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Corneal Endothelial Cell Density and Cell Morphology in Type 2 Diabetes Mellitus Patients: A Case Control Study

Brajesh A Patil[1], Shishir Nyamagoudar[2], Shilly Varghese[3], Sangameshwarayya Salimath[4]

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Abstract

Evaluation & comparison of corneal endothelial cell density and cell morphology changes between type 2 diabetes mellitus patients and age matched controls.

Materials and methods: A case control study is conducted at the out patient department at S Nijalingappa Medical college HSK Hospital and Research Centre, Bagalkot from December 2019 - June 2021. A total of 130 study subjects, patients were enrolled into two groups, 65 patients known case of diabetics and 65 non-diabetic age matched controls. All patients under went complete ophthalmic evaluation along with endothelial cell parameters.

Results: The mean endothelial cell density in diabetic group was significantly reduced compared tonon diabetic. There was higher co-efficient of variation and lower hexagonal cells in diabetic group.

Conclusion: The study concludes that the endothelial cell density was lower in diabetic group compared to controls. Thealtered endothelial cell morphology was significantly seen in form of polymegathismand pleomorphism (hexagonality). We also found that there is some positive correlation with duration of disease and endothelial cell densityin diabetic group.

Keyword: Diabetes Mellitus; Endothelial Cell Density; Co-efficient of Variation; Hexgonality.

INTRODUCTION

Diabetes is perhaps the most important noninfective epidemic that affects theworld in the present millennium. It was estimated that prevalence of diabetes in adults worldwide to be 4% in 1995 and to rise to 5.4% by 2025.[1] Type 2 diabetes mellitus (T2DM) is an extended metabolic disease which is recognized by hyper glycemia and triggered by insulin resistance and decreased insulin release.[2]

Diabetes mellitus is a major cause for blindness in the world. This may lead to micro and macrovas cular disorders, which may introduce ocular manifestation sincluding changes in corneal endothelial cell density (ECD), central corneal thickness and intraocular pressure.[3]

Corneal endothelium plays an important role in maintaining the corneal optical transparency.[4] India bet esthereis in creased aqueo ushumor glucose levels and direct lyin hibits the corneal end othelial function. In hyperglycemic state, significantly corneas wells less. The recovery rate is slower in diabetics even in euglycemic state.[5]

Corneal endothelium is a single layer, the cells are hexagonal and metabolically active. Endothelium

Author Affiliation: [1]Professor, [2,3]Junior Resident, [4]Assistant Professor, Department of Ophthalmology, S. Nijalingappa Medical College & HSK Hospital, Bagalkot 587102, Karnataka, India.

Corresponding Author: Shishir Nyamagoudar, Junior Resident, Department of Ophthalmology, S. Nijalingappa Medical College & HSK Hospital, Bagalkot 587102, Karnataka, India.

Email: shishirkn7@gmail.com

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is a monolayer and when viewed from the posteriorside itappears as a honeycomb like mosaic structure. There is endothelial pumpaction which regulates water content.[6] The corneal endothelial cells in diabetes have morphological abnormalities. Abnormalities includes decrease in endothelialcell density and hexagonality, and increase in polymegathism, pleomorphism and CCT.[7]

The endothelial changes seen in diabetes appear similar to changes caused duetoaging process with a higher rate of endothelial cellloss.[8] Diabetic corneaun dergoes morphological changes has explained by many studies this was established by the assessment of polyol (sorbitol aldose reductase) pathway.[9] The intracellular accumulation of sorbitol, causes swelling of the endothelial cells. Thus, slowing downthe Krebs cycle with consequent reduction in production of ATP which is necessary for function of end othelial pump. This resulting in permeability and morphological change sinthediabetic corneas. Thus, it is import anttoaccess the corneal end othelium in all type 2 Diabetes Mellitus using Specular Microscopy. It should be apart of assessment in all diabetes patients preoperatively, so that postoperative corneal complications can be predicted based upon the parameters of specular microscopy and a high-risk cornea prone for early decompensation can beidenti fied.[10] This prospective study is conducted to evaluate the corneal endothelial cell density with agematched controls.

METHODOLOGY

Sourceof data

Patients of age above 50 years and of either sex attending Ophthalmology Outpatient department in S Nijalingappa Medical College & HSK Hospital, Bagalkot, Karnataka, between the period from December 2019 to June 2021 satisfying inclusion criteria.

Method of collection of data

The data for this study were collected from the subjects fulfilling the in clusion/exclusion criteria. 130 eyes of 130 patients attending the ophthalmology department at SNMC & HSK Hospital, Bagalkot, Karnataka, between the period from december 2019 to June 2021 were enrolled for this study. These subjects were selected consecutively as and when they present with following inclusion and exclusion criteria.

Study design- *Case control study.*

Period of study- *December 2019 to June 2021*

Methodology: Ethical committee clearance has been taken from institutional ethical committee. 65 Patients with type 2 DM attending Out patient department of ophthalmology fitting in inclusion criteria will be taken for study. Informed consent was taken. Patients will be distributed in 2 groups.

- Controls (Age matched normal subjects)-Group A
- Cases (Type 2 Diabetes Mellitus)-Group B

Ophthalmological examination

- Visualacuity (best corrected) using Snellen's Chart.
- Refraction
- Near vision with Times New Roman Chart.
- Slit lamp biomicroscopy examination.
- IOP with Goldman's applanation to nometery.
- Fundus examination with direct ophthalmoscope and Indirect Ophthalmoscope.
- Corneal endothelial cell count is assessed by Non-contact Topcon SP 3000 PS pecular Microscope.

