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Comparative Study between Superiorly Based Pharyngeal Flap and Sphincteroplasty in Treatment of Velopharyngeal Insufficiency after Cleft Palate Repair

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ABSTRACT

Background: Despite technic d nces in c eft p te rep irs, the post-surgic de e op ent of p t fistu s nd P is not unco on. Appro i te y 20-38% of chi dren ho undergo c eft p te rep ir de e op e oph ryngе insufficiency P . Surgic   ter tion of the P sphincter is directed t decre sing the horizont cross-section surf ce re of the sphincter s tissue ound ries, his c n e chie ed y the interposition of pedic ed ph ryngе f ps (sp itting one rge port into o s er one) or repositioning the posterior nd ter orders of the sphincter y the introduction of uscu o ucos tissue f ps (Sphincterop sty).

The Aim of this Work: s to co p re resu ts of ph ryngop sty nd superior y sed ph ryngе f p in the tre t ent of e oph ryngе insufficiency fter c eft p te rep ir.

Patients and Methods: A r ndo group of enty- o p tients ith P fter c eft p te rep irs s studied. P tients ere prone to three di gnostic procedures t phoni tric c inic, preoper ti e y: – F e i e fi er optic n soph ryngoscopy. 2– N so etric e u tion. 3– pe recording. P tients ere c ssified into o r ndo groups; for p tients ph ryngop sty s done. Superior y sed ph ryngе f p s done for the rest of the p tients. N so etric e u tion nd t pe recording ere repe ted fter phonother py (3- onths postoper ti e y) nd percent ge drop in n so eter for n s nd or sentences ere c cu ted. F e i e fi er optic n soph ryngoscopy s repe ted fter 3-6 onths postoper ti e y.

Results: n group , 3 p tients h d persistence of n s tone postoper ti e y (o p tients h d t ed i pro e ent nd one p tient h d ini i pro e ent) gi ing incidence of co p ic tions 2 3%. According to resu ts of postoper ti e t pe recording of this group, 8 p tients ere c tegorized s good resu ts, o s oder te nd one s poor resu t. n group , one p tient h d p ti dehiscence nd persistence of n s tone postoper ti e y, o p tients h d hypo n s ity, one of the de e oped s eep pne ncidence of co p ic tions in this group s 2 3%. According to resu ts of postoper ti e t pe recording in this group, 9 p tients ere c tegorized s good resu ts, one s oder te nd one s poor resu t. Percent ge drop in n so eter in n s sentence in group & s 35.55% nd 2. % respecti e y. Percent ge drop in n so eter in or sentence in group & s 5 .95% nd 9. % respecti e y.

Conclusion: Both sphincter ph ryngop sty nd superior y sed ph ryngе f p pro ed to e effecti e in tre t ent of e oph ryngе insufficiency ith ccepted incidence of co p ic tions. Sphincter ph ryngop sty h d etter resu ts in p tients ith good p t nd ter ph ryngе o e- ents on preoper ti e ideoendoscopy. Superior y sed ph ryngе f p h d etter resu ts in p tients ith poor p t nd ter ph ryngе o e ents on preoper ti e ideoendoscopy.

INTRODUCTION

e oph ryngе insufficiency P inc udes ny structur nd or neuro uscu r disorder of the e u nd or ph ryngе s t the e e of n soph ryn s in hich interference ith nor sphincteric c osure occurs. P insufficiency P y resu t fro n to ic, yoneur , eh ior , or co in tion of disorders. t is di gnosed c inic y conste tion of sy pto s th t inc udes p tho ogic y incurred n s reson nce (hypern s ity) is rticu tion, esc pe of ir through the nose (n s e issions) nd err nt f ci o e ents (gri cing) [1].

he source of P y e p te th t is structur y deficient (e.g., too short or c ing usc e u) P ech nis th t is neuro ogic y i - p ired (e.g. cere r p sy, y stheni gr is, he d in uries nd cere ro scu r ccidents) or the resu t of f u ty e rning (e.g. phone e-specific n s e ission). Most co on y, ho e er, the p stic surgeon i encounter P in the post- p top sty [2].

Despite technic d nces in c eft p te re- p irs, the post-surgic de e op ent of p t fistu s nd P is not unco on. Appro i te y 20-38% of chi dren ho undergo c eft p te rep ir de e op P [3].

