

Evaluate and Compare the use and Effectiveness of PRP [Platelet Rich Plasma] and Threads in Facial Rejuvenation

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Abstract:- Evaluate and Compare The Use And Effectiveness Of Prp [Platelet Rich Plasma] And Threads In Facial Rejuvenation

BACKGROUND: The symmetry of face is very important biologic factors that will leads to facial attractiveness and will aim to improve symmetry.

AIM: The aim of the study is to compare and evaluate non-surgical procedures for facial rejuvenation between PRP and THREADS.

METHOD: Patients were randomized into two different groups based on different procedures like PRP and THREADS for facial rejuvenation. Group A included 10 cases, treating with PRP and Group B included 10 cases, treating with THREADS application.

RESULTS: The study will identify the any change in the Nasolabial fold, Swelling and aesthetic appearance, pain, bruising and wrinkles. This therapy have been used to manage many cosmetic skin problem and enhance their efficacy, also maintain youthful appearance and results to rejuvenate the ageing face for prolonged periods.

CONCLUSION: The study concludes that PRP and THREADS may provide effective, safe with relatively long lasting and natural results in the correction of prominent nasolabial fold and skin elasticity in restoring youthfulness.

Keywords:- Platelet Rich Plasma, Threads, Facial rejuvenation, Nasolabial fold.

I. INTRODUCTION

Ageing is a time related and biological process and during ageing, skin commence to lose its elasticity and volume that will also result in deep wrinkles. This is a time related part to grow older, patients are concerned about signs of aging and might discover facelift to converge the patient presupposition¹.

The rejuvenation is a notable process which is involved in reinstate youthfulness and patients desire to prevail over the aesthetic problems correlated with aging. A youthful face which is a balanced structure with smooth skin and unescorted by fine lines¹.

The past, concept of rejuvenation was dominated by invasive surgical procedures like partial and full face lift. Now, the trend is for less invasive procedures which are quick and simple and which also do not affect there daily routine and activities for prolonged periods³. It will lay out effectual, safe, enduring and reasonable outcome.

The process of aging is inter connected with intrinsic and extrinsic factors. The most important and very frequent changes observed due to continuing aging process will be the presence of wrinkles, atrophy of subcutaneous fat, and reduction in collagen and elastic production⁴.

There is also evident lowering of the turnover of skin cells. The gravitation and muscular aging are involved thus, increasing skin flaccidity.

During ageing, the muscle involved will rearrange and shortens, as there will be repeated shrinking which increase the tonicity. The skin will become dry, thin and which eventually results in loss of the skin texture and elasticity⁶.

Sun exposure [photoaging] is very important and extremely aggressive extrinsic factor⁷. Some other factors may also include exaggerated mimic expressions, gravity, sleeping position and smoking.

Patients might have very high expectations and rapid recovery after surgery. A thread-based facelift will meet the desired requirements and which is becoming popular these days. These minimally invasive, thread-based facelift will always have some benefits. First, there will be consideration of functional anatomy of the face⁹. Second, there will be stronger pulling force of the threads than previously used.

The main aim of the minimally invasive treatment is via inducing selective dermal injury and that will induceresponse in wound repair thus by maintaining the overlying epidermis intact¹¹.

Since symmetry is very important biologic factors that will leads to facial attractiveness, facial rejuvenation procedures are that usually aimed at improving symmetry¹²

II. MATERIALS AND METHODS

A. Source of data:

The study was conducted on patients undergoing the procedure of facelift due to various reasons like age or beautification etc.in the department of oral and maxillofacial surgery in Rama dental college, hospital and research center, Kanpur, between March 2021 – March 2022.

B. Method of collection of data:

- A detailed case history will be obtained.
- The patient will undergo routine pre-operative Hematological, Biochemical, Microbiological and other required investigations.
- The study will be a prospective analysis of patients undergoing the procedure of facelift due to various reasons like age or beautification etc.
- Baseline demographic data of all patients will be recorded at the start of study.

- Investigator's assessment and the patient satisfaction will be analyzed and recorded within 24 hours of surgery, 3rd post operative day, 1 week post operatively, 15 days, 3 months and 6 months
- In this method, Photographs will be taken with same digital camera and same operator.
- Grade of wrinkles for nasolabial folds will be evaluated by wrinkle severity at rest scale along with outcomes and side effects before treatment.
- Degree of improvement will be recorded along with questionnaire to determine satisfaction and complication.
- A consecutive series of patients will be analyzed without any bias for the use of PRP and THREADS.
- Patients is to be informed about the study and a written informed consent will be taken.
- Pre-operative, intra operative, post-operative pictures will be taken and recorded.

C. Sample size:

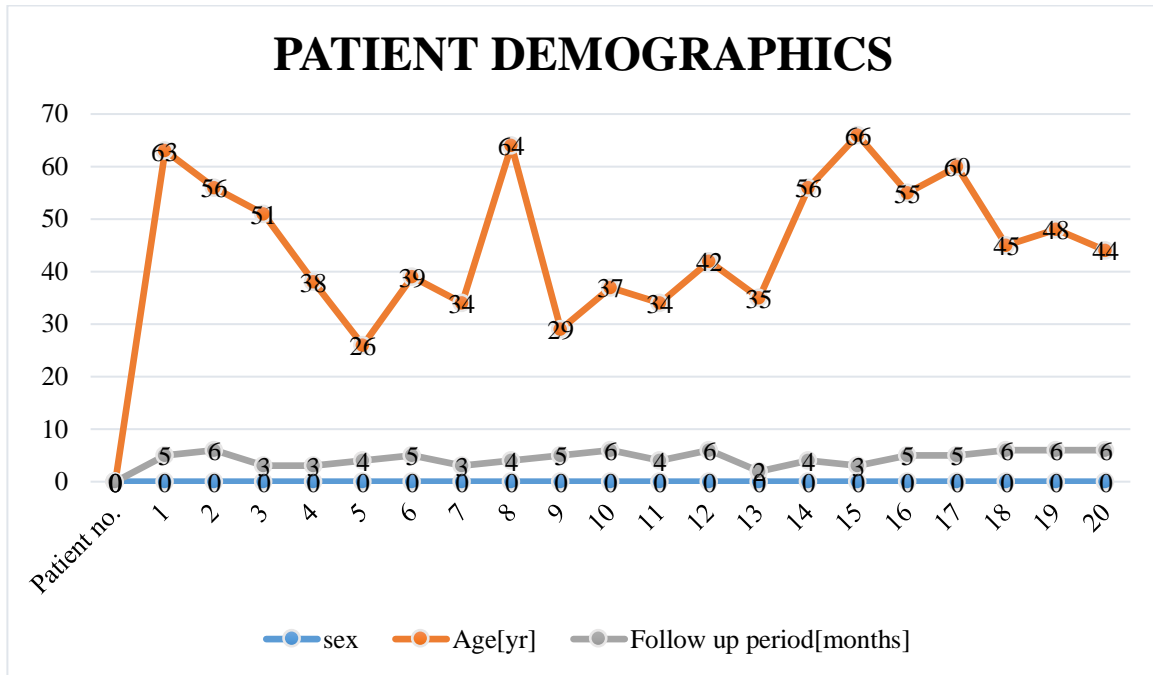
- 20 subjects.