Inclusioncriteria for cases

- Patient who will give informed consent.
- Patient with Type 2 Diabetes mellitus according to American Diabetic Association criteria 11 - A patient is grouped as diabetic who is diagnosed, or is a known case of diabetic based on his/her past history of getting treated for diabetes, self referred patients or referred from other departments of the same hospital as a part of standard treatment protocol. OR
- If the patient's blood test reports are as follows;
- Any one of the following is diagnosed as diabetic based on; Diagnostic criteria by the American Diabetic Association (ADA)[11]
- HbA1C level more than 6.5%
- A fasting plasma glucose level of 126mg/dl or higher.
- A 2 hours plasma glucose level of 200mg/dl

or higher during a 75g oral glucose tolerance test (OGTT)

- A random plasma glucose of 200 mg/dl or higher with classic symptoms of hyperglycemia or hyperglycemic crisis.
- Cataract grading by LOCS III classification done and nucleussclerosis grades 1-4, all cortical cataract grades and all posterior subcapsular grades included. (Fig. 1)

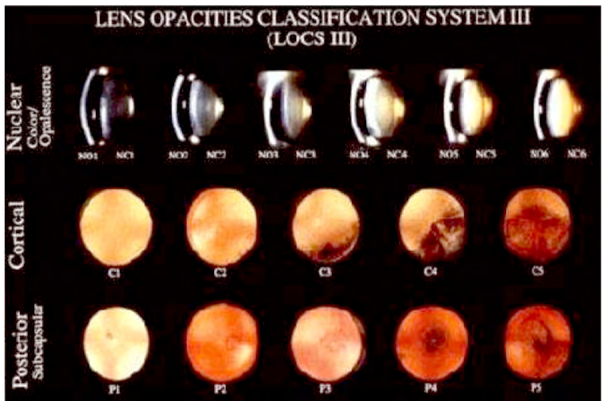

Fig. 1 : LOCS III classification

Inclusioncriteria for controls

Age and sex matched healthy controls who are nondiabetic will be selected from patient attenders or patients who are coming to OPD for some other eye problems.

Exclusioncriteria

- Patient not willing to give informed consent
- History of past intraocular surgeries
- Type 1 Diabetes
- Corneal diseases or dystrophies
- Contact lens users
- Active eye infections or inflammations
- Pterygium
- Glaucoma
- Posterior Staphyloma
- Keratectasia

Procedure of Specular microscopy

Corneal endothelial cell morphology and endothelial cell density is examined in all eyes by non contact specular microscope (Topcon SP 3000P). The endothelial structure is studied by measuring variety of features including endothelial cell density, coefficient of variation and percentage of hexagonal cells. (Fig. 2)

Fig. 2: Procedure of Specular Microscopy

SAMPLE SIZE ESTIMATION

Sample size calculation was done with reference study conducted by El-agamy A9

Sample size calculated 63 in each group

RESULTS

65 patients of diabetic and 65 patients of non-diabetic group were included in the study.

Statistical methods

Data collected entered in Microsoft excel sheet, there after analysed using SPSS software version 19. Chi square test and student's "t" test used to compare corneal endothelial density and cell morphology between diabetic and non-diabetic patients. Odds ratio with 95% confidence interval calculated and p value less than 0.05 is considered as significant.

Demography and epidemiology: In the current study, mean age group of controls is 61.59±5.38 and mean age group of cases is 61.79±5.08. The study included 71 (54.6%) males and 59 (45.4%) females.

AGE

In the current study, mean age group of non-diabetics is 61.59±5.38 and mean age group of diabetics is 61.79±5.08. Out of 130, there were 30 patients in <65 age group, 100 patients in >65 age group. Out of 65 non-diabetics 53 (81.5%) patients were less than 65 year old & 12 patients (18.5%) fall in to more than 65 years age category and in the

diabetic group 47 patients (72.3%) were less than 65 years old & remaining 18 (27.7%) were more than 65 years old.

SEX

Among the total patients 45.4%(59) were females and 54.6%(71) were males. In non-diabetic (control) group, 13 (47.7%) are male and 34 (52.3%) are female. In diabetic group, 40 (61.5%) are male and 25 (38.5%) are female.

Descriptive Analysis of Eye

Out of 130 patients, 62 (47.7%) patient's left eye was included and 68 (52.3%) patient's right eye was included in the study. Among group A (Control), 30 (46.2%) patients left eye is included and 35 (53.8%) patients right eye is included. Among group B (Cases), 32 (49.2%) patients left eye is included and 33 (50.8%) patients right eye is included.

Endothelial cell Density

In group A the mean endothelial cell density (ECD) is 2502.75±186.25 cells/mm2 and in the Group B the mean ECD is 2306.08±286.80 cells/mm2. The mean endothelial cell density was lower in diabetic than in non-diabetic. There was significant difference in mean ECD between two groups (P<0.05).(Fig. 3, Table 1)

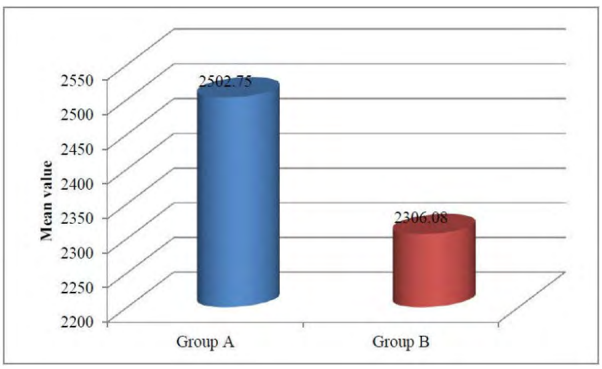

Fig. 3: Mean ECD between two groups

Coefficient of Variation

In group A the mean coefficient of variation (CV) is 36.79±3.35% and in group B mean CV is 41±8.89%. There is statistically significant difference in mean CV between two groups were P<0.05.

Hexagonal Cells(6A)

The mean hexagonal cells in group A is 45.19±3.70% and in group B the mean hexagonal cells is 41.88±6.72%. The mean hexagonality was lower in diabetics than in non-diabetic. There is significant difference between two groups P<0.05

Random Blood Sugar (RBS)

In group A the mean RBS is 114.26±15.25 and in group B the mean RBS is 141.51±22.94. There is increased RBS in diabetic group than in non-diabetic group which is statistically significant (P value <0.001)

Group B issu b divided into duration of diabetes for the correlation of endothelial cell density and cell morphology.

Endothelial Cell Density (ECD) With Duration of Diabetes

The mean endothelial cell density was correlated with duration of diabetes. There was significant reduction in the mean ECD among diabetic patients with duration of diabetes >10 years (P<0.05) (Table 2, Fig. 4).

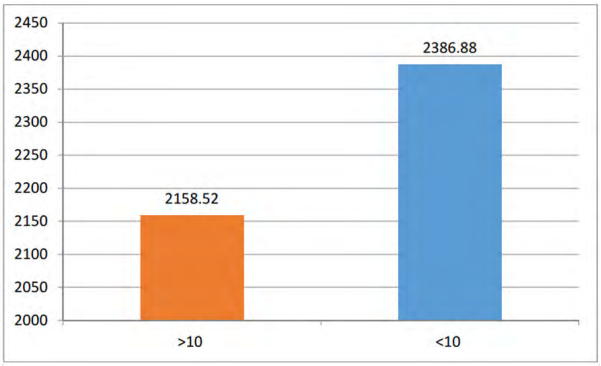

Fig. 4: Comparison of mean ECD with duration of diabetes

Coefficient of Variation (Cv) with Duration of Diabetes

Coefficient of variation was correlated with duration of diabetes. There was no significant change in the mean coefficient of variation among diabetic patients with duration of diabetes >10 years.

