ORIGINAL ARTICLE

"The role and ability of orthopaedic postgraduate resident's clubfoot treatment with ponseti's methodology." A comparative study of resident's versus consultant's directed treatment

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Abstract

Objective: To evaluate the outcome of Ponseti treatment carried out by the Postgraduate Orthopaedic Trainees compared with the treatment given by their Mentors.

Methods: The prospective comparative case series study was conducted at Jinnah Postgraduate Medical Centre, Karachi, and comprised idiopathic Congenital Clubfoot Deformity patients treated from September 2012 to December 2013. Also included were a few cases treated between September 2006 and September 2012, who had complete record, serial photograph and updated follow-up. The patients were divided into two groups. Those treated by residents formed Group A and those by consultants were in Group B. The follow-up duration ranged from 06 months to 05 years. Outcome measures included the number of casts required to achieve correction with Pirani score 0.5, the rate of Per-Cutaneous Achilles Tenotomy (PCAT), the rate of early relapse and treatment and failure to maintain correction. SPSS 13 was used for statistical analysis.

Results: Of the 172 patients in the study, 111(64.5%) patients with 185 feet were treated by the residents, while 61(35.5%) patients with 96 feet were treated by consultant. The overall mean age was 25.8±32.88 weeks (range: 1-156 weeks). The difference in age between the two groups was significant (p=0.01). A total of 166(96.51%) patients were on maintenance phase in Foot Abduction Bracing and 6(3.48%) completed the treatment successfully without residual deformity. The median number of cast per patient given by Group A was 6 and 5 in Group B. The number of 8+ casts given in Group A were 46 (24.86%) and 17 (17.7%) in Group B. Tenotomies performed in Group A were 106 (57.27%) and 70 (73%) in Group B, and overall PCAT performed were 183 (65.12%). The overall success rate was nearly similar between the two groups, with the difference of<1%.

Conclusion: The best practice to achieve excellent to good results from the beginners in Ponseti technique is to provide mentorship training for the skill of Ponseti manipulation, application of cast and continued treatment.

Keywords: Clubfoot, Congenital, Idiopathic, Ponseti, Treatment. (JPMA 64: S-57 (Suppl. 2); 2014)

Introduction

The clubfoot treatment with Ponseti's method is "currently the most practised treatment bringing forth the excellent long-term outcomes of 95%-98%, over 30-year follow-up".[1,2] It has increasingly been adopted in Pakistan, following a series of Clubfoot Ponseti Basic hands-on training workshops held since 2006. The mindset of orthopaedic surgeons has now switched from Lovell & Hancock3and Hiram J Kite's[4] "three-phase manipulations"[3,4] un-specified manipulations and early-age surgery to Ponseti's methodology[5] of "simultaneous correction of clubfoot deformity"[5] with the exception of equinous, which is "corrected last".[5] The Jinnah Postgraduate Medical Centre (JPMC), being a premier postgraduate teaching centre in the public sector played a pivotal role in changing the mindset of orthopaedist to this gold standard Ponseti technique. In the Kite's methodology,[4] fore foot and heel are abducted while pressure is placed on the lateral border of the foot at calcaneo-cuboid joint, thereby individually correcting adductus, cavus and equinous. In the Ponseti technique5the cavus, adductus and varus components of Congenital Clubfoot Deformity (CCFD) are corrected "simultaneously",[5] "all in the initial manipulation",[6] with "sequential manipulation"[5] and casting of the foot, while the "equinousis corrected last".[5] With the Ponseti's technique,[5] gradual correction is obtained by abducting the supinated foot with counter-pressure applied on lateral aspect of the head of the talus. "Heel is not touched"[5] as that moves synchronously with the movement of the forefoot. The counter-pressure on the head of talus stabilises the bone against rotation in the ankle mortise. The medial ligaments are stretched, allowing the calcaneus to abduct with the foot, and the

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anterior tuberosity of the calcaneus is disengaged from its position under the head of the talus.[7,8] This sequential manipulative correction of CCFD is started "soon after birth",[9] "so as to take advantage of the favourable fibero-elastic properties of the connective tissue that forms the ligaments, joints, and tendons".[8,10] The CCFD treatment is aimed at achieving the goal of normal-looking "plantigrade foot with good joint mobility that is functional, straight, painless, stable over time, free of calluses, with no requirement of modified shoes"[6,7,11] and exhibits a "normal radiographicappearance.[11] To achieve these targets, one needs to follow strictly the Ponseti technique of sequential manipulation, casting, moulding and the maintenance with Foot Abduction Brace (FAB) for the next three years.[5]

Training is given by the Ponseti provider (PP), the principal author, to his trainees at the dedicated Clubfoot Clinic