III. OBSERVATION AND RESULTS

Table 1: According to patient demographics

Patient no.	Sex	Age [yr]	Follow up period[months]
1	F	63	5
2	M	56	6
3	M	51	3
4	M	38	3
5	F	26	4
6	F	39	5
7	M	34	3
8	F	64	4
9	M	29	5
10	M	37	6
11	F	34	4
12	F	42	6
13	F	35	2
14	F	56	4
15	F	66	3
16	F	55	5
17	F	60	5
18	F	45	6
19	F	48	6
20	F	44	6

The total 20 cases were included in the study with different age group and follow up period of 6 months was undertaken.

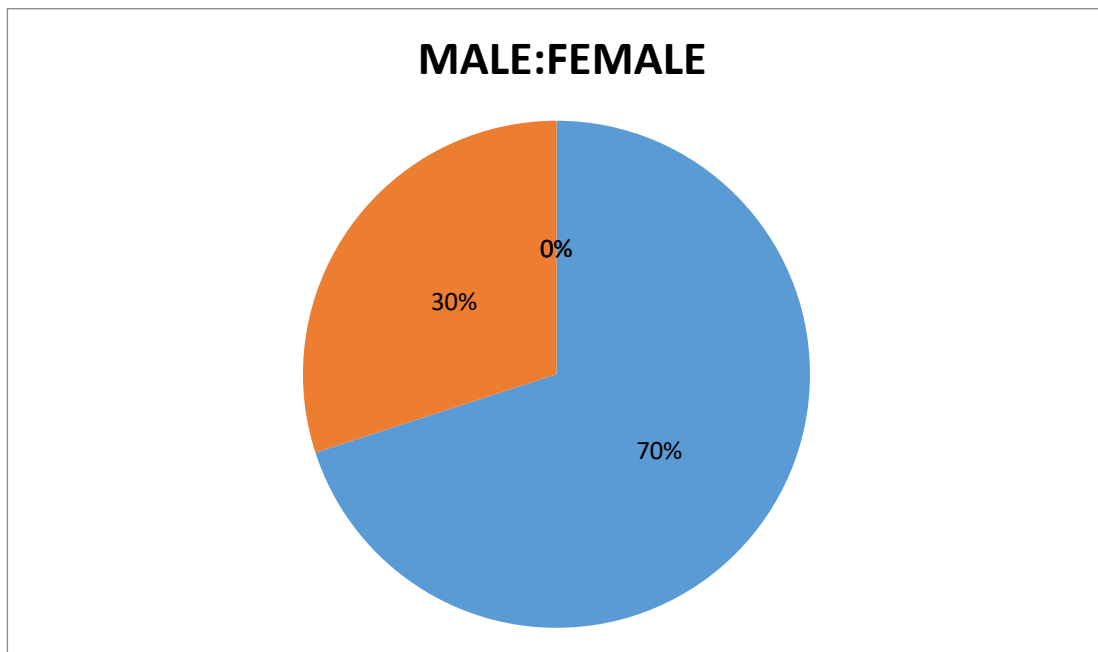


Graph 1: Showing patient demographics including number of patient, sex, age and follow up period

Table 2: According to gender distribution

Facelift technique	Gender distribution	Percentage
Male	6	30%
Female	14	70%
Total	20	100%

The total 20 cases were included in the study and divided into two groups according to gender distribution.

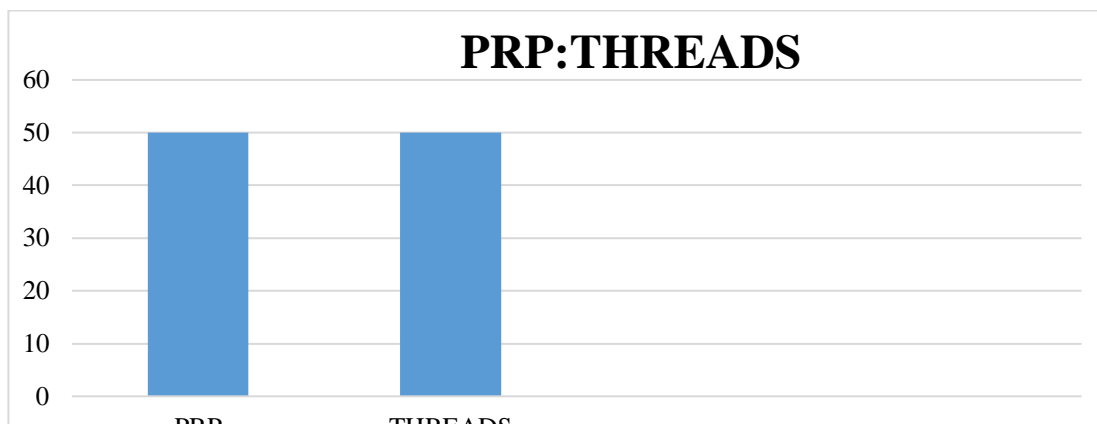


Graph 2: Showing distribution of groups into male and female

Table 3: According to facelift methods performed

Facelift	Number	Percentage
PRP	10	50%
Threads	10	50%
Total	20	100%

The total 20 cases were divided into 50% PRP and 50% THREADS methods.



