

Injection Medialization For Unilateral Vocal Fold Paralysis: Effect Of Timing On Need For Open Laryngeal Procedures.

Dr Deepika Sethi¹, Dr Ashwani Sethi², Dr. A.K. Mishra², Dr A. Mallick²

¹(Otorhinolaryngology And Head & Neck Surgery, Dr BSA Medical College, New Delhi, India)

²(Otorhinolaryngology And Head & Neck Surgery, Army College Of Medical Sciences, New Delhi, India)

Corresponding Author : Dr Ashwani Sethi.

Abstract: Vocal Fold Medialisation By Injection Of Tissue Fillers Has Been Used To Close Small Phonatory Gaps In Cases Of Unilateral Vocal Fold Paralysis (UVFP). Some Of These Patients May Also Require Vocal Fold Medialization Using Open Thyroplasty Procedures. The Aim Of The Present Study Is To Determine Whether Temporary Vocal Fold Injection Affects The Need For Permanent Medialization Thyroplasty In Patients With Unilateral Vocal Fold Paralysis. The Study Involves A Retrospective Analysis Of 34 Consecutive Patients Meeting Inclusion Criterion Undergoing Vocal Fold Injection Medialisation Laryngoplasty For UVFP Using Two Different Tissue Fillers (I.E. Hyaluronic Acid And Agarose Gel). Rates Of Permanent Medialization Laryngoplasty In Patients Undergoing Vocal Fold Injection Before And After 6 Months Of Onset Of UVFP Were Compared. A Total Of 22 Patients Underwent Temporary Injection Medialization Within 6 Months Of Onset Of UVFP And 12 Patients Underwent The Procedure Beyond 6 Months. All The Patients Had A Statistically Significant Improvement In Voice Following The Procedure. Only 6 Of The 22 Patients With Early Injection Medialization (< 6 Months) Subsequently Underwent Permanent Medialization Thyroplasty Compared To 9 Of The 12 Patients With Late Injection Medialization (> 6 Months) ($P < .05$, Paired T-Test). In Conclusion, Patients Receiving Early Injection Medialization For Vocal Cord Paralysis Were Less Likely To Require Permanent Injection Medialization.

Key Words: Vocal Cord, Injection Medialization, Thyroplasty, Hyaluronic Acid, Agarose.

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I. Introduction

UVFP Is Characterized By Inadequate Approximation Of Vocal Folds Leading To Dysphonia. Surgical Trauma, Tumours And Neurological Afflictions Are Common Causes For Such An Occurrence^{1, 2}. Various Treatment Modalities Have Been Developed Across The World For Treating Such Patients With The Primary Aim Of Achieving Approximation Of The Vocal Folds In Order To Correct The Dysphonia. These Treatment Modalities Can Be Broadly Divided Into: Injection Laryngoplasty, Isshiki Type I (Medialization) Thyroplasty, Arytenoid Adduction And Laryngeal Reinnervation^{3, 4, 5}. Injection Laryngoplasty Is Considered To Be A Less Invasive And Temporary Method Of Managing This Condition With An Aim Of Improving Voice And Preventing Aspiration In Patients Where A Spontaneous Recovery Of Vocal Fold Function Is Anticipated⁶. This Procedure Also Obviates The Need For A Permanent Open Medialization Thyroplasty In These Patients. However, A Few Of The Recent Studies Have Concluded That Early Injection Medialization May Altogether Obviate The Need For A Permanent Medialization Thyroplasty In A Majority Of Patients^{6, 7, 8, 9}. The Aim Of The Present Study Is To Assess The Role Of Timing Of The Injection Medialization In Obviating The Need For A Permanent Open Medialization Thyroplasty Procedure.