In 875, after detailed study of VP physiology, Passant was the first to tether the uvula to the pharynx in an attempt to restore competent velopharyngeal mechanism during speech. Since that time the use of removable devices designed correct the VPI, also numerous surgical procedures have been devised to restore the physiological closure of this sphincter- like mechanism [4].

Surgical alteration of the VP sphincter is directed at decreasing the horizontal cross-sectional surface area of the sphincter's tissue boundaries. This can be achieved by the interposition of pedicled pharyngeal flaps (sp itting one large port into two smaller ones) or repositioning the posterior and lateral borders of the sphincter by the introduction of muscu omucosal tissue flaps (Sphincteroplasty) [5].

The pharyngeal flap has proven been the single most popular method of treating individuals with VPI over the past two decades. The procedure was initially described in the 9th century and later refined by surgeons such as Rosenthal, Padgett, Sanvenero-Rossellini and Conway [6].

Hynes initially described sphincteroplasty in 950, but its use in VPI management has only recently become popular as a result of modifications by Orticochea and Jackson [7].

The aim of this work is to compare results of pharyngoplasty and superiorly based pharyngeal flap in the treatment of velopharyngeal insufficiency after cleft palate repair.

PATIENTS AND METHODS

A randomized group of twenty-two patients with VPI after cleft palate repair was studied in the Department of Pediatric Surgery, Cairo University and in Hearing and Speech Institute.

The study was conducted during the period from January 2000 to March 200 2.

Full history was obtained from each patient with physical examination stressing on presence of fistula hypernasality, nasal regurgitation, compensatory is articulation and faci al grimacing, type of palatal repair was excluded as in most cases it was difficult to be sure of it.

Patients were Prone to Three Diagnostic Procedures at Phoniatric Clinic, Preoperatively:

- *Flexible fiber optic nasopharyngoscopy:* Following Groft et al. [8] patients were classified into four categories.

a- Short palate, good palatal mobility, poor or limited posterior pharyngeal wall movement, ± posterior pharyngeal wall movement.

- Good posterior pharyngeal wall movement, poor palatal elevation, ± posterior pharyngeal wall movement.

c- Short palate, large VP gap, and good palatal and posterior pharyngeal wall movement, ± posterior pharyngeal wall movement.

d- Limited or poor movement of the palate and posterior pharyngeal walls.

2- *Nasometric Evaluation:* Nasometer is a device for calculating the ratio between the nasal and oral output (percent nasalance). It consists of three major units:

- Nasal and oral microphones.

2- Electronic circuits for processing the microphone signals.

3- A personal computer for calculating nasalance values.

A short simple oral nasal sentence and oral sentences were used.

$$\text{Percent nasalance} = \frac{N}{N + O} \times 00$$

3- *Tape recording:* According to results of postoperative tape recording, patients were categorized as good, moderate and poor results.

Patients were classified into two major groups; for patients pharyngoplasty was done, technique used was that described by Jackson and Silverton [7]. Superiorly based pharyngeal flap was done for the rest of the patients. Michael Sidoti et al. [9]. Both techniques are shown in illustrations (Figs. .5)

Oral feeding was allowed 2 hours postoperative y and patients were discharged 8 hours postoperative y.

Phonotherapy started one month postoperative y for all patients and continued for six sessions.

Nasometric evaluation and tape recordings were repeated after phonotherapy (3- months postoperative y) and percent age drop in nasometer for nasal and oral sentences were calculated.

Flexible fiber optic nasopharyngoscopy was repeated after 3-6 months postoperative y.

All patients were followed regularly every 2 weeks, the best period of follow-up was 5 months with mean period of 0. months.

Fig. (1): Flexible fiber optic nasopharyngoscopy. Photo: Category (B) with good posterior pharyngeal movement.
A: Lateral pharyngeal wall.
B: Palate.
C: Posterior pharyngeal wall.

Fig. (2): Flexible fiber optic nasopharyngoscopy showing Photo (c category C) with poor posterior pharyngeal movement.
A: Lateral pharyngeal wall.
B: Palate.
C: Posterior pharyngeal wall.

Fig. (3): Flexible fiber optic nasopharyngoscopy showing Photo (c category D)
A: Lateral pharyngeal wall.
B: Palate.
C: Posterior pharyngeal wall.