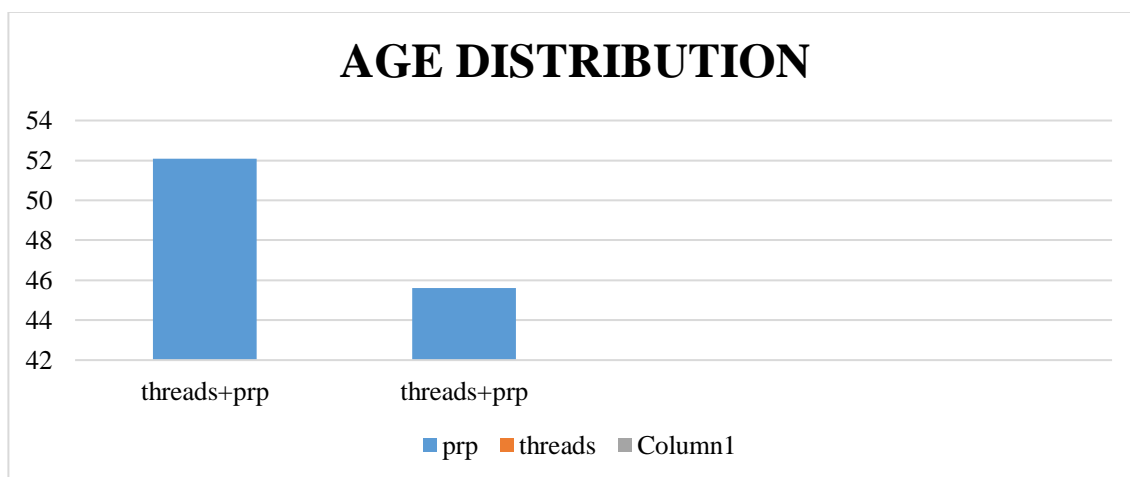
Graph 3: Showing distribution of groups according to facelift methods used.

Table 4: According to age distribution:

facelift	Age in years		t value
	mean	SD	
PRP	52.10	8.01	2.54
Threads	45.60	7.50	

P value 0.022

The mean age of PRP method group was 52.10+8.01 years while the mean age of THREADS method group was 45.60+7.50. the significant difference was found in mean ages between groups[p=0.022]



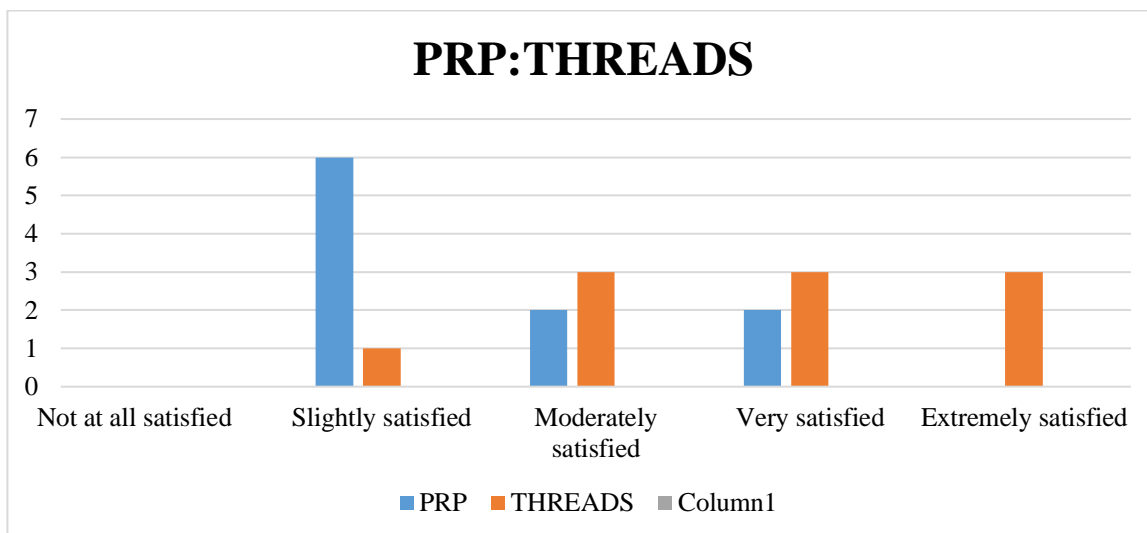
Graph 4: Showing age distribution for PRP and THREAD methods.

Table 5: According to patient satisfaction

Satisfaction index	PRP		THREADS		Chi square	p-value
	NO.	%	NO.	%		
Not at all satisfied	-	-	-	-	0.00	1.00
Slightly satisfied	6	60%	1	10%		
Moderately satisfied	2	20%	3	30%		
Very satisfied	2	20%	3	30%		
Extremely satisfied	-	-	3	30%		
total	10	100%	10	100%		

In PRP group the patient satisfaction was slightly satisfied in 6[60%] cases while remaining 2 each were moderately satisfied and very satisfied.

In THREADS group the patient satisfaction was overall satisfied with 3 each in moderately, very and extremely satisfied.

