Section: Anatomy

Original Research Article

AGE RELATED CHANGES IN NUMBER OF RETE PEGS AND DERMO-EPIDERMAL JUNCTION IN HUMAN SKIN– A MORPHOMETRIC STUDY

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ABSTRACT

Background: Skin is a major sensory organ reflecting the earliest signs of various systemic disorders. Skin has 2 layers, the epidermis and dermis. Dermis is split into upper papillary layer and the lower reticular layer. The papillary layer of the dermis invaginates into the epidermis forming the dermal papillae. The deeper layer of the dermis is the reticular layer which contains dense irregular connective tissue. Between the dermal papillae, the portion of the epidermis into the dermis is the epidermal papillae (Rete Pegs). With increasing age, epidermis and dermis undergoes atrophy. This produces changes in the external appearance, microscopic structure and also the functions of the skin. Atrophy in the epidermis is reflected as thinning, loss of basal Rete Pegs, flattening of the Dermo- Epidermal junction. It undergoes series of changes as age advances which can be studied microscopically. **Aim of the study:** The aim is to study the changes in number and depth of the rete pegs and Changes in the nature of Dermo-Epidermal junction as age advances.
Materials and Methods: Skin was obtained from the plastic surgery department in 10% formalin bottle. Normal skin was obtained from both males and females from 3 years to 75 years of age from different parts of the body except palm and sole.Skin specimens were grouped into 4 age groups, Group A (3 to 20yrs), Group B (21 to 50 yrs), Group C (51 to 65yrs and Group D (>65trs). Tissues were processed and slides were prepared. Slides were subjected to Haematoxylin and Eosin stain and changes in the number and the depth of the Rete Pegs and the nature of the Dermo-Epidermal junction was noted.
Results: The number of Rete pegs were found to be reduced as age advances resulting in the flattening of the dermo-epidermal junction.
Conclusion: The reduction in the number of dermal papillae produces flattening of the Dermo-Epidermal interface predisposing the skin of the aged individuals to bulla formation and various shear type of injuries.
Keywords: Rete pegs, Dermo-Epidermal Junction.

INTRODUCTION

Skin is a complex organ forming 8% of the total body mass, which interacts with the environment and also protects the host from the external environment. It acts as an effective barrier against microbial invasion and maintains body temperature. It is a major sensory organ reflecting the earliest signs of various systemic disorders. It undergoes series of changes as age advances which can be studied microscopically in the various layers of the skin. These changes are reflected externally as wrinkling, dryness, loss of elasticity and various changes.[1] Skin has mainly two layers called epidermis and dermis. The layers of epidermis from deep to superficial are as follows. The Basal layer (Stratum basale), spinous or prickle cell layer (Stratum spinosum), Granular layer (Stratum granulosum, Clear cell layer (Stratum lucidum) and cornified layer (Stratum corneum).[2]
Dermis present below the epidermis is an irregular light staining connective tissue. The papillary layer

of the dermis invaginates into the epidermis forming the dermal papillae. The deeper layer of the dermis is the reticular layer which contains dense irregular connective tissue. Between the dermal papillae, the portion of the epidermis into the dermis is the epidermal papillae (Rete Pegs).[3]

With increasing age, epidermis and dermis undergoes atrophy. This produces changes in the external appearance, microscopic structure and also the functions of the skin. Atrophy in the epidermis is reflected as thinning, loss of basal Rete Pegs, flattening of the Dermo- Epidermal junction etc. Since there is minimal change in the thickness of the cornified layer in old age, the permeability of the skin is little affected. The rate of replacement of the cells in the superficial layer is reduced up to 50%. In the skin of elderly persons, the microscopic changes in the dermis are reflected externally as wrinkling, flaccidity, stiffness and loss of elasticity. The production of fibroblast is decreased and hence the collagen synthesis is also decreased. With increasing age, the vascularity of the skin is reduced. The papillary loops present in the dermal papillae are affected. The cutaneous microvasculature becomes fragile which is indicated by the increasing tendency towards small spontaneous purpuric haemorrhages.[5]

Since skin is the major sensory organ and it forms eight percent of the total body mass and also the microstructure of epidermis and dermis is altered and reflected externally with increasing age, it would be absolutely necessary to study the various changes that occur in the micro structure of the rete pegs and Dermo – Epidermal junction and the skin appendages.[8]

Aims and Objective

1. The changes in number and depth of the rete pegs.
2. Changes in the nature of Dermo-Epidermal junction as age advances

MATERIALS AND METHODS

Study Design: Cross sectional study

Study Population

Inclusion Criteria

All patients who are undergoing surgery, skin Grafting (full thickness), Flap surgery, Wound closure (irregular wound closure) who are willing to give a bit of skin tissue (discarded skin) from any part of the body except palm and sole.