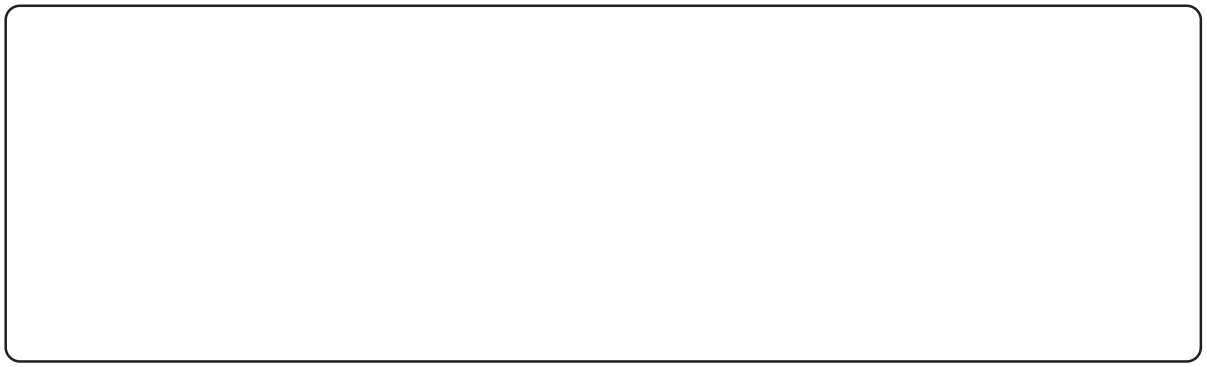

Fig. (4): Sphincter pharyngoplasty. (Soft palate is artificially split for diagnostic purposes and is not performed as part of the procedure). A- Superior myomucosal flap design. B- Flap elevation and reorientation posterior. C- A horizontal posterior pharyngeal muscle is created by flap interdigitation and closure of the donor defects narrows the horizontal dimension. (Quoted from: Michael Sidle et al., 1999) **[9]**.

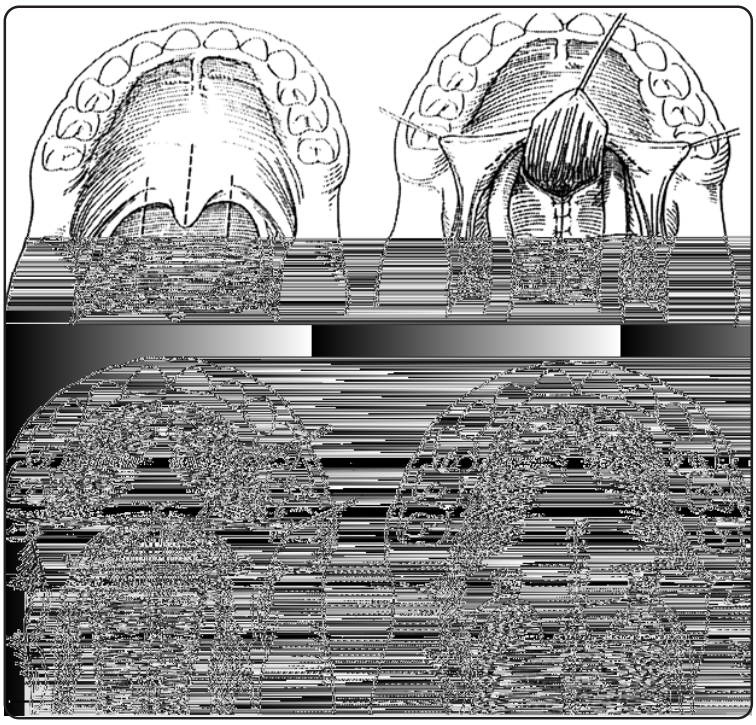

Fig. (5): Superior y ased ph ryngea f p. A- Di ision of soft p ate and ph ryngea f p design. B- Fu -thic ness uscu o usco f p e e tion off the pre erte r f sci A he posterior ucos is re ppro i ted and c theters re p ssed n y for the f shioning of ter ports. C- Mucos f ps re e e ted fro the n sides of the sp it soft p ate and sutured to cre te n c osure round the c theters. D- A he r uscu r surf ce of the f p is ined ith soft p ate ucos to co p ete the c osure. (Quoted fro : Mich e S do e et ., 999) [9].