Hexagonal Cells (6A) with Duration of Diabetes

Hexagonal Cells was correlated with duration of diabetes. There was very slight increase in the mean hexagonal cells among diabetic patients with duration of diabetes >10 years.

DISCUSSION

This study entitled "Corneal endothelial cell density and cell morphology in type 2 diabetic

mellitus patients: A case control study" was conducted in the department of ophthalmology, S Nijalingappa Medical College & HSK Hospital, Bagal kotusing Topcon SP 3000PS pecular Microscope.

Inourstudy, we evaluated corneal endothelium & cell morphology in 130 eyes of 130 patients, with 65 patients of diabetic and 65 age matched normal subjects. Our study design is similar to other previous studies inthe literature that were done to evaluate corneal endothelial cell density in diabetes.

Diabetes mellitus prevalence is rising all over the globe and consider edas mildd is order of elder lyto major cause of morbidity and mortality affecting young and middle age persons. The International diabetes federation (IDF) estimated that in India the diabetic subjects to be around 40. 9 million and there is further setofrises to 69.9 million by the year 2025.[12]

Globally T2 DM approximately present 1 in every 11 adults and about 75% of patients of diabetes live in developing countries.[13] Hypergly cemia causes toxic to cells in the body. The ocular complications ofhyperglycemia are profound in retina and cornea. About 70% of diabetic patientssuffer from corneal complications calledas diabetic kera to pathy.[14]

Age incidence

Lipscombe LL et al conducted a study entitled "Trends in diabetes prevalence, incidence and mortality in Ontario, Canada 1992-2005: a population based study" have found that higher prevalence rate of diabetes above 50 years or older is remained same than in those aged 20-49 years.15 In our study the meanage group is 61.79±5.08 years in Diabetic group and 61.59±5.38 years in Non diabetic group. There sults of our study show similar as above mentioned.

Sex incidence

Nagaraj G et al conducted a study entitled "Corneal thickness and endothelial cell density in diabetic and non-diabetic patients: a hospital based comparative study"have found that among diabetics the female ratio was more than male and in non-diabetic males were more than females.[16] In our study the female prevalence was higher than males in non-diabetic groups and male prevalence was higher than females in diabetic groups. In diabetic group, females were 38.5% (25) and males were 61.5% (40). In non-diabetic group, females were 52.3%(34) and males were 47.7%(31).

Endothelial cell density

K.I noueetal conducted study entitled "The corneal endothelium and thickness in type 2 diabetes mellitus" investigated the corneal morphology in diabetic and non-diabetic and found significant decrease in endothelial cell density. 17 Sudhir et al conducted the study entitled "Changes in the corneal endothelial cell density and morphology in patients with type 2 diabetes mellitus: a population based study and thus concluded that, subjects with type 2 diabetes mellitus had lower endothelial cell counts incomparison with non-diabetic controls. 4 Our study was similar to above mentioned studies, the endothelial cell density is decreased in the diabetic group when compared with then on-diabetics.

Choo MM et al conducted the study entitled "Corneal changes in type II diabetes mellitus in Malaysia" concluded that endothelial cell density was significantly lower in diabetic group (2541.6±516.4 cells/mm2) when compared to non-diabetic (2660.1±515.5 cells/mm2).[7] El-agamy A et al conducted a study entitled "Corneal endothelium and central corneal thickness changes in Type 2 Diabetes Mellitus" concluded that ECD was significantly lower in Diabetic cornea group (2,491.98±261.08 cell/ mm2) than in the control group (2,629.68±293.45 cell/mm2).[9] Nagaraj G et al conducted study entitled "Corneal thickness and endothelial cell density in diabetic and non-diabetic patients: a hospital based comparative study" and found that the endothelial cell density was significantly lower (2438.73±250.23cells/mm2) in the diabetic group when compared with non-diabetics (2599.88±168.16cells/mm2).[16] These studies were similar to our study were the mean endothelial cell density is significantly lower compared to non-diabetics.

Elsobkyetal conducted study entitled "Corneal endothelial and central corneal thickness changes in patients with type 2 diabetes mellitus" found that themean endothelial cell count was significantly decreased in the diabetic group. In this study, the diabetic group was sub divided into disease of duration and stage of retinopathy and they found that there was statistically significant difference in mean ECD between patients having diabetes for <10 years duration and those having diabetes >10 years duration.[18]

This study was similar tour study endothelial cell density was decreased and found significant in diabetic group of duration >10 years compared to those < 10 years of duration.

Correlation of Endothelial cell density with diabetic duration

JS Lee et al conducted study entitled "Differences in corneal thickness andcorneal endothelium related to duration in diabetes" observed that the ECD was lower for diabetes of over 10 years duration than for diabetes of under 10 years.[19] This study was similar to our study in which the mean ECD was significantly lower in patients with duration of diabetes >10 years.

Stella Brigg setal conducted study entitled "Manifestations of Type 2 Diabetes in Corneal endothelial cell density, Corneal thickness and Intraocular pressure" demonstrates that there was significant difference in mean ECD of diabetic patients with duration of diabetes >10 years when compared with duration of diabetes<10 years.[3] Our study is similar tothis study as there is significant difference in mean ECD value in diabetes with diabetic duration >10 years.

CONCLUSION

This study titled "Corneal endothelial cell density and cell morphology in type 2 diabetes mellitus patients: A case control study." was conducted in Department of Ophthalmology, SNMC & HSK Hospital, Karnataka from December 2019 to June 2021.

130 patients were included in the study, 65 patients who are diagnosed with type 2 DM and 65 patients were age matched controls.

In this study, age of the patient ranged from 50 to 80 years, with mean age being 61.79 ± 5.08 years in Diabetic group and 61.59 ± 5.38 years in Non diabetic group. In this study, the mean endothelial cell density in diabetic group 2306.08±286.80 cells/ mm2 and in non-diabetic group 2502.75±186.25 cells/mm2.