Exclusion Criteria

Patients having skin lesions,

All patients having venous ulcers, diabetic ulcers, ischemic ulcers and gangrene.

Sample Size & Sampling Technique

Sample Size

(3-15yrs)-5,(15-30yrs)-10,(30-45yrs)-10,(45-60yrs)-15,(>65yrs)-10. It's a convenient sample size. So no sampling technique is involved in the study.

Study Period

This study was done after obtaining clearance from the ethics committee for a period of one year.

Methodology

Skin was obtained from the plastic surgery department in 10% formalin bottle. Approval from ethics committee and informed consent was obtained from the patient. Normal skin was obtained from both males and females from 3 years to 75 years of age from different parts of the body except palm and sole. Changes in the number and depth of the rete pegs and the nature of the Dermo – Epidermal junction was studied from the skin samples of different ages in the extensor aspect of the leg. The specimens were fixed in formalin for 24 hours and processed in series of alcoholic changes and xylene. The specimen was dehydrated by placing it in wax in the incubator overnight and embedded in wax. Blocks were prepared. Then the blocks were cut in microtome of 0.4 microns thickness and placed in glass slide. The slides were placed in incubator overnight for removal of wax. The next day the slides were stained with Haematoxylin and Eosin by the following procedure.

The slides were placed in xylene for 30minutes for dewaxing. Slides were hydrated in series of alcoholic changes for 1minute each, in absolute alcohol, 90%, 70% and 50% alcohol. Then stained with Haematoxylin for 3 minutes and rinsed in running water following which the slides were differentiated in 0.3% acid alcohol. Then the slides were rinsed in running tap water for 10 minutes, stained with Eosin, dehydrated in absolute alcohol, cleared in xylene with alcohol and mounted. The slides were stained with Haematoxylin and Eosin and the changes in the number and depth of the rete pegs and the nature of the Dermo – Epidermal junction was observed.

RESULTS

The changes in the skin with increasing age are a complex process. The structural changes lead to disturbances in the functions of the skin, making the skin susceptible to various diseases. So microscopic structural changes in the layers of the skin were studied by grouping the individuals in 4 age groups.

Group A: Skin specimens from 5 persons of 3 to 20 years of age of which 2 specimens were from females and 4 from males.

Group B: Skin specimens from 12 persons of 21 to 50 years of age of which 3 specimens were from females and 9 were from males.

Group C: Skin specimens from 8 persons of 51 to 65 years of age of which 5 specimens were from females and 3 specimens were from males.

Group D: Skin specimens from 4 persons of more than 65 years of which 3 specimens were from females and 1 from male.

The microscopic changes in the epidermis, Dermo-Epidermal junction and the number and the depth of Rete Pegs and nature of the Dermo – Epidermal junction were observed in the Haematoxylin and Eosin stained slides.

Group A: 3 to 20 years of age.

NO of rete pegs – 11 as in Fig(1).

The depth of the Rete Pegs were more Fig(1).

Dermo-Epidermal junction was convoluted Fig(1)

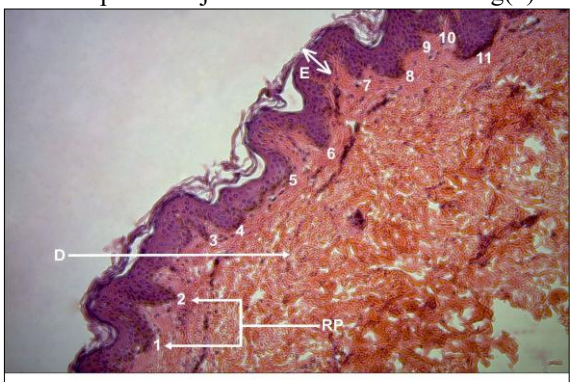


Figure 1: Group A : 3-20 Years (10x X 10)
E : Epidermis (Thin) D : Dermis RP : 11 Rete Pegs

GROUP B: 21 to 50 years of age

Group B: 21 to 30 years of age

No of rete pegs – 11(fig 4)

The depth of the Rete Pegs was less and the Dermo-Epidermal junction was highly convoluted as found in fig(4).