RESULTS

A r ndo group of enty-o p tients ith P s studied of the ere su ected to c eft p ate rep ir ith no fistu A of the on perceptu e u tion h d n s reson nce. Second oper tion s done e st onths ter c eft p ate rep ir ith e n period of .3 onths.

They were Classified Into Two Random Groups:

Group I: P tients for ho ph ryngop sty s done.

Group II: P tients for ho superior y ased ph ryngea f p s done.

n this study the postoper ti e e u tion s sed on t pe recording, st tistic n ysis for n so etric d t and findings of f e i e fi er optic n soph ryngoscopy.

A pe recording s c tegorized into three degrees: good, oder te nd poor resu ts.

Concerning group , they ere se en gir s nd four oys. Age of p tients r nged e een .5 ye rs to 2.3 ye rs ith e n ge of 3 ye rs nd 9 onths.

Preoper ti e findings ccording to ideoendoscopy re sho n in e ( ).

e ( ): Preoper ti e findings of ideoendoscopy of group

C tegory	No. of p tients	Preoper ti e findings	C osure p ttern
A		Short p ate, good p t o e ent, poor or i ited ter ph ryngea o e ent, ± posterior ph ryngea o e ent	Coron
B	3	Good ter ph ryngea o e ent, poor p t e e tion, ± posterior ph ryngea o e ent	S itt
C		Short p ate, ge P g p, good p t nd ter ph ryngea o e ent, ± posterior ph ryngea o e ent	Circu r
D		Li ited or poor o e ent of the p ate nd ter nd posterior ph ryngea s	Circu r

n this group, 3 p tients h d persistence of n s tone postoper ti e y o p tients h d g ed i pro e ent nd one p tient h d ini i pro ent), gi ing incidence of co p ic tions 2 .3% (three p tients out of). t is i port nt to ention th t: the three p tients h d poor p t nd ter

ph rynge s w s o e ent on preoper ti e ideoendoscopy. According to resu ts of postoperti e t pe recording of this group, 8 p tients ere c tegorized s good resu ts, o s oder te nd one s poor resu t.

Concerning group , they ere gir s nd 5 oys. Age of p tients r nged et een . ye rs to 2.8 ye rs ith e n ge of 3 ye rs nd 5 7onths.

Preoper ti e findings ccording to ideoendoscopy re sho n in e (2).

e (2): Preoper ti e findings of ideoendoscopy of group ( ).

C tegory	No. of p tients	Preoper ti e findings	C osure p ttern
A	5	Short p te, good p t o e ent, poor or i ited ter ph rynge w s o e ent, ± posterior ph rynge w s o e ent	Coron
B	3	Good ter ph rynge w s o e ent, poor p t e e tion, ± posterior ph rynge w s o e ent	S gitt
C		Short p te, rge P g p, good p t nd ter ph rynge w s o e ent, ± posterior ph rynge w s o e ent	Circu r
D	2	Li ited or poor o e ent of the p te nd ter nd posterior ph rynge w s	Circu r

n this group, one p tient s co p ic ted y p rti dehiscence nd persistence of n s tone postoperti e y, o p tients h d hypon s ity, one of the de e oped s eep pne . ncidence of co p ic tions in this group is 2 .3% (three p tients out of . t is i port nt to ention th t: the o p tients ho de e oped hypon s ity h d good p t nd ter ph rynge w s o e ent on preoper ti e ideoendoscopy. According to resu ts of postoperti e t pe recording in this group, 9 p tients ere c tegorized s good resu ts, one s oder te nd one s poor resu t.

St tistic n ysis for n so etric d t nd postoperti e percent ge drop in n so eter oth for or nd n s sentences for groups & is sho n in e (3) nd Figs. (7-9).

e (3): N so etric d t nd postoperti e percent ge drop in n so eter oth for or nd n s sentences for groups & .

	Group	Group
Main differences:		
N s	-2	-3 .58
Or	-30 .92 7	-28.
Percentage drop:		
N s	35.55%	2. %
Or	5 .95%	9. %

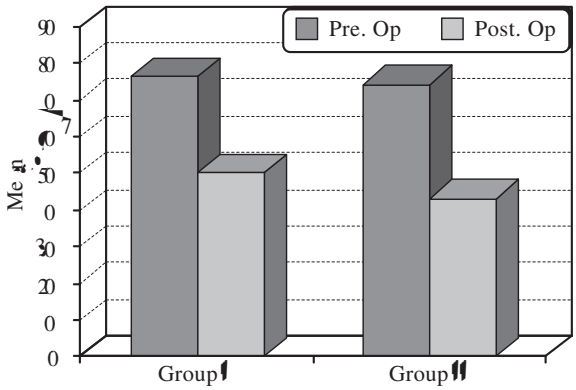

Fig. (7): Pre nd postoperti e n so etric d t for n s sentence for groups & .