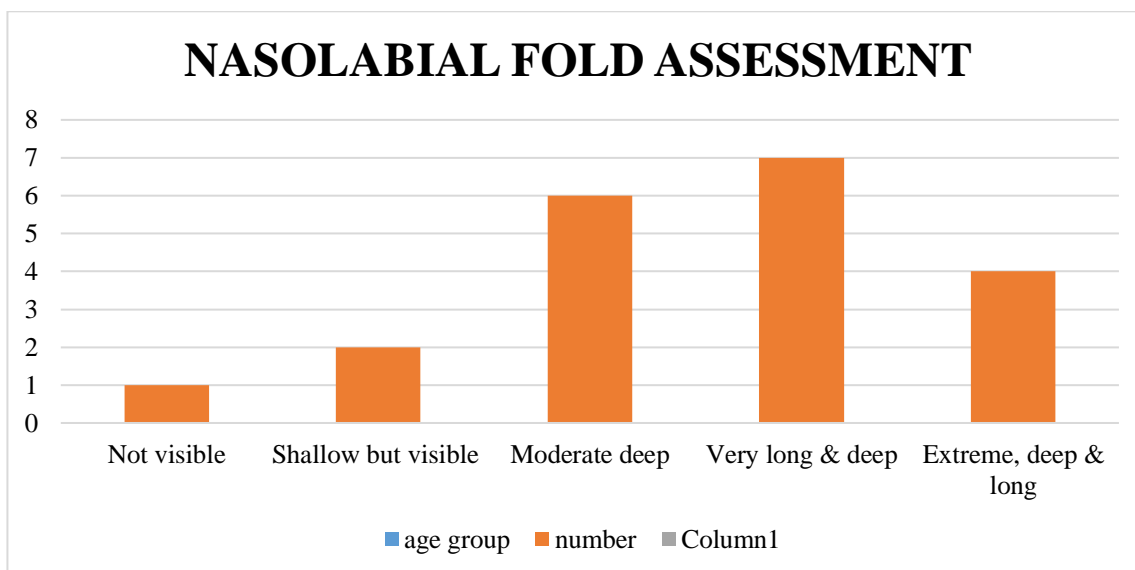


Graph 5: Showing patient satisfaction between PRP and THREADS

Table 6: According to nasolabial fold severity assessment

Nasolabial fold assessment	Age group	Number of individuals
0-Not visible	30-33	1
1-Shallow but visible	33-36	2
2-Moderate deep	36-42	6
3-Very long & deep	42-50	7
4-Extreme, deep & long	50-65	4

The nasolabial fold severity was examined by dividing into different age group and assessment were done [7 cases with very long and deep fold]

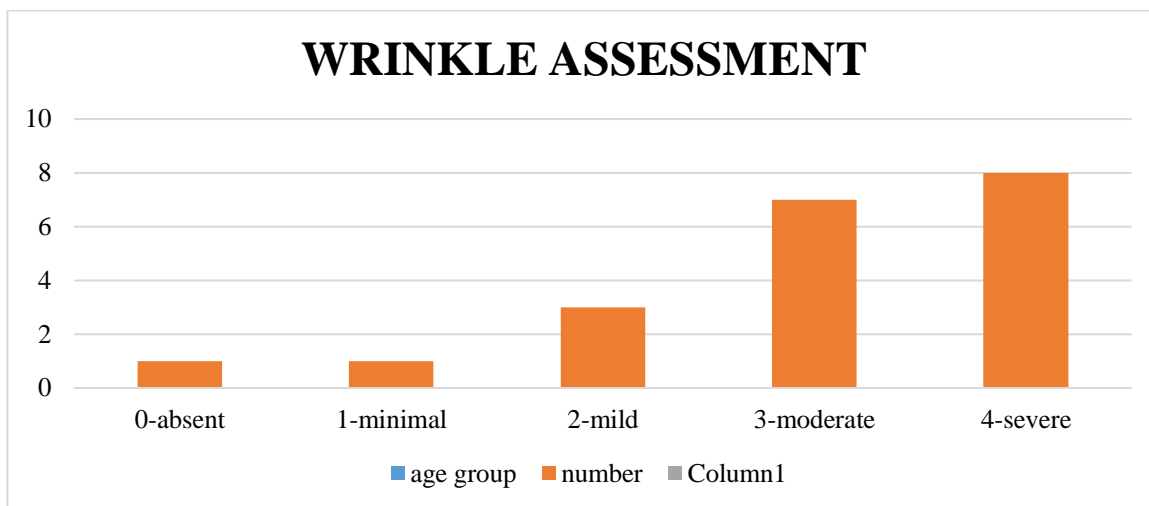


Graph 6: Showing nasolabial fold severity with different age group and number of individuals.

Table 7: According to wrinkle assessment

wrinkle assessment	Age group	number
0-absent	30-33	1
1-minimal	33-36	1
2-mild	36-42	3
3-moderate	42-50	7
4-severe	50-65	8

The wrinkle assessment was done by dividing into different age group and number of individuals [8 cases with scoring 4-severe]

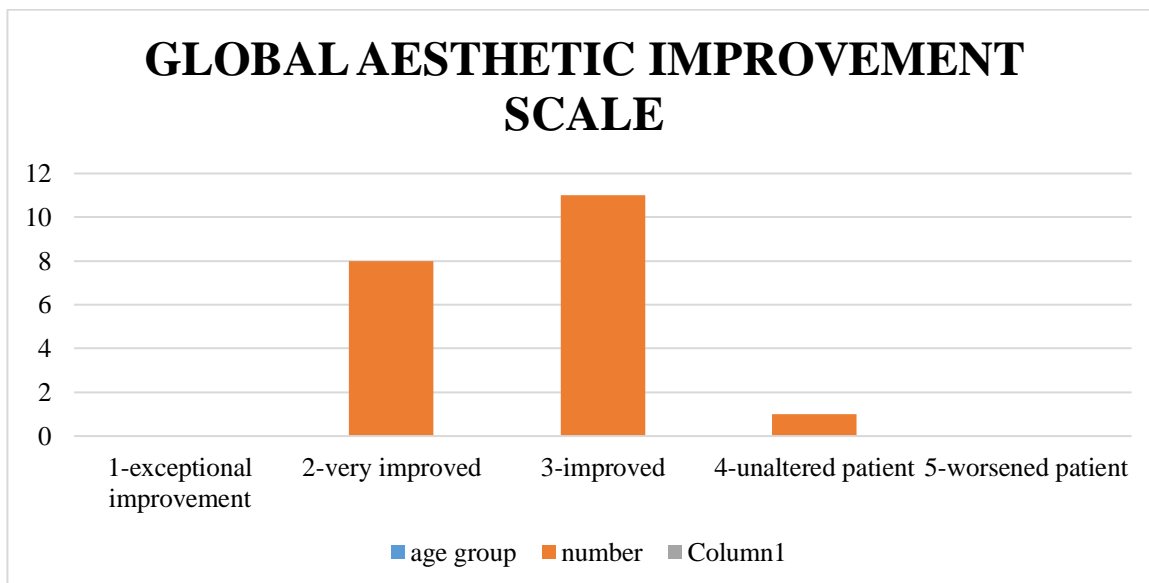


Graph 7: Showing wrinkle assessment with different age group and number of individuals.