II. Material And Methods

This Retrospective Study Included 34 Patients Of Either Sex Meeting The Inclusion Criteria With Age Ranging From 18 To 60 Years Who Presented To The ENT Department With Complaints Of Hoarseness Secondary To Unilateral Vocal Fold Paralysis. Patients With Hoarseness Secondary To Other Laryngeal Lesions And Those Who Were Uncooperative For Injection Under Local Anaesthesia, Spontaneous Recovery Of Vocal Fold Mobility, <12 Months Of Follow-Up After Injection, Previous Treatment At Other Institutions, Neoplastic Disease Involving The Larynx, Or History Of Radiation To The Larynx Were Excluded. The Patients Underwent A Thorough ENT Examination And General Physical Examination For Any Associated Systemic Illness. Patients With Idiopathic Vocal Cord Paralysis Were Further Investigated With The Help Of Chest And Neck X-Rays And CT-Scans (Wherever Required) And Suitable Referrals Were Sought From Chest/Medical Specialists In Order To Identify The Cause Of Palsy.

The Selected Patients Also Underwent A Preoperative Voice Analysis Using Objective And Subjective Parameters Such As Voice Handicap Index, Shimmer, Jitter, Harmonic / Noise Ratio And VQE (Voice Quality Estimate). The Patients Underwent Injection Laryngoplasty Under Local Anaesthesia After Obtaining An Informed Consent In The OPD Setting. The Procedure Involved Injecting A Tissue Filler Lateral To The Vocal Fold Through Percutaneous Route Through The Cricothyroid Membrane Under Videoendoscopic Guidance. The Tissue Fillers Used In Our Study Were Liquid Agarose And Hyaluronic Acid. The Choice Of Tissue Filler Was Randomly Made. The Amount Of Filler Injected Was Titrated On The Basis Of Improvement In Patients' Voice On Table And The Amount Of Vocal Cord Approximation Achieved As Visualized On Videoendoscopy. Voice Analysis Using The Same Parameters Was Performed At 3 Months Post Procedure. The Patients Were Followed Up Post Procedure For A Duration Ranging From 12 Months To 2 Years. The Number Of Patients Requiring Open Medialization Thyroplasty Was Recorded And Results Compared With The Timing Of Their Injection Medialization Following The Onset Of UVFP.

Statistical Analysis

The Following Parameters Were Statistically Analyzed Using SPSS Version 17:

VHI Scores

The Average Scores Of The Three Domains Of VHI (I.E. Physical, Functional, And Emotional) Were Analyzed.

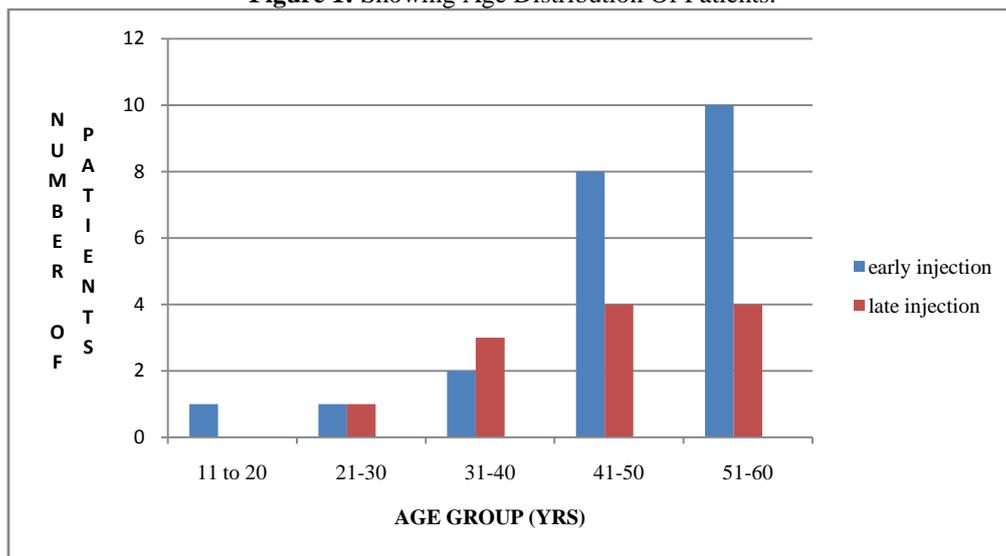
Acoustic Analysis

Voice Analyses Were Done In Terms Of Shimmer, Jitter, Normalized Noise Energy (NNE), And Fundamental Frequency (F0) And Voice Quality Estimate (VQE) Score Was Calculated For All The Patients Using Dr. Speech Voice Analysis Software.