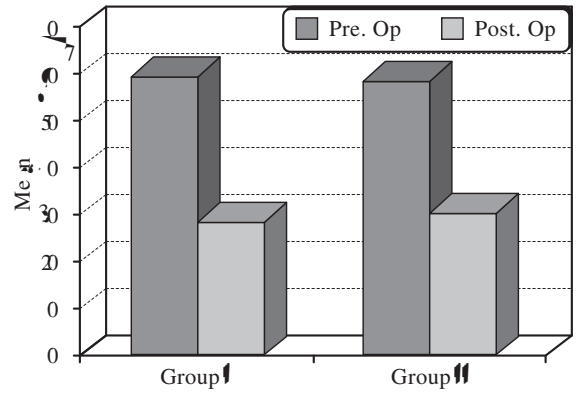

Fig. ( ): Pre nd postoperti e n so etric d t for or sentence for groups & .

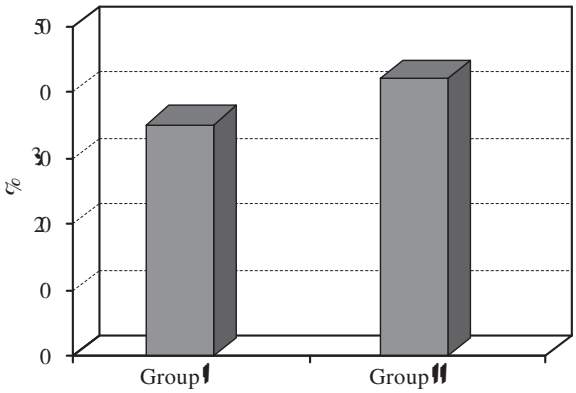

Fig. (8): Percent ge drop in n so eter for n s sentence for groups & .

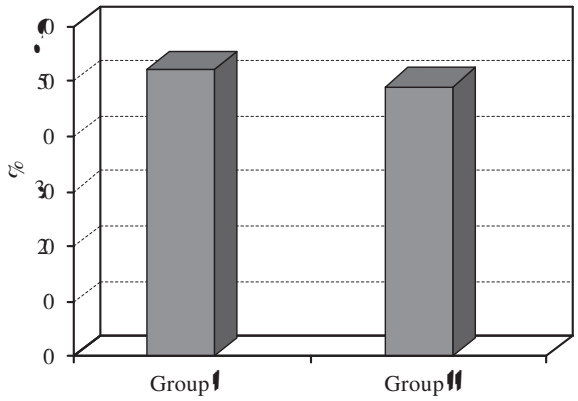

Fig. (9). Percentage drop in nasometer for oral sentence for groups I & II.

No major post-operative complications were encountered in both groups. There were no recorded cases of postoperative bleeding or pulmonary complications. Patients were discharged in the same night of operation (early in the study they were discharged 2 hours postoperatively).

Fig. (10). Postoperative videoendoscopy after sphincter pharyngoplasty showing complete closure of the velopharyngeal sphincter.

Fig. (11). Postoperative videoendoscopy after sphincter pharyngoplasty showing incomplete closure of the velopharyngeal sphincter (Persistence of nasal tone with marked improvement).

DISCUSSION

Even in this modern era of palatal procedures that incorporate palatal lengthening and intravelar muscular repair, the incidence of VPI has been reported as high as 38% in some series [10].

A comprehensive assessment of velopharyngeal function includes both perceptual speech and instrumental evaluation. Current strategies based on only one of these assessments are prone to failure [11].

In this study assessment of velopharyngeal function was based on pre and postoperative findings of flexible fiberoptic nasopharyngoscopy, nasometric evaluation and tape recording.

It is difficult to judge the degree of nasality by listening to speech. For this, nasometer is a useful device to comment upon the degree of velopharyngeal insufficiency and to compare between pre and postoperative instances to judge upon the improvement of the patients.