Table 8: According to Global aesthetic improvement scale:

Global aesthetic scale	Age group	number
1-exceptional improvement	30-33	0
2-very improved	33-36	8
3-improved	36-42	11
4-unaltered patient	42-50	1
5-worsened patient	50-65	0

The Global aesthetic improvement scaling was performed by dividing into different age group and involved individuals with rating of 3-improved, were given in the age group of 36-42 [11 number of individuals]

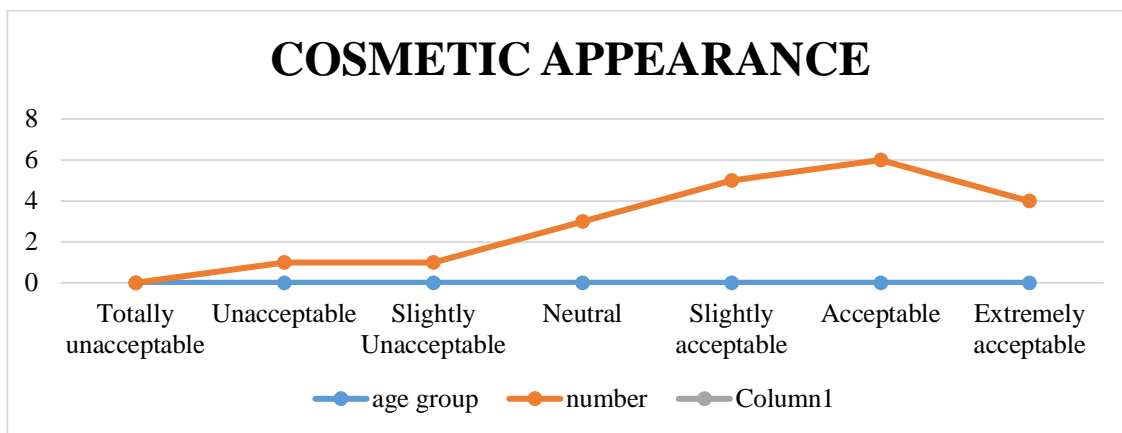


Graph 8: Showing Global aesthetic improvement scale among different age group of individuals.

Table 9: According to cosmetic appearance

Cosmetic appearance	Age group	number
Totally unacceptable	30-35	0
Unacceptable	35-40	1
Slightly Unacceptable	40-45	1
Neutral	45-50	3
Slightly acceptable	50-55	5
Acceptable	55-60	6
Extremely acceptable	60-70	4

Cosmetic appearance scale was rated from 0 to 4 among different age group and number of individuals involved with maximum rating 6-acceptable.

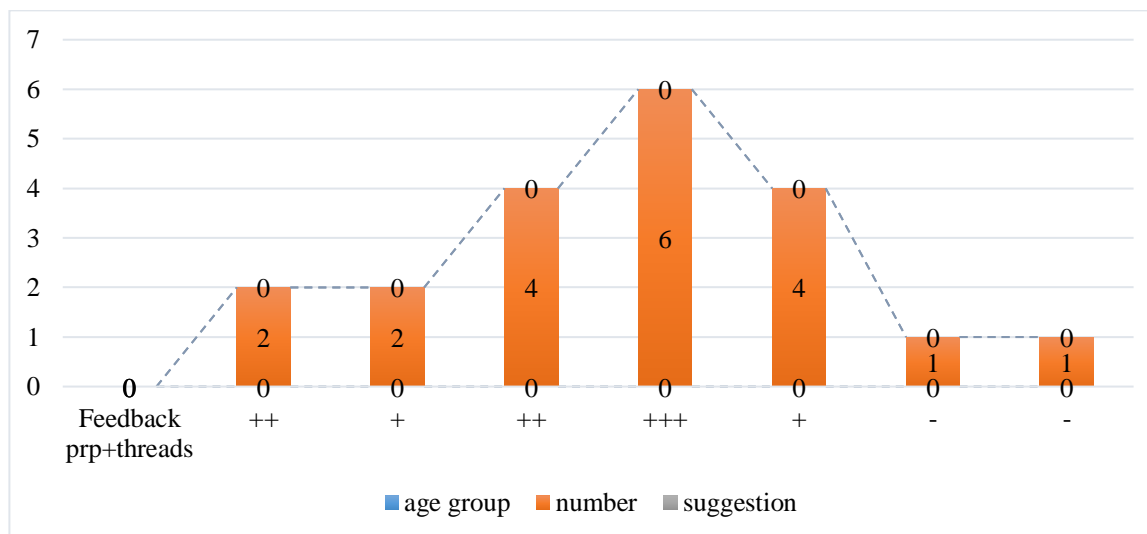


Graph 9: Showing cosmetic appearance among different age group with 60% acceptable result.

Table 10: According to patient feedback and outcome results:

Feedback PRP+Threads	Age group	number	suggestion
++	20-35	2	Y
+	35-40	2	N
++	40-45	4	Y
+++	45-50	6	Y
+	50-55	4	N
-	55-60	1	N
-	60-70	1	N
total		20	Y-12, N-8

Data was collected on the basis of patient feedback and out come results in different age groups and number of individuals involved. The positive feedback with 60% and negative was 40% in a total strength of [n=20] individuals.