III. Result

A Total Of 22 Patients In The Age Range Of 18-56 Years (Mean Age= 45.86 Yrs) Underwent Injection Medialization Within 6 Months Of Onset Of UVFP And 12 Of The Patients In The Age Range Of 28-60 Years (Mean Age =46.25 Yrs) Underwent Injection Medialization After 6 Months (**Figure 1**). Amongst The 34 Cases Of Vocal Cord Paralysis, 16 Were Idiopathic, 11 Were Secondary To Thyroid Surgery, 04 Each Were Secondary To Viral Illness And Pulmonary Tuberculosis, Whereas, One Patient Had Sarcoidosis.

Figure 1: Showing Age Distribution Of Patients.



VHI Scores

In The Early Injection Group, The Mean Total VHI Score For The Patients Pre- Injection Was 67.09 (SD = 22.52). The Post Injection VHI Score At 3 Months Was 14.6.

In The Late Injection Group, The Mean Total VHI Score For The Patients Pre- Injection Was 63.08 (SD = 26.07). The Post Injection VHI Score At 3 Months Was 17.42

VQE Scores

In The Early Injection Group, The Mean VQE Score For The Patients Pre- Injection Was 2.23 (SD =0.81). The Post Injection VQE Score At 3 Months Was 0.45.

In The Agarose Group, The Mean VQE Score For The Patients Pre- Injection Was 2.33 (SD = 0.78). The Post Injection VQE Score At 3 Months Was 0.58.

In The Early Injection Group, There Was A Significant Reduction In The Total And Individual Domain VHI And VQE Scores In All 22 Patients At 3 Months Post Injection As Compared To Pre Injection Scores As Assessed By Paired T –Test (P< .05) (**Table I**).

In The Late Injection Group, There Was A Significant Reduction In The Total And Individual Domain VHI And VQE Scores In All 12 Patients At 3 Months Post Injection As Compared To Pre Injection Scores As Assessed By Paired T –Test (P< .05) (**Table I**).

Table I: Comparison Of Pre And Post Injection Parameters In Early And Late Groups.

	PRE-INJECTION VALUES		POST- INJECTION VALUES		Stastical Correlation Using Paired T-Test
	Early Injection	Late Injection	Early Injection	Late Injection	
MEAN VHI	67.09	63.08	14.60	17.42	P<.05
MEAN VQE	2.23	2.33	0.45	0.58	P<.05

However, There Was No Statistically Significant Difference In The Post Injection Voice Parameter Improvement Between The Early And The Late Injection Groups.

Need For Open Permanent Medialization Thyroplasty

In The Early Injection Group, 16 Of The 22 Patients Retained An Improved Voice For A Follow Up Period Ranging From 12 Months To 2 Years Post Injection. However, 6 Patients Required The Open Surgical Procedure Owing To Recurrence Of Significant Dysphonia.

In The Late Injection Group, Only 3 Of The 12 Patients Retained An Improved Voice For A Follow Up Period Ranging From 12 Months To 2 Years Post Injection. As Many As 6 Patients Required The Open Surgical Procedure Owing To Recurrence Of Significant Dysphonia.

There Was A Statistically Significant Difference In The Need For Open Permanent Medialization Between The Early And The Late Injection Groups As Assessed By Paired T-Test (P<0.5) (**Table II**).

Table II: Showing Correlation Between Timing Of Injection Medialization And Need For Open Permanent Medialization.

Number Of Patients	Early Injection Group	Late Injection Group	Statistical Correlation
Needing Open Permanent Medialization	06	09	P < .05 = Significant Correlation
Not Needing Open Permanent Medialization	16	03	
Total	22	12	34

IV. Discussion

Being The Most Important Mode Of Communication For Human Beings, Any Pathology Affecting The Voice Is Liable To Cause A Physical, Functional And Emotional Handicap To The Concerned Individual¹⁰. Out Of The Various Pathologies That Involve The Larynx Resulting In Dysphonia, Vocal Fold Paralysis, Especially Of The Adductor Variety Significantly Hampers The Generation Of Voice. The Treatment Modalities Available For Management Of This Condition Can Be Broadly Divided Into Open Surgical Procedures On Larynx I.E. Laryngeal Framework Surgeries, And, Injection Medialization Of Vocal Folds^{3,4,5,6}.