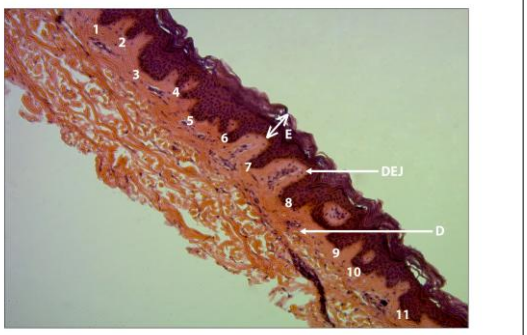


Figure 4 : Group B : 21-30 Years (10x X 10)
E : Epidermis (Thick) D : Dermis DEJ : Dermo - Epidermal Junction (Highly Convoluted)
RP : 11 Rete Pegs

Group B: 31 to 40 years of age

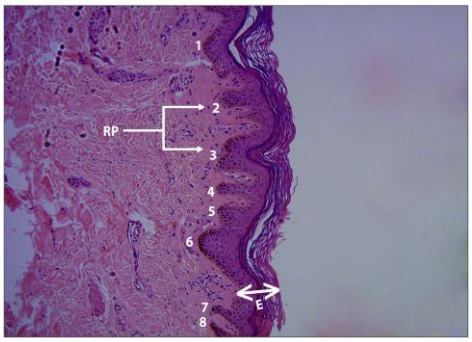


Figure 6 : Group B : 31- 40 Years (10x X 10)
RP : 8 Rete Pegs E : Epidermis (Thick)

Group B: 41 to 50 years of age

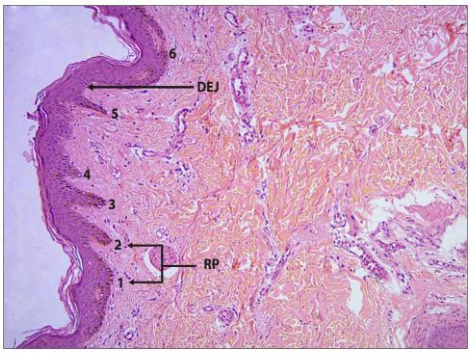


Figure 8 : Group B : 41- 50 Years (10x X 10)
RP : 6 Rete Pegs DEJ : Dermo - Epidermal Junction (Convoluted)

RETE PEGS AND DERMO-EPIDERMAL JUNCTION: GROUP B

The average number of Rete Pegs among Group B individuals from 21-50years of age was as found in the following Table 1.

Table 1

AGE GROUP (in years)	NUMBER OF RETE PEGS	FIGURE NUMBER
21 – 30	11	Fig (4)
31 – 40	8	Fig (6)
41 – 50	6	Fi Fig (8)

The number of Rete Pegs was more and the depth of the Rete Pegs of Group B from 21-30 years was similar to Group A persons from 3-20years as found in Fig (4) and fig (5) and the Dermo-Epidermal junction was convoluted similar to Group A individuals from 3-20years of age as found in Fig (4). In Group B persons from 31- 40 years of age less number of Rete Pegs was noted as in Fig (6) and the depth of the Rete Pegs was more as found in Fig (6). In Group B from 41-50 years also the number of Rete Pegs was found to be reduced, but the Dermo-Epidermal junction was convoluted as found in Fig (8).

GROUP C: 51 to 65 years of age

The average number of Rete Pegs - 5 to 6.

The depth of the Rete Pegs was reduced.

The Dermo-Epidermal junction was less convoluted compared to group B individual.(Fig 10).

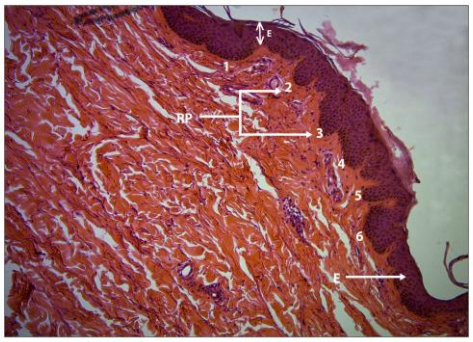


Figure 10 : Group C : 51 - 65 Years (10x X 10)
RP : 6 Rete Pegs (Reduced Depth) E : Epidermis (Thin)

GROUP D: > 65 YEARS OF AGE

The number of Rete Pegs was absolutely nil or 1- 2 Rete Pegs.