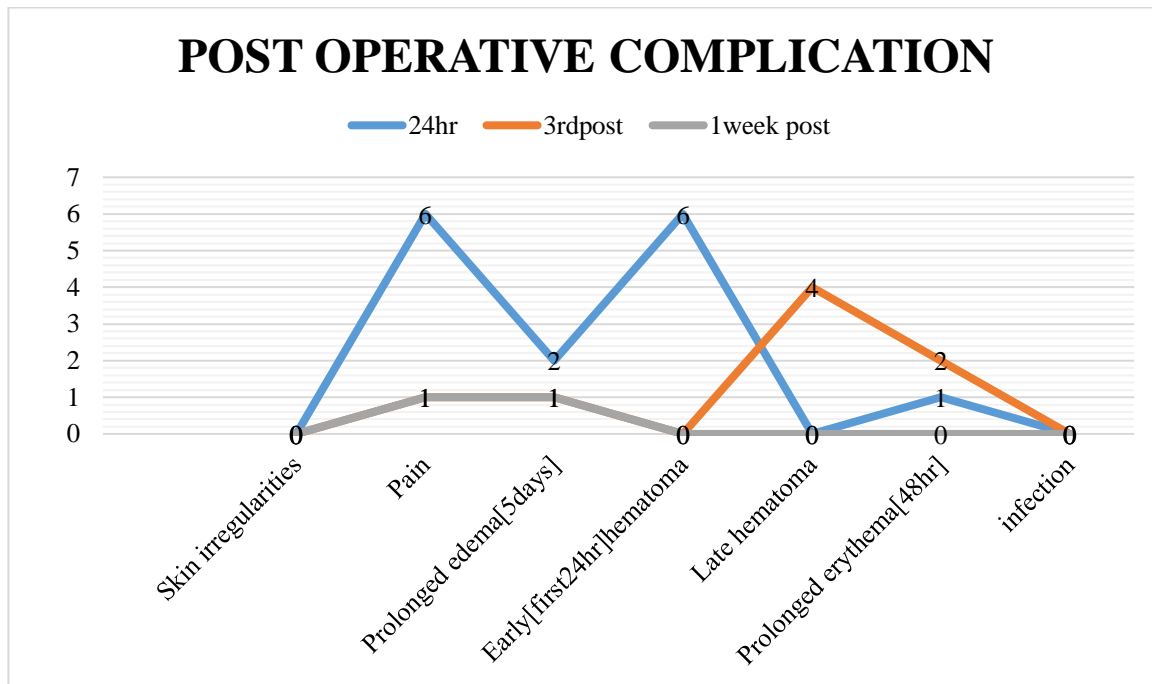


Graph 10: Showing patient feedback and out come results with different age group and number of individuals involved.

Table 11: According to post operative complications in numbers

complications	24hr	3 rd post	1week post	15days	3months	6months	Patient [n]
Skin irregularities	0	0	0	0	0	0	0
Pain	6	1	1	1	1	1	11
Prolonged edema[5days]	2	1	1	0	0	0	4
Early[first24hr]hematoma	6	0	0	0	0	0	6
Late hematoma	0	4	0	0	0	0	4
Prolonged erythema[48hr]	1	2	0	0	0	0	3
infection	0	0	0	0	0	0	0

A complete data showing post operative complications in regular interval of time with pain as a major complication[n=11] 55% followed by Early hematoma [n=6].



Graph 11: Showing post-operative complications among 20 individuals during a follow up duration of 6 months.

IV. DISCUSSION

Cosmetic surgery has now become very common and accepted. The easy access to information and reality shows, there has been an increase in demand for these procedures, which has given rise to our new generation who have undergone a facelift or neck lift procedure¹⁴.

The methods of facial rejuvenation are effectively proven and which have also won the trust and faith of patients. The injectable and lasers will be the novel techniques and will continue to expand. The paramount importance to appreciate the role of these respect to how these methods interplay with surgical standards of treatment¹⁵.

Nowadays, PRP has come to the attention, with newer applications that ranges from hair restoration to soft tissue augmentation. PRP’s in cosmetic surgery is rapidly growing with promising and exciting treatment modality. The use of PRP in aesthetic medicine will involve: tissue regeneration and rejuvenation, induction of cell differentiation, extracellular matrix formation, recruitment of other cells in injury site, and rise in collagen formation, which will increase skin thickness and overall health²⁰.

Most people who wants facial rejuvenation methods should be well adjusted psychologically with realistic goals and expectations.

The minimally invasive modalities will improve collagen induction and helps in penetration of topical agents. Minimally invasive procedures involve’s chemical peels, microdermabrasion, mesotherapy, microneedling, threads, PRP, non-ablative lasers, selective photothermolysis, and dermal fillers. The desirable and latest trend is non surgical cosmetic treatments tailored according to the patient needs and desires²⁴.

The results of thread-based lifts can only be evaluated subjectively. Thus, the effects such as skin type, race, age, and history of smoking on final outcomes can be discussed as complications³³. The main purpose of the study is to compare and evaluate the non surgical procedures for facial rejuvenation between PRP and THREADS currently used to manage prominent nasolabial folds.

In this study, cosmetic appearance with acceptable results in 6 number of patients and score of 5 [acceptable] in the age group of 55-60 and wrinkle assessment with scoring of 4 [severe] in the age group of 50-65 in 8 number of patients while using PRP as treatment modality. Dr. Neerja Puri et al. in 2015 experienced PRP as a promising therapy. PRP is used in facial and neck rejuvenation, fine lines and wrinkles and facial scarring. She concluded, as collagen matures, it will begin to shrink, tightens and strengthens the skin along with refinement in skin texture and tone within 3 weeks. Mild swelling, bruising along with redness for the upcoming 12 to 24 hours with bruise may be visible for 2 to 3 days³⁵.

In our study, the nasolabial fold was assessed and we have found scoring of 4 [extreme,deep]in the age group of 50-65 with number of patients 4 using PRP and scoring of 2 [moderate] in the age group of 36-42 with number of patients 6 while using Threads and PRP with minimal improvement . Sang Yeul Lee et al. in 2011 observed as most prominent signs of aging is deepening and lengthening of the nasolabial folds, which might make people look old and aesthetically displeasing. Skoog demonstrated the technique and gave only minimal improvement in nasolabial area using PRP and THREADS³⁶.

The study conducted, has shown patient satisfaction index with 30% [extremely satisfied] while using threads and 60% [slightly satisfied] while using PRP. Moetaz El-Domyati et al in 2018 advocated the minimally invasive

procedures like PRP and THREADS has increased acceptance due to their efficacy, safety, and relatively long-lasting and natural results³⁷. Author concluded, significant increase in epidermal thickness and collagen production with decreased abnormal elastic fibers.

In this study, complication index showing post operative complications in regular interval of time with pain as a major complication [n=11] 55% followed by Early hematoma [n=6]. S. Zenker et al in 2011 concluded minimally invasive methods as safe and creates an immediate, long lasting volumetric effect with natural looking results³⁸. The technique is easy to perform with more than 100 patients were facially injected with PRP and threads with a follow up period of 3-6 months and his study results in pain as the common side-effects with high level of patient satisfaction.

Aesthetic improvement assessment was performed by dividing into different age group and involved individuals with rating of 3-improved, were given in the age group of 36-42 [11 number of individuals]. The technique is easy to perform with more than 100 patients were facially injected with PRP and threads with follow up period of 3-6 months and his study results in pain as the common side-effects with high level of patient satisfaction³⁸.

