373 2375 Email:
lavishad@dut.ac.za
http://www.dut.ac.za/research/institutional_research_ethics

www.dut.ac.za

31 January 2022

Ms S N Memela
P.O. Box 18
Empangeni
3880

Dear Ms Memela

A Study on the Management of Hyperpigmentation in Skin Types IV to VI at Aesthetic Clinics in eThekwini, KwaZulu-Natal.

NOTE: With Respect to all research protocols that require Community Engagement (CE) (students, patients, Health care workers, rural and urban communities, etc.) a*ll IREC approved researchers, supervisors and applicants must be familiar with prevailing SA Department of Health DOH COVID-19 Infection Prevention and Control Guidelines and the Disaster Management Act Relating to COVID-19. All adverse events in any IREC-approved study, including COVID-19 infections of researchers and research participants, research staff or related parties must be reported to IREC within 7 days or less of occurrence on the standard IREC SAE report in the midst of the Covid-19 pandemic the IREC respects the call by Government of social distancing and practice of all safety requirements. These regulations must be adhered to especially when interacting with potential research participants*

Please be advised that your research proposal was reviewed, and the following decision was made:

Provisional approval subject to minor changes to the satisfaction of the IREC chair

1. Page 5: Research design – point 3 mentions the use of a semi-structured questionnaire. The researcher is using a qualitative research design and cannot use a questionnaire. Questionnaires are instruments for quantitative data collection. This should be changed to interview schedule, interview guide, etc.
2. The researcher also states that a census sample size will be used. Please clarify.
3. The researcher should clearly indicate the research design that will be used for this study.
4. The researcher should clearly indicate the sample size for quantitative and qualitative aspect of the study.

5. State duration of these interviews.

6. State how long it will take the participants to complete the questionnaires.
7. Clearly state the data analysis method that will be used for the study.
8. Page 5: Recruitment – the last statement under "Recruitment" is confusing. The researcher should be clear on whether they are targeting 2 clinics (A and B) or 6 clinics. This should be mentioned with clarity.
9. Page 5: Inclusion criteria – point 4 indicates that "individuals in KwaZulu-Natal" will be included. This should be changed to "individuals in the eThekwini Municipality" because the study uses a case of clinics in the municipality, and not across KwaZulu-Natal. Point 4 under exclusion criteria should also be rephrased.
10. The researcher interchangeably uses the words participants/patients/clients. After indicating that participants are clients of selected aesthetic clinics, the term "participant" should be consistently used throughout the study.

11. 34 Questions: It is suggested that where comments are given, the researcher should write these comments as full sentences so that they can make adequate sense. Currently, the comments are too shortened and may be interpreted differently. For example, in question 32, the comment should read "The researcher will obtain permission to collect data from the owner/manager of each clinic". This is better than just writing "From clinic owner/manager". This applies to all other comments given, they should be written in full.
12. Ethics Checklist:
    - No. 6: Remove comments.
    - No. 15: Add comments and thereafter make reference to the document. ➢ No. 16: Results should be made available to all those interested.
13. The researcher must use the updated version of the PG2a.
14. Letter of Information:
    - Page 21: Letter of information – the research title given under "Brief introduction and purpose of the study" is not complete. The title should be written in full throughout the study, every time it is mentioned.
    - Page 21: Letter of information – the fourth bullet points for inclusion and exclusion criteria should be corrected as mentioned above.
    - Letter of information must be directly addressed to the participants
15. Appendix E: This appendix contains a questionnaire with closed-ended questions (Likert scale and dichotomous). Surely this is quantitative data being collected yet the researcher indicated they will be using a qualitative design. The research design should be changed from qualitative to mixed method because both qualitative and quantitative data are collected. Further, the analysis of the quantitative component of the data should also be given.
16. Gatekeeper letter must be addressed to the relevant gatekeeper.

Please submit the amended proposal with a cover letter to the IREC administrator; this document must reach the IREC as soon as possible but not more than 6 months from 31 January 2022. Please note that research on the proposed project may not proceed until you receive Full Approval from the IREC.

Yours Sincerely

Prof J K Adam
Chairperson: IRE C