The Dermo-Epidermal junction was almost flat.(FIG 14)

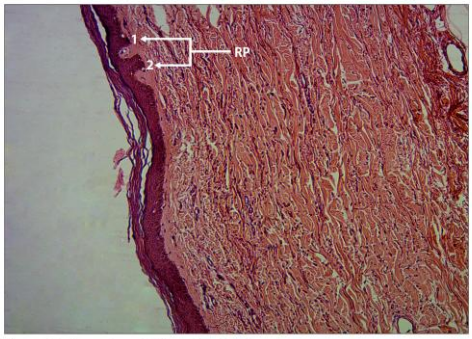


Figure 14 : Group D : > 65 Years (10x X 10)
RP : 2 Rete Pegs

RETE PEGS

The difference in the number of Rete Pegs among Group A persons from 3-20years, Group B persons from 21-50 years, Group C persons from 51-65years and Group D persons > 65 years of age was tabulated in Table 2.

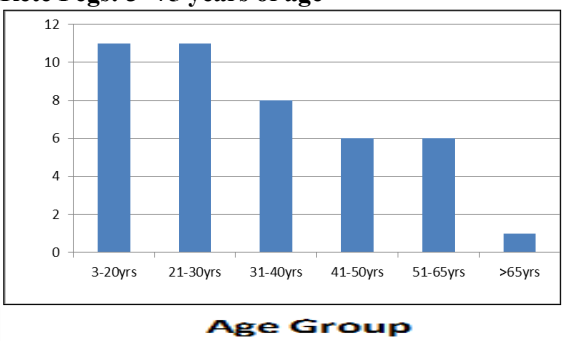
Table 2: Rete Pegs

AGE GROUP (in years)	NUMBER OF RETE PEGS	FIGURE NUMBER
3 -20	11	Fig (1)
21 – 30	11	Fig (4)
31 – 40	8	Fig (6)
41 – 50	6	F Fig (8)
51 - 65	6	F Fig (10)
>65	1	F Fig (14)

The number of Rete Pegs was found to increase in Group A persons of 3-21years and in Group B persons from 21-30years.

The number was found to get reduced in Group B persons from 31years of age with marked decrease in Group C persons of 51-65 Years of age. In Group D persons of more than 65 years the number of Rete Pegs was almost absent or only one or two in number as represented in the bar diagram.

Rete Pegs: 3- 75 years of age



DISCUSSION

The various changes observed microscopically in the structure of the layers of the skin and skin appendages produces changes in the structure and functions of the skin which is mainly reflected in old age. As the average life expectancy keeps increasing, this becomes an increasing problem for the dermatologists. Most of the studies have quoted little or no difference in the structure of the epidermis and dermis in different areas of the body. But difference has been noted in the sun exposed and non-exposed areas.

Robert M Lavker (1987) has described the microscopic features of the skin of individuals of different age groups which reveals the thinner epidermis in older individuals due to retraction of Rete Pegs. Retraction of Rete Pegs leads to flattening of the Dermo-Epidermal junction.

Similar to the above report in the present study also, the epidermis was observed to be reduced in thickness and was found to be very thin in older individuals and it was also observed that the Rete Pegs were retracted, which was leading to flattening of the Dermo-Epidermal junction.[1]

W. Montagna (1990) has reported that the Dermo-Epidermal junction started to get flatten in old age. The Rete Pegs were reduced and also very blunt instead of complete disappearance.

In the present study the Dermo-Epidermal junction was found to be flattened and the Rete Pegs were observed to be blunt because of the decrease in the depth of the Rete Pegs.[2]

Esmat Z. Gheith (1991) has reported that the Dermo-Epidermal junction was undulating in Group 1 between 20-40yrs, but in Group 2(40-60) and Group 3(60-75) the Dermo-Epidermal junction was flattened.