In patients with diabetes has lower endothelial cell density and found to be significant decrease in the mean ECD. Coefficient of variation is higher in diabetic group when compared to non-diabetic control group. The hexagonality percentage is lower in diabetics than in non-diabetics.

Hexagonality percentage is lower in diabetic group comparing to non-diabetic and the reduction is significant in diabetic group which is comparable to the most of studies earlier. In this study the duration of disease is correlated with endothelial cell density. There is significant decreased ECD in diabetic duration >10 years and found positive correlation with duration of diabetes with endothelial cell density and discussed earlier with some of the studies. We observed that the diabetic corneas are at higher risk of damage to the corneal endothelium.

Lower endothelial cell count in diabetes is due to glycaemic stress and the age also can be con founding factor for decrease in the endothelial cell density along with diabetes mellitus. This could be contributed by any difference in inclusion orexclusion criteria with duration of diabetes, glycaemic control, and also severity of disease. The endothelial cell density was decreased in diabetic group when compared to non-diabetic group. The corneal endothelial changes seen in diabetes mellitus appear similar to changes caused due to aging process with a higher rate of endothelial cell loss. So specular microscopy can thus be used as a tool for studying the corneas of diabetic patients and it is imperative that corneal specular microscopy is to be done routine lypreoperatively for diabetic patient even if cornea appears to be healthy.

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Randomized Controlled Study to Compare Axial Length Measurement using Contact Technique and Immersion Technique in Cataractous Eyes in a Tertiary Care Hospital, Bagalkot

Brijesh A Patil[1], Jay Singh B N[2], Shilly Varghese[3]

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Abstract

Purpose: Comparison of contact technique with immersion technique in terms of axial length measurements in cataractous eyes & to compare prediction errors in these eyes as measured after surgery.

Materials & Methods: Randomised control study done in 101 patients from December 2019 to June 2022. IOL Power was calculated using SRK/T formula in both groups. Prediction error was compared along with BCVA in contact and immersion technique.

Results: Postoperatively out of 51 cases 24 cases (47.05%) were in the estimated target refractive group (-0.25 to -1 D) and immersion group showed 49 cases (98%) within the estimated target refractive group (-0.25 to -1D). Mean prediction error in contact group was -0.85 ± 0.74 and immersion group -0.25 ± 0.16 with "p" value of <0.001 which is clinically significant.

Conclusion: There was a significant difference in ocular biometry measurement with the contact and immersion ultrasound technique. Precision of immersion technique is better than contact technique.

Keywords: Axial length measurement; Contact technique; Immersion technique; Prediction error.

Author Affiliation: [1]Professor & Head, [2,3]Junior Resident, Department of Ophthalmology, S. Nijalingappa Medical College & HSK Hospital, Bagalkot 587102, Karnataka, India.

Corresponding Author: Brijesh A Patil, Professor & Head, Department of Ophthalmology, S. Nijalingappa Medical College & HSK Hospital, Bagalkot 587102, Karnataka, India.

Email: drbrij74@yahoo.co.in

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INTRODUCTION

Among the many artificial prosthesis invented by man, the intraocular lens is undoubtedly one of the most gratifying. It has revolutionized the treatment of cataract for a better result, in comparison with the other available modalities of optical rehabilitation like aphakic spectacles.[1]

In regular ophthalmological practice, ocular

biometric values like axial length, anterior chamber depth and lens thickness values are measured routinely.[2,3] It has great importance in measuring IOL power before cataract surgery which is aimed not only to restore visual clarity but also to provide good vision in refractive terms.[2]

Errors in axial length are the most significant errors in IOL power calculation.[4,5,6] The ultrasound axial length of the eye is commonly measured using either contact or immersion techniques. In the contact method, cornea can be compressed by the probe which can result in shorter axial length.[7] Immersion A-scan measurement eliminates corneal compression and is considered better technique for axial length measurement.[8-11]

MATERIALS AND METHODS

This study was conducted on 101 patients who visited in the Ophthalmology Department of S. Nijalingappa medical college and HSK hospital and research centre, Bagalkot.

Source of data: Ophthalmology Department of S. Nijalingappa medical college and HSK hospital and research centre, Bagalkot.

Type of study: Randomized Controlled Study.

Sample size calculation: Done using med calc software & estimated is 40 in each group. Taking dropout rate: 20%, 50 in immersion group & 51 in contact group was taken. Computer generated random allocation of study subjects into 2 groups (immersion and contact) was done. Duration of the study – 1.5 years (December 2019 - June 2021).

Ethical clearance was taken from institutional ethical committee.

Inclusion Criteria:

- All patients coming to OPD in ophthalmology department from December 2019 to May 2021 with uncomplicated, senile, immature and mature cataract.
- Willing to take part in the study.

Exclusion Criteria

- Hyper mature cataract.
- Traumatic cataract.
- Paediatric cataract.
- Patient with associated ocular pathology.
- Complicated cataract.
- Secondary cataract.
- Non-cooperative patients.

Pre-operative evaluation was done by history taking general examination, local examination with torch light, slit lamp examination, visual acuity for distance and near without and with corrections, intraocular pressure measurement using Goldmanns applanation tonometry, fundoscopy with dilated pupil by using 90 D Volks lens in slit lamp, Lacrimal sac syringing & Serology test was done for HIV, HCV and HBsAg.

B-Scan was done in patients with mature cataract to rule out any vitreous or fundus pathology & special investigations were carried out for patients having diabetes and hypertension.

IOL power was calculated using keratometry readings & axial length measurements.

Keratometry: It was carried out by Bausch and Lomb type of keratometer & readings were available in dioptres whose range was 36 D to 50 D.

A-Scan Biometry: Axial length of the eye was measured using Biomedix Echorule 2 biometer with a built in microprocessor and computing a suggested IOL power.

The transducer when applied to the cornea directly as in contact method or indirectly through the pregar shell as in immersion technique will fire many ultrasonic pulse through the eye, time these pulses and convert them into numerical value. Incorrect readings are avoided as the microprocessor analyses the retinal and lens spikes for amplitude and uses them as criteria to ensure proper alignment. Proper alignment was indicated by the beep sound and automated 5 readings were recorded. Mean axial length reading with SD of ≤ 0.06 was taken.

Two different techniques were used for A-scan biometry-A) Contact & B) Immersion

Calculation of IOL Power

- The machine was set in calculation mode and SRK-T formula was chosen for calculation.
- The keratometry readings K1 and K2, the A constant and axial length were entered & calculated IOL power displayed on the screen was recorded & in general the aim was to make the patients slightly myopic.