The Present Study Comprised Of 34 Patients Who Were Treated With Injection Medialization Laryngoplasty Via Percutaneous Approach. The Other Approaches Used For The Procedure Include: Peroral, Percutaneous Transthyroid And Percutaneous Transthyroid Cartilage Route¹¹. We Used Agarose And Hyaluronic Acid As The Tissue Fillers For Injection In Our Patients. Both Of These Are Established Tissue Fillers Approved For Human Use^{9,12,13}. These Materials Are Inert And Can Be Injected Percutaneously. The Disadvantage Of These Materials Is That They Tend To Get Absorbed With Time. All Our Patients Had A Significant Voice Improvement As Assessed By Voice Analysis Using Different Subjective And Objective Parameters. Collagen, Fat And Teflon Are The Other Materials That Are Commonly Used For This Procedure. Out Of These, Only Fat And Teflon Can Be Injected Percutaneously, Whereas, Collagen Can Only Be Injected Perorally Under Direct Laryngoscopic Control^{3,13,14}. Absorption And Migration Of The Injectate, Stiffening Of The Cords, Granuloma Formation, Hypersensitivity Reactions, Compromise Of The Vibratory Function Of

Vocal Fold And Bleeding Are The Reported Complications Of This Procedure^{3, 13, 14}. However, No Significant Complications Were Identified In Our Study Using Tissue Fillers. Carboxymethylcellulose, Micronized Acellular Dermal Matrix, Calcium Hydroxyapatite, Gel Foam, Autologous Fascia And Autologous Platelet-Poor Plasma Gel Are Some Of The Relatively Newly Reported Injection Materials^{8, 11, 15, 16}. Another, Commonly Used Procedure For Managing UVFP Is Permanent Open Medialization Thyroplasty³. This Procedure Involves A Surgical Insertion Of An Implant Into The Larynx To Mechanically Push The Paralyzed Vocal Fold Medially.

We Aimed To Compare The Effect Of Timing Of This Procedure Following The Onset Of UVFP On The Overall Need Of A Permanent Open Medialization Thyroplasty In Our Patients. In Our Study, The Patients Who Underwent Early Injection (Within 6 Months Of Onset Of UVFP) Were Seen To Have A Significantly Lesser Likelihood To Undergo A Permanent Open Medialization Thyroplasty Than Patients With Late Injection (Beyond 6 Months). Similar Results Have Also Been Reported In A Few Of The Studies In The Past Using Similar Procedure^{7, 8, 9}. It Has Been Postulated That Early Medialization Of The Vocal Folds By Injection Of A Tissue Filler Creates A More Favorable Vocal Cord Position For Phonation That Can Be Maintained By Synkinetic Reinnervation. Whereas, In Patients Not Given An Early Medialization Of The Vocal Fold, The Reinnervation Of The Vocal Fold Occurs With The Vocal Fold In A More Lateral Position Thereby Causing A Persistent Dysphonia^{7, 8, 9}. One Of The Studies In The Past Also Reports A Significantly Better Immediate Voice Improvement In Patients Given Early Injection As Compared To The Ones Receiving A Late Injection¹⁷. However, We Did Not Find Any Such Difference In Our Study Groups. Another Established Advantage Of An Early Injection Is The Prevention Of Aspiration In Susceptible Patients With UVFP⁶. None Of Our Patients In Either Group Had Complaints Suggestive Of Aspiration.

V. Conclusion

Injection Medialization Laryngoplasty Is A Well Established And Safe Option For Managing Dysphonia In Patients With UVFP. If Performed Early Following UVFP, It Significantly Reduces The Need For Undergoing A More Invasive Permanent Open Medialization Thyroplasty In Patients. We Advocate The Early Use Of This Procedure In Patients Suffering From UVFP.

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