There are few limitations that includes, short term follow-up and small number of cases. The assessment scale depends on subjective factors. Long term follow-up results with more objective assessment criteria are thus needed.

V. CONCLUSION

The nonsurgical and surgical procedures are very important to consider in facial rejuvenation. The thread lift will redefine the facial contours by inducing collagen formation and creating a lifting effect that will last upto 2-3 years and will form an integrated support structure due to collagen synthesis for the face.

There are many innovative PRP applications, which includes skin rejuvenation and hair restoration with no major side effects, which makes it a safe, inexpensive and readily available. The gradual improvement will be seen soon after thread lift treatments.

Although there are many techniques that are used to correct prominent nasolabial folds, but the surgeon's ability to individualize the treatment plan accordingly to the patient, aesthetic needs, downtime and even economic status is the key to consistent results. In order to select the optimal procedure for the patient, proper understanding of diverse techniques currently used in clinical fields is essential.

REFERENCES

- [1.] Fulton JE, Saylan Z, Helton P, Rahimi AD, Golshani M. The S-lift facelift featuring the U-suture and O-suture combined with skin resurfacing. *Dermatol Surg.* 2001 Jan;27(1):18-22. PMID: 11231235.
- [2.] Eppley BL, Pietrzak WS, Blanton M. Platelet-rich plasma: a review of biology and applications in plastic surgery. *Plast Reconstr Surg.* 2006 Nov;118(6):147e-159e. doi: 10.1097/01.prs.0000239606.92676.cf. PMID: 17051095.
- [3.] Ogden S, Griffiths TW. A review of minimally invasive cosmetic procedures. *Br J Dermatol.* 2008 Nov;159(5):1036-50. doi: 10.1111/j.1365-2133.2008.08845.x. Epub 2008 Sep 23. PMID: 18823403.
- [4.] Abraham RF, DeFatta RJ, Williams EF 3rd. Thread-lift for facial rejuvenation: assessment of long-term results. *Arch Facial Plast Surg.* 2009 May-Jun;11(3):178-83. doi: 10.1001/archfacial.2009.10. PMID: 19451452.
- [5.] Sclafani AP. Platelet-rich fibrin matrix for improvement of deep nasolabial folds. *J Cosmet Dermatol.* 2010 Mar;9(1):66-71. doi: 10.1111/j.1473-2165.2010.00486.x. PMID: 20367676.
- [6.] Chaffoo RA. Complications in facelift surgery: avoidance and management. *Facial Plast Surg Clin North Am.* 2013 Nov;21(4):551-8. doi: 10.1016/j.fsc.2013.07.007. PMID: 24200374.
- [7.] Peng GL. Platelet-Rich Plasma for Skin Rejuvenation: Facts, Fiction, and Pearls for Practice. *Facial Plast Surg Clin North Am.* 2019 Aug;27(3):405-411. doi: 10.1016/j.fsc.2019.04.006. PMID: 31280855.
- [8.] Sang-Yeul Lee¹, Kun-Yong Sung. Subcision Using a Spinal Needle Cannula and a Thread for Prominent Nasolabial Fold Correction: may 16, 2013. Doi: <https://doi.org/10.5999/aps.2013.40.3.256>. PMID: 3128977
- [9.] Warren RJ, Aston SJ, Mendelson BC. Face lift. *Plast Reconstr Surg.* 2011 Dec;128(6):747e-764e. doi: 10.1097/PRS.0b013e318230c939. PMID: 22094776.
- [10.] Mulholland RS. Radio frequency energy for non-invasive and minimally invasive skin tightening. *Clin Plast Surg.* 2011 Jul;38(3):437-48, vi. doi: 10.1016/j.cps.2011.05.003. PMID: 21824541.
- [11.] Lubkowska A, Dolegowska B, Banfi G. Growth factor content in PRP and their applicability in medicine. *J Biol Regul Homeost Agents.* 2012 Apr-Jun;26(2 Suppl 1):3S-22S. PMID: 23648195.
- [12.] McCollough EG, Perkins S, Thomas JR. Facelift: panel discussion, controversies, and techniques. *Facial Plast Surg Clin North Am.* 2012 Aug;20(3):279-325. doi: 10.1016/j.fsc.2012.02.001. PMID: 22910022.