Follow Up:

All the patients were reviewed after 1 week and then at 4-6 week. During each visit they were examined for visual acuity, condition of wound, condition of the cornea, anterior chamber depth and reactions. Pupils were examined for size, shape

and rection to light. IOL was examined and its position was noted. Fundoscopy was done using direct ophthalmoscope.

After 4-6 weeks, manual refraction was done as refractive status considered to be stable. Retinoscopy was performed and correction was given for distance and near. In a few patients who had oblique astigmatism automated refraction was done and correction given. The difference between the expected and postoperatively calculated refraction was noted

RESULT

The study under taken included 101 cases. All the patients under went small incision cataract surgery with a posterior chamber intraocular lens implantation. The results post surgically (i.e., four to six weeks postoperatively) were analysed and the following observations were made.

Out of 101 cases in the study, 51 cases (50.5%) belong to contact group and 50 cases (49.5%) belong to immersion group. In our study, maximum number of cases i.e., 36 cases (35.64%) belong to age group of 60-69 years followed by 31 cases (30.69%) belonging to age group of 50-59 years. Out of 101 cases, 44 cases (43.5%) were male and 57 cases (56.5%) were female. Contact group comprised of 51 cases out of which 21 cases (41.2%) were male and 30 cases (58.8%) were female. Immersion group comprised of 50 cases out of which 23 cases (46%) were male and 27 cases (54%) were female.

In our study, maximum axial length was between 22-24 mm which is seen in 81 cases (80.2%) followed by 12 cases (11.9%) having axial length more than 24 mm and 8 cases (7.9%) having axial length less than 22 mm.

In this study, mean estimated post-operative refraction in dioptre was -0.51±0.09D in contact group and -0.49 ± 0.099 D in immersion group & mean actual post-operative refraction found tobe -1.18±0.91 D and -0.68 ± 0.25 D in contact and immersion group respectively having p value of <0.001 which is statistically significant.

Minimum prediction error of 0 to 0.50 D was seen in 22 cases (43.13%) incontact group and 46 cases (92%) in immersion group respectively Mean prediction error (indioptre) in contact group was -0.85±0.74 D where as in immersion group it was -0.25 ± 0.16 D.

Table 1: Comparison of BCVA with Contact and Immersion groups (N=101)

BCVA	Technique		Total	Chi square	Pvalue
	Contact	Immersion			
6-Jun	6 (11.76%)	27 (54%)	33(32.67%)		
6-Sep	44 (86.27%)	23 (46%)	67 (66.33%)	24.86	<0.001
6-Dec	1 (1.96%)	0 (0%)	1 (1%)		
Total	51 (100%)	50 (100%)	101 (100%)		

In contact group, only 6 cases (11.8%)achieved BCVA of 6/6 where as in immersion group, 27 cases (54%) achieved BCVA of 6/6 (table 1 and chart 1).

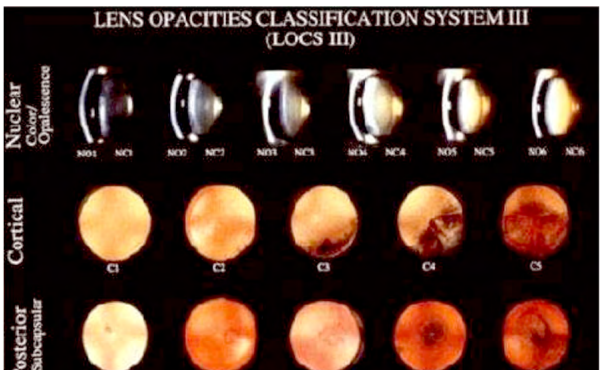

Chart 1: Bar chart of comparison of BCVA with contact & immersion group(N=101)

DISCUSSSION

Minimizing the post-operative refractive error or prediction error is a primary goal in all cataract surgery patients. Accurate postoperative refraction target would potentially yield a better visual acuity in the operated eye, by minimizing long term anisometropia and possible secondary amblyopia or the need for later IOL exchange.[12]

In our study, the average age was 60.55 ± 10.30 year in contact group and 63.70 ± 9.42 year in immersion group. There was slight female preponderance with 30 cases (58.8%) and 27 cases (54%) in contact and immersion group respectively showing no significance difference in incidence of cataract between sexes.

Precise measurement of ocular biometry values, especially axial length measurement is central to the accurate calculation of IOL power inserted at surgery.

Axial length measurement was done by two methods in our study, contact and immersion method respectively

In immersion technique, measurements are performed through a water bath. This prevents direct contact of the A-scan probe with the cornea thus avoiding corneal compression. The shell also stabilises the globe, keeps the eyelid open, and allows proper alignment of the probe to visual axis.[13] In the contact method, the probe touches the cornea and may result in corneal compression and a shorter axial length.[3,9,10,14] The error in preoperative axial length measurement was the most significant error in IOL power calculation and equates to almost 2.5 D/mm in IOL power in a normal AL eye but decreases to 1.75 D/mm in a 30 mm eye and increases to 3.75 D/mm in a 20 mm eye.[15]

Ademola-Popoola DA. et al[2], did a similar study in year 2016 on 92 cases in which average axial length (22-24.4 mm) was reported to be in 75 cases (81.5%). In our study of 101 cases, average axial length (22-24 mm) was found to be in 81 cases (80.2%) which was similar to the above study (table 2).

In our study, mean axial length by contact technique was found to be 23.07 ± 0.87 mm and by immersion technique was 22.96 ± 0.81 mm.

Table 2: Comparative analysis of mean axial length in contact and immersion technique

Study	Mean Axial Lenth (Contact)mm	Mean Axial Length (Immersion)mm
Hoffer[16] (1981)	22.7	23.10
Shammas[17] (1984)	23.28	23.52
Artaria[18] (1986)	23.13	23.44
Schelenz[10] (1989)	22.39	22.59
Olsen[13] (1989)	23.35	23.49
Watson And Armstrong[9] (1999)	23.24	23.55
Hennessy MP et al[3] (2003)	23.28	23.25
Trivedi RH et al[4] (2011)	21.36 ±3.04	21.63 ±3.09
Ademola-Popoola DA. Et al	23.46 ±1.46	23.66 ±1.36
Present study	23.07 ±0.87	22.96 ±0.81

In our study among contact group, postoperatively out of 51 cases, 2 cases (3.92%) became hyperopic, 2 cases (3.92%) became emmetropic and 47 cases (92.15%) became myopic out of which 24 cases (47.05%) were in the estimated target refractive group (-0.25 to -1 D) and 23 cases (45.09%) were above the targeted refractive group (>-1 D)(table3).