In idealcircumstances, the goals of surgical management is to eliminate the symptoms of hypernasality and audible nasal emission, the extent to which this goal is realized depends on an appreciation of the preoperative VP anatomy, physiology, and mechanics and the appropriateness of the pharyngoplasty that is performed [12].

Mobilizing the superior constrictor muscle and mucosa from the posterior pharyngeal wall a pedicled flap is created that inserts into the soft palate, thus resulting in a permanent midline connection between the nasopharynx and oropharynx, which bisects the VP port into two lateral ports [13].

The intraoperative use of rubber catheters with non dilating and wide pharyngeal flap is commonly used to create lateral ports that aid to maintain the desirable distance between nasopharyngeal patency and adequate VP function. Intraoperative "over tightening" of the port combined with scar contracture, however, runs the risk of nasal airway obstruction and sleep apnea, there is currently greater interest in individualizing flap width to the amount of lateral pharyngeal wall motion present rather than to a predetermined port size.

Studies have shown success rates for pharyngeal flap surgery of 80-90 %. The classification success depends on the investigator. Certain studies classify patients with hyponasality as success. Other studies classify post surgical hyponasality as failure. In

these studies, the success r te is so e h t o er [9]. n this study the success r te of superior y sed ph ynge f p is 2. %. n this study, if c ses ith post surgic hypo n s ity ere c ssified s success, the success r te of superior y sed ph ynge f p i e 90 .9%, his y e p in the ide r nge of success r te in different series.

Ph ynge f ps c n e d ngerous if perfor ed in p tients ith unusu y n rro upper i ys. P tients requiring surgic P n ge ent ho h e ris f ctors for upper i y o struction re preferenti y reco ended for sphincter ph yngop sty sed on reports of its ini effect on the i y [14,15].

n i e the ph ynge f p, the sphincter ph yngop sty is p ti circu ferenti n rro ing th occ udes the ter nd posterior spects of the e oph ynge port ut nt ins the centric opening [16].

Sphincter ph yngop sty h s en ssoci ted ith o er success r tes of 0 -0 %. c son st ted th the success r te c n re ch ppro i te y 80 % ith ppropri te p tient se ection [7].

n this study sphincter ph yngop sty s perfor ed for p tients, three p tients out of h d persistence of n s tone gi ing incidence of co p ic tions 2 .3% nd success r te 2. %. t is i port nt to ent on th t: the three p tients h d poor p t nd ter ph ynge o e ents on preoper ti e ideoendoscopy.

n group (p tients for ho superior y sed ph ynge f p, the o p tients ho de e oped hypo n s ity h d good p t nd ter ph ynge o e ents on preoper ti e ideoendoscopy.

ing in consider tion the re ti e y s nu er of p tients in this study, sphincter ph yngop sty h d etter resu ts in p tients ith good p t nd ter ph ynge o e ents on preoper ti e ideoendoscopy. A so, superior y sed ph ynge f p h d etter resu ts in p tients ith poor p t nd ter ph ynge o e ents on preoper ti e ideoendoscopy.

Conclusion:

e oph ynge insufficiency is correct e condition in ost inst nces if it h s een c refu y e u ted preoper ti e y nd the ppropri te surgic correction is perfor ed successfu y fo o ed y speech ther py nd fo o s up.

Both sphincter ph yngop sty nd superior y sed ph ynge f p pro ed effecti e in tre t ent of e oph ynge insufficiency ith ccepted incidence of co p ic tions.

ing in consider tion the re ti e y s nu er p tients in this study, sphincter ph yngop sty h d etter resu ts in p tients ith good p t nd ter ph ynge o e ents on preoper ti e ideoendoscopy. Superior y sed ph ynge f p h d etter resu ts in p tients ith poor p t nd ter ph ynge o e ents on preoper ti e ideoendoscopy.

he success r te of rep ir of P c n e i - pro ed y se ecting the ost ppropri te procedure sed on the n to y nd o e ent of the P port.

he gre test future ch enge, therefore, is to de e op nd coordin te u ticenter r ndo ized contro ed studies to e u te tre t ent outco es. his ou d id gre t y in producing etter tch et een differenti di gnosis nd differenti n ge ent.

Additionally and Lastly; he co prehensi e te ppro ch gi es the chi d c eft p te the gre test opportunity for est outco es.

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