- [13.] Mehryan P, Zartab H, Rajabi A, Pazhoohi N, Firooz A. Assessment of efficacy of platelet-rich plasma (PRP) on infraorbital dark circles and crow's feet wrinkles. *J Cosmet Dermatol*. 2014 Mar;13(1):72-8. doi: 10.1111/jocd.12072. PMID: 24641609.
- [14.] Savoia A, Accardo C, Vannini F, Di Pasquale B, Baldi A. Outcomes in thread lift for facial rejuvenation: a study performed with happy lift™ revitalizing. *Dermatol Ther (Heidelb)*. 2014 Jun;4(1):103-14. doi: 10.1007/s13555-014-0041-6. Epub 2014 Jan 17. PMID: 24436079; PMCID: PMC4065274
- [15.] Savoia A, Accardo C, Vannini F, Di Pasquale B, Baldi A. Outcomes in thread lift for facial rejuvenation: a study performed with happy lift™ revitalizing. *Dermatol Ther (Heidelb)*. 2014 Jun;4(1):103-14. doi: 10.1007/s13555-014-0041-6. Epub 2014 Jan 17. PMID: 24436079; PMCID: PMC4065274
- [16.] Chaffoo RA. Complications in facelift surgery: avoidance and management. *Facial Plast Surg Clin North Am*. 2013 Nov;21(4):551-8. doi: 10.1016/j.fsc.2013.07.007. PMID: 24200374.
- [17.] Kang RS, Lee MK, Seth R, Keller GS. Platelet-Rich Plasma in Cosmetic Surgery. *Int J Otorhinolaryngol Clin* 2013;5(1):24-28. doi: 10.5005/jp-journals-10003-1106
- [18.] Willemsen JC, van der Lei B, Vermeulen KM, Stevens HP. The effects of platelet-rich plasma on recovery time and aesthetic outcome in facial rejuvenation: preliminary retrospective observations. *Aesthetic Plast Surg*. 2014 Oct;38(5):1057-63. doi: 10.1007/s00266-014-0361-z. Epub 2014 Jul 2. PMID: 24984784.
- [19.] Brobst RW, Ferguson M, Perkins SW. Noninvasive treatment of the neck. *Facial Plast Surg Clin North Am*. 2014 May;22(2):191-202. doi: 10.1016/j.fsc.2014.01.011. PMID: 24745382.
- [20.] Haiavy J, Dhaliwal H. Reoperative face and neck lifts. *Atlas Oral Maxillofac Surg Clin North Am*. 2014 Mar;22(1):91-102. doi: 10.1016/j.cxom.2013.11.001. PMID: 24581568
- [21.] Leo MS, Kumar AS, Kirit R, Konathan R, Sivamani RK. Systematic review of the use of platelet-rich plasma in aesthetic dermatology. *J Cosmet Dermatol*. 2015 Dec;14(4):315-23. doi: 10.1111/jocd.12167. Epub 2015 Jul 23. PMID: 26205133.
- [22.] Sinno S, Schwitzer J, Anzai L, Thorne CH. Face-Lift Satisfaction Using the FACE-Q. *Plast Reconstr Surg*. 2015 Aug;136(2):239-242. doi: 10.1097/PRS.0000000000001412. PMID: 25909302.
- [23.] Andrew A, Jacono, MD, FACS, Melanie H. Malone, MD, Thomas John Lavin, BS, Nonsurgical Facial Rejuvenation Procedures in Patients Under 50 Prior to Undergoing Facelift: Habits, Costs, and Results, *Aesthetic Surgery Journal*, Volume 37, Issue 4, 1 April 2017, Pages 448–453, <https://doi.org/10.1093/asj/sjw217>
- [24.] Rigotti G, Charles-de-Sá L, Gontijo-de-Amorim NF, Takiya CM, Amable PR, Borojevic R, Benati D, Bernardi P, Sbarbati A. Expanded Stem Cells, Stromal-Vascular Fraction, and Platelet-Rich Plasma Enriched Fat: Comparing Results of Different Facial Rejuvenation Approaches in a Clinical Trial. *Aesthet Surg J*. 2016 Mar;36(3):261-70. doi: 10.1093/asj/sjv231. PMID: 26879294; PMCID: PMC5127465.
- [25.] Ali YH. Two years' outcome of thread lifting with absorbable barbed PDO threads: Innovative score for objective and subjective assessment. *J Cosmet Laser Ther*. 2018 Feb;20(1):41-49. doi: 10.1080/14764172.2017.1368562. Epub 2017 Dec 4. PMID: 28863268.
- [26.] Lin J, Sclafani AP. Platelet-Rich Plasma for Skin Rejuvenation and Tissue Fill. *Facial Plast Surg Clin North Am*. 2018 Nov;26(4):439-446. doi: 10.1016/j.fsc.2018.06.005. Epub 2018 Aug 16. PMID: 30213425.
- [27.] Goldman A, Wollina U. Facial rejuvenation for middle-aged women: a combined approach with minimally invasive procedures. *Clin Interv Aging*. 2010 Sep 23;5:293-9. doi: 10.2147/cia.s 13215. PMID: 20924438; PMCID: PMC2946856.
- [28.] El-Domyati M, Abdel-Wahab H, Hossam A. Combining microneedling with other minimally invasive procedures for facial rejuvenation: a split-face comparative study. *Int J Dermatol*. 2018 Nov;57(11):1324-1334. doi: 10.1111/ijd.14172. Epub 2018 Aug 13. PMID: 30105816.
- [29.] Jacono AA, Malone MH, Lavin TJ. Nonsurgical Facial Rejuvenation Procedures in Patients Under 50 Prior to Undergoing Facelift: Habits, Costs, and Results. *Aesthet Surg J*. 2017 Apr 1;37(4):448-453. doi: 10.1093/asj/sjw217. PMID: 27965217.
- [30.] Ruiz-Rodriguez R, Martin-Gorgojo A. Integral Facial Management of the Aesthetic Patient: The Skin Age Management Protocol. *Actas Dermosifiliogr (Engl Ed)*. 2019 Apr;110(3):197-205. English, Spanish. doi: 10.1016/j.ad.2018.10.016. Epub 2019 Feb 14. PMID: 30771857.
- [31.] Pourang A, Rockwell H, Karimi K. New Frontiers in Skin Rejuvenation, Including Stem Cells and Autologous Therapies. *Facial Plast Surg Clin North Am*. 2020 Feb;28(1):101-117. doi: 10.1016/j.fsc.2019.09.009. PMID: 31779934.
- [32.] Singh P, Gupta J. You are never too old to become younger. *Int J Aesthet Health Rejuvenation* 2019;2(2):17-9.
- [33.] Ashammakhi N, Ahadian S, Darabi MA, El Tahchi M, Lee J, Suthiwanich K, Sheikhi A, Dokmeci MR, Oklu R, Khademhosseini A. Minimally Invasive and Regenerative Therapeutics. *Adv Mater*. 2019 Jan;31(1):e1804041. doi: 10.1002/adma.201804041. Epub 2018 Nov 22. PMID: 30565732; PMCID: PMC6709364.
- [34.] Dario Bertossi, MD, Giovanni Botti, MD, Alessandro Gualdi, MD, Piero Fundarò, MD, Riccardo Nocini, MD, Ali Pirayesh, MD, Berend van der Lei, MD, PhD, Response to “Is There a Role for a Noninvasive Alternative to Face and Neck Lifting? The Polydioxanone Thread Lift”, *Aesthetic Surgery Journal*, Volume 39, Issue 8, August 2019, Pages NP364–NP365, <https://doi.org/10.1093/asj/sjz150>.

- [35.] Pourang A, Rockwell H, Karimi K. New Frontiers in Skin Rejuvenation, Including Stem Cells and Autologous Therapies. *Facial Plast Surg Clin North Am.* 2020 Feb;28(1):101-117. doi: 10.1016/j.fsc.2019.09.009. PMID: 31779934.
- [36.] Hashem AM, Couto RA, Duraes EFR, Çakmakoğlu Ç, Swanson M, Surek C, Zins JE. Facelift Part I: History, Anatomy, and Clinical Assessment. *Aesthet Surg J.* 2020 Jan 1;40(1):1-18. doi: 10.1093/asj/sjy326. PMID: 30843042.