Table 3: Comparative analysis of Spherical post-operative correction (Dioptre)

Study		N.K. Limbdi66 (1991)	" Present study (Contact)	Present study (Immersion)
Spherical	> +0.25	52 (52%)	02 (3.92%)	–
post-	–	11 (11%)	02 (3.92%)	–
operative	-0.25 to -1	28 (28%)	24 (47.05%)	49 (98%)
correction in	–1.25 to –2	07 (7%)	16 (31.37%)	01 (2%)
Dioptre	>-2	02 (2%)	07 (13.72%)	–

Immersion group showed 49 cases (98%) were in the estimated target refractive group (-0.25 to -1 D) and 1 case (2%) was above the targeted refractive group (>-1 D).

This leads to conclusion that immersion technique is better than contact method to achieve the target refractive outcome.

In our study, we found that mean prediction error in contact group was -0.85 ± 0.74 D and immersion group -0.25 ± 0.16 D with "p" value of <0.001 which is clinically significant.

CONCLUSION

The targeted spherical refractive equivalent error is achieved in 24 cases (47.05%) in contact group and 49 cases (98%) in immersion group with SRK/T formulae. BCVA for distance was done 4-6 week postoperatively which showed that in contact group, 6 cases (11.76%) out of 51 cases got correction of 6/6 whereas in immersion group, 27 cases (54%) out of 50 cases got correction up to 6/6. The "p" value of <0.001 suggest that the difference in mean actual postoperative refraction in contact and immersion group is clinically significant.

Mean prediction error (estimated postoperative refraction – actual postoperative refraction) in contact and immersion group were -0.85 ± 0.74 and -0.25 ± 0.16 respectively with "p" value <0.001 suggesting the study is clinically significant. So, immersion technique is better than contact technique according to my study and it is the most applicable method for calculation of required intraocular lens power before cataract surgery.

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Original Article

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Visual Outcome in Grade IV Nuclear Cataract After Small Incision Cataract Surgery in Patients Attending Tertiary Care Centre

Rajashekar Dharmayat[1], Anupama Raju Taklikar[2], Nitin G[3], Varshitha BM[4]

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Abstract

Aim: To evaluate the visual outcome in grade IV nuclear cataract after small incision cataract surgery.

Materials and Methods: A prospective study of 100 patients with grade IV nuclear cataract (grade IV) were reviewed. All patients underwent small incision cataract surgery with effective technique of minimal hydrodissection and copious viscoelastic usage. The surgical techniques used, intraoperative complications, preoperative and postoperative visual acuity and the causes of impaired visual acuity after surgery were examined.

Results: Among 100 patients, majority of the patients were from 61-70 years age group (i.e., 52%), mean age of the study population was 65.42 +/- 8.56 years, males were predominant in our study with male to female ratio as 1.71:1. Intraoperative complications included iris injury (2%), posterior capsular rent (3%), aphakia (3%), post operative complications included epithelial edema (5%), stromal edema (6%), anterior chamber reaction (5%), iritis (5%). Snellen's visual acuity on day 1 was > 6/18 in 85% cases, and after one week was> 6/18 in 90% cases. BCVA after 6 weeks was >6/18 in 98% cases.

Conclusion: Visual outcome in patients with grade IV nuclear cataract is good when surgery done after proper pre-op assessment, with thorough planning. Experienced surgeons with proper knowledge of the technique during the surgery.

Keywords: BCVA; Grade IV nuclear cataract; Intraoperative complications; SICS; Visual outcome.

Author Affiliation: [1,3,4]Junior Resident, [2]Professor and HOD, Department of Ophthalmology, Navodaya Medical College Hospital and Research Centre, Raichur, Karnataka 584103, India.

Corresponding Author: Rajashekhar Dharmayat, Junior Resident, Department of Ophthalmology, Navodaya Medical College Hospital and Research Centre, Raichur, Karnataka 584103, India.

Email: drchittoria@gmail.com

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INTRODUCTION

Cataract is a significant and increasing global problem with vast economic and social implications.[1] It is the principal cause of blindness in India accounting for 62.6%.[2,3] Grade IV nuclear cataract represents an exaggerated densification of the crystalline fibers transforming the entire lens into nucleus. The lens nucleus has become so hardened, sclerotic and blackened that it has gone

beyond what is known as brunescence. Brunescence is a discolouration of the nucleus that occurs as the nucleus becomes sclerotic. Brunescence begins as a yellowing and progresses to orange and brown. With the progressive discolouration and opacification, the vision gradually diminishes over time. Grade IV nuclear cataract causes legal blindness meaning the vision is expected to be Hand Motion or Light Perception and not much better. This presents serious and anticipated risks for planning surgery. With a diagnosis of Grade IV nuclear cataract, the preferred surgical procedure may be a planned Extracapsular Cataract Extraction.[4]

MATERIALS AND METHODS

Study setting: Tertiary Care Centre

Study population: The patients with Grade IV attending tertiary care centre.

Study period: December 2019 to June 2021 (18 months)

Study design: Descriptive study

Sample size: 100

Inclusion criteria:

1. All grade IV nuclear cataracts, including the grade IV nuclear cataract with systemic diseases with age >50 years

Exclusion criteria:

- Grade I to III cataract
- Age less than 50 years
- Complicated cataract
- Traumatic cataract
- Cataract associated with increased intra ocular pressure

History: Detailed history including that of diabetes mellitus, hypertension, cardiovascular disease & drug intake was taken.

Clinical examination:

- Pre-operative ocular examination including systemic examination.
- Measurement of uncorrected visual acuity and best corrected visual acuity.
- Intra-ocular pressure by Applanation tonometer.
- Keratometry and A-Scan biometry.
- Grading cataract using lens opacity classification system 3.
- Detailed fundus examination with Slit-lamp biomicroscopy using + 90D and indirect ophthalmoscopy using + 20D lens.
- Anaesthesia – peribulbar block was given for all operating cases.
- Intraoperative – under aseptic precautions all patients were operated by standard small incision (6 to 6.5 mm) cataract surgery, with effective technique of minimal hydrodissection and copious viscoelastic usage by well experienced and skilled surgeon.
- Visual outcome evaluation was done in all the study subject.
- Post-Operative Evaluations Done on post-operative day 1, post-operative day 7 and after 6 weeks postoperative.
- Visual acuity testing for distance vision and near vision using Snellen's distant chart and Jaeger's chart respectively.
- Refraction and correction.
- Slit lamp bio-microscopic examination for details of: a) Cornea. b) Placement of IOL. c) Posterior capsule evaluation. d) Fundus examination using 90 D lens.