These findings correlated with the present study as in Group A from 3-20years, the numbers of Rete Pegs were more and the Dermo-Epidermal junction was highly convoluted. In Group B individuals between 21-50yrs of age, the Dermo-Epidermal junction was convoluted similar to Group A persons of 3-20 years of age and it was observed that there was no difference in the Dermo-Epidermal junction among the Group B individuals between 21-30, 31-40 and 41-50yrs age group. In Group C the number of Rete Pegs was found to be reduced and the Dermo-Epidermal junction was found to be less convoluted. In Group D individuals of more than 65 yrs of age, there were no Rete Pegs and the Dermo-Epidermal junction was almost flattened.[3]

Neerken S(2004) describes the structure of the skin and age related changes in vivo by applying confocal laser scanning microscopy (CLSM) and optical coherence tomography (OCT).He has studied the overall effect of aging skin in 2 age groups and has reported that there in decrease in the overall thickness of the epidermis with increasing age leading to flattening of the Dermo – Epidermal junction.

Correlating with this study, our study also showed the similar changes with flattening of the Dermo – Epidermal junction more marked after 65 years of age.[4]

Jeanette M. Waller (2005) has explained that the thinning of the epidermis in old age is due to the reduction in the number of epidermal projections into the dermis resulting in flattening of the Dermo-Epidermal junction which becomes more marked in old age.

Our study also reflected the same picture.[5]

Pasricha in his illustrated textbook of dermatology has explained that skin being the largest organ of the body shows changes in the layers of the skin as age advances.

Correlating with the explanation in his textbook in our study, the number and depth of the rete pegs was found to get gradually reduced as age advances, with flattening of the Dermo-epidermal junction more marked after 65years of age.[6]

Susan Standring (2008) describes that the natural aging process starts to get reflected from 3rd decade producing epidermal and dermal atrophy. The thickness of the Stratum corneum is not reduced in old age. So the permeability barrier is not affected. The loss of Rete Pegs producing flattening of the Dermo-Epidermal junction is reflected as decreased adhesion of epidermis to dermis. So the epidermis gets separated from the dermis even with minor injury. Photo aging mainly influences the langerhan cells and the melanocytes.

Similar to the above description the Rete Pegs were found to be reduced in depth and number and the Dermo-Epidermal junction was found to be flattened as the age increases. But the age changes were observed to be reflected from second decade of life in contrary to the above description.[7]

Langton (2010) studied the roll of elastic fibers causing changes in the aged skin and has reported that the surface area of the Dermo-Epidermal junction is reduced in subjects from 21-40years of age and almost flattened in 61 to 80 years of age. This flattening makes the skin more fragile due to decrease in the transfer of nutrients between the epidermis and dermis.

In our study, similar changes were noted as the reduction in the number of rete pegs being marked after 65 years of age leading to flattening of the Dermo – Epidermal junction.[8]

Karine Cucumel (2012) has reported that, in individuals between 20-30years of age and 30-40 years of age, dermal papillae were found to be increased in number and the Dermo-Epidermal junction was highly convoluted. It was also reported that the dermal papillae started to get reduced and retracted after 40 years of age. After 60years of age the flattening of the Dermo-Epidermal junction was noted.

Coinciding with the above report in the present study it was observed that the Dermo-Epidermal junction was highly convoluted as early as 3-20 years of age and it was also observed that there was an increase in the number of Rete Pegs which was also reported in the above study. Coinciding with the above report the Rete Pegs was found to be decreased in number from 40 years of age and the Dermo-Epidermal junction was less convoluted in Group C individuals from 51-65 years of age. The Dermo-Epidermal junction was found to be flattened after 65 years of age which was similar to the above report.[10]

CONCLUSION

Intrinsic aging predisposes the skin to various skin diseases. The various changes in the skin reflected externally act as markers for prevention and early diagnosis of systemic diseases. The microscopic changes in the skin in old age leads to cystic and lacunae formation. These makes the elastic fibers more porous and the skin becomes lax . The permeability barrier of the epidermis is altered due to decrease in the number of nucleated cell layers and flattening of the Dermo-Epidermal junction. The thickness of the epidermis gets reduced in old age due to altered cellular morphology. This leads to decrease in the moisture content of the stratum corneum producing dryness or roughness of the skin, which is the common skin problem encountered in old age. The reduction in the number of dermal papillae produces flattening of the Dermo-Epidermal interface predisposing the skin of the old persons to bullae formation and various shear type of injuries. In aged persons the collagen fiber content decreases making the collagen less soluble. Changes in the photoaged skin due to chronic sun exposure predisposes the skin to various common skin disorders like xerosis, pruritis, purpuras and

eczematous dermatitis. The permeability barrier of the epidermis is altered due to decrease in the number of nucleated cell layers and flattening of the Dermo-Epidermal junction.

Conflicts of Interest: None

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