RESULTS

Majority of the patients in our study were from 61-70 years age group i.e. 52%, followed by 31% from 50-60 years and 17% from above 70 years. Mean age of the study population was 65.42±8.56 years.

Table 1: Distribution according to age group

		Frequency	Percent(%)
Age group in years	50-60	31	31
	61-70	52	52
	> 70	17	17
	Total	100	100

Table 2: Distribution according to gender

		Frequency	Percent(%)
Gender	**Male**	**54**	**54**
	Female	46	46
	Total	100	100

Males were 54% and females were 46%. Males were predominant in our study with male to female ratio as 1.17:1.

Table 3: Distribution according to laterality of eye

		Frequency	Percentage (%)
Eye	Right	45	45
	Left	55	55
	Total	100	100

Right eye was affected in 45% cases and left eye in 55% cases in our study.

Table 4: Distribution according to preoperative visual acuity

Pre op vision	Frequency	Percentage(%)
PL + ve – CF 2mts	88	88
CF 3mts – 6/60	12	12
<6/60	0	0
Total	**100**	**100**

88% patients had pre op vision as PL +ve - CF 2mts followed by 12% had CF 3mts - 6/60

Post operative vision on day 1 revealed that 85% patients had VA >6/18 followed by 10% had <6/18 - 6/60 and 5% had <6/60.

Table 5: Post operative vision on day 1 and day 7

Visual acuity	Post op day 1	Post op day 7
>6/18	85	90
<6/18 - 6/60	10	6
<6/60	5	4
Total	**100**	**100**

Post operative vision after one week revealed that 90% patients had VA >6/18 followed by 6% had <6/18 - 6/60 and 4% had <6/60.

BCVA after 6 week revealed that 98% patients had VA >6/18 followed by 1% had <6/18 - 6/60 and 1% had <6/60

Table 6: BCVA after 6 weeks

Visual acuity	Frequency	Percentage
>6/18	98	98

<6/18 - 6/60	1	1
<6/60	1	1
Total	100	100

DISCUSSION

Table 7: Intraoperative complications

Intra-operative complications	Frequency	Percentage (%)
Iris injury	2	2
Posterior capsular rent	3	3
Aphakia	3	3

Table 8: Post-operative complications

Post-operative complications	Frequency	Percentage (%)
Corneal edema	11	11
Iritis	10	10

Age and Sex Distribution in patients with Grade IV nuclear cataract

A study conducted by Venkatesh R. et al[10] showed the mean age of the patients was 66.2 years, there were 41 male and 61 female patients, Our findings were comparable with this study. A study conducted by Abhinav Ashok Agrawal et al[8] showed that the age range of patients was between 40 – 80 years, there were 64 males and 56 females, Our findings were comparable with this study.

Intraoperative complications

Iridodialysis

Patil et al,[11] reported that two eyes had superior iridodialysis during delivery of the nucleus. In our study 2 cases had iris injury in the form of sphincter damage,however no cases of iridodialysis were observed in our study.

Intraoperative hyphaema

Patil et al,[11] reported that 8% had Intraoperative hyphaema. In our study no such cases were found.

Posterior capsular rent

A study conducted by Venkatesh R. et al[10], showed the main intraoperative complication was posterior capsule rupture in two patients (2.0%), Our findings were comparable with this study. In our study there were 3 % cases of PCR and aphakic state of the patient was 3% which was comparatively lesser when compared to above studies.

Postoperative complications

Corneal edema

Addagarla SR et al[7] conducted a study,8% cases had corneal edema, which was high as compared to our study findings.

Straite keratopathy (SK)

Addagarla SR et al[7] reported there was striate keratopathy (SK) in 12 cases.

In our study there was corneal epithelial edema seen in 5%,stromal edema in 6% cases.

Anterior chamber reaction

A study conducted by Addagarla SR et al[7], Toxic syndrome (TASS) with Anteriorchamber reaction are seen in 10% cases which was high as compared to our study findings. In our study there was Anterior chamber reaction seen in 5% cases which were comparatively lesser compared to above studies.

Iritis

A study conducted by Addagarla SR et al[7], 10% cases had iritis which was higher as compared to our study findings

In our study iritis seen in 5% cases which were comparatively lesser compared to above studies.

IOL decentration

Khandekar RB et al[6] reported that there was 3 cases of IOL decentration seen. In our study no such cases were found.

Treatment outcome

In our study, on post operative day 1, majority of the patients had >6/18 vision i.e. 85%, followed by 6/18 – 6/60 i.e. 10% ,5% of the patients still had <6/60.

After one week of post operative period, majority of the patients had >6/18vision i.e. 90%, followed by 6/18 – 6/60 i.e. 6%, 4% of the patients still had <6/60 vision. After six weeks of post operative, majority of the patients had vision >6/18 i.e. 98%, followed by 6/18 – 6/60 i.e. 1% , <6/60 i.e. 1%.

Abhinav Ashok Agrawal et al[8] reported that post operative best corrected visual acuity was >6/18 in 80 % cases which was less as compared to our study findings.

Addagarla SR et al[7] reported that good outcome with best corrected visual acuity was recorded in 92% cases, which was less as compared to our study findings.

Khandekar RB et al[5] reported that post operative 6 weeks visual acuity >6/18 in 87% cases, which was less as compared to our study findings.

CONCLUSION

Small incision cataract surgery is a safe and effective technique with excellent visual outcome in dealing with grade IV nuclear cataract, with lower complication rate and earlier post operative visual rehabilitation.

Visual outcome in patients with grade IV nuclear cataract is good when surgery done after proper pre-op assessment,due intra operative precautions and thorough planning of experienced surgeons with proper knowledge of the technique during the surgery.

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Role of Autologous Platelet Rich Plasma in Adult Scald Burns

[1]Hemani Yadav, [2]Ravi Kumar Chittoria, [3]Neljo Thomas

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Abstract

Autologous Platelet Rich Plasma (APRP) and its clinical applications had drastically improved in the field of plastic surgery in the recent times. The efficacy of Autologous Platelet Rich Plasma (APRP) forburnsis widely seen to have reduced scarring effects. APRP is an increasingly popular adjunct in surgical, medical and aesthetic interventions. Their beneficial effects lie in their ability to deliver a high concentrate of growth factors. In this study we study the efficacy of APRP therapy in wound bed preparation of scald burns.

Keywords: APRP; Scaldburn; Wound bed preparation.

INTRODUCTION

Cataract Autologous Platelet Rich Plasma (APRP) is the platelet concentrate in small amount of plasma which contains higher concentrations of growth factors. It is rich in platelets, growth factors and chemokines.[1] Now a days it is widely studied for its role in scar reduction. It is prepared by centrifuging blood of patient. Blood is separated into 3 layers viz Platelet poor plasma (PPP) at top, PRP in middle and RBC at bottom. RBC and PPP are discarded sequentially. PRP obtained is added with thrombin. Here in this study, we are evaluating the effect of APRP in wound bed preparation in a patient with scald burns.[2]

Author Affiliation: [1]Junior Resident, [2]Professor and Head of IT Wing and Telemedicine, [3]Senior Resident, Department of Plastic Surgery, Jawaharlal Institute of Postgraduate Medical Education and Research, Pondicherry 605006, India.

Corresponding Author: Ravi Kumar Chittoria, Professor, Department of Plastic Surgery, Jawaharlal Institute of Postgraduate Medical Education and Research, Pondicherry 605006, India.

Email: drchittoria@gmail.com

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MATERIALS AND METHODS

This study was conducted in tertiary care centre in department of plastic surgery after getting the department ethical committee approval. Informed consent was obtained for examination and clinical photography. A 33 year female child with no known co-morbidities presented with alleged accidental scald burns due to hotwater fell on her over both the thighs and abdomen. She was taken to nearby hospital and was treated with analgesics and antacids, intravenous fluids. She was subsequently referred to JIPMER for further management. General and systemic examination was found to be normal. Second degree superficial burns were found over both the thighs and lower abdomen on local examination. The patient was treated with local injection of APRP (Fig. 1). Wound

bed preparation was done with the help of APRP and she subsequently underwent skin grafting (Fig. 2).

Autologous platelet rich plasma (APRP) obtained by standard double centrifugation protocol using 10cc of the patient's blood with APRP being injected over 2 sittings over 4 days.

RESULT

Autologous platelet rich plasma (APRP) helped in good wound bed preparation and helped in better uptake of skin grafting (Fig. 3).

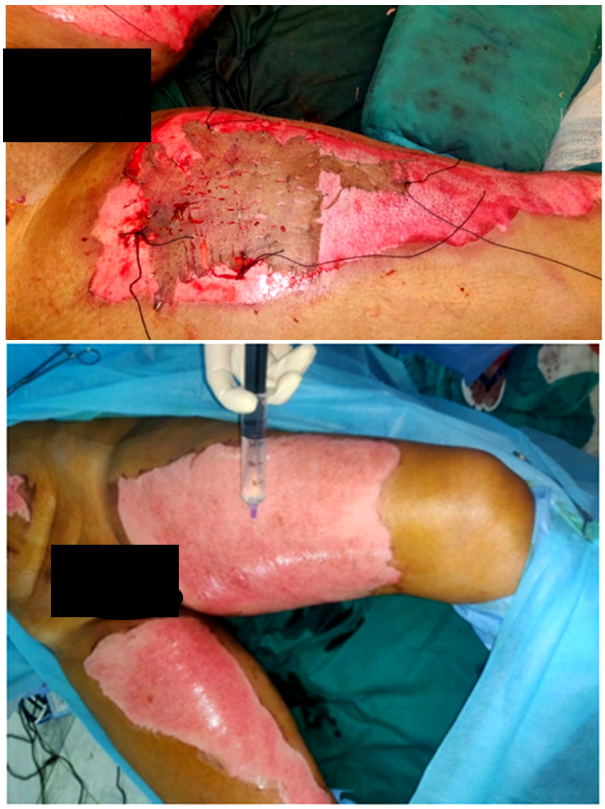

Fig. 1. Autologous Platelet Rich Plasma being injected into the scald burn for wound bed preparation

DISCUSSION

Autologous platelet rich plasma (APRP) as the name implies refers to the plasma derived from the patient's own blood with a platelet count higher than the platelet counts in the peripheral blood of the patient. Historically having been used to treat thrombocytopenia, the use in other specialties became widespread with its use in sports medicine to treat musculoskeletal injuries.[3] PRP is a platelet concentrate obtained by whole blood centrifugation.

Fig. 2. Scald burn after wound bed preparation with APRP

Platelets release a variety of growth factors after activation, such as transforming growth factor β, fibroblast growth factor, platelet derived growth factor, insulin like growth factor, epidermal growth factor, vascular endothelial growth factor, keratinocyte growth factor, interleukin-8, and so on. These growth factors promote and regulate cell proliferation, adhesion, differentiation, mitosis, angiogenesis, collagen synthesis and secretion through multiple channels to achieve the purpose of accelerating tissue repair. In addition, studies have shown that PRP has a pain relieving effect.

Burn wound is the main cause of bacterial infection in patients with severe burn. Burn wound leads to the disappearance of skin barrier and denatured necrotic tissue provides good conditions for bacterial reproduction, which result in wound infection. Once the infection occurs, it often accompanies the whole course of the disease, until the wound healed completely. Related studies have shown that PRP can significantly repair severe burn wounds, while it is effective in the treatment of tissue infections such as bone infection. Therefore, on one hand, the application of PRP in severe burn wounds can repair the wound and reduce the generation of bacteria; on the other hand, it can prevent the invasion and infection of bacteria, thus reducing the occurrence of wound infection.[4]

CONCLUSION

Autologous platelet rich plasma is an effective measure wound bed preparation and enhancing the uptake of skin graft. It is a good choice for treating scald burns provided the patient has a good functional status and surface area to be treated is small.

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Language and grammar

- Uniformly American English
- Abbreviations spelt out in full for the first time. Numerals from 1 to l0 spelt out
- Numerals at the beginning of the sentence spelt out

Tables and Fig.s

- No repetition of data in tables and graphs and in text.
- Actual numbers from which graphs drawn, provided.
- Fig.s necessary and of good quality (color)
- Table and Fig. numbers in Arabic letters (not Roman).
- Labels pasted on back of the photographs (no names written)
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- Manuscript provided on a CDROM (with double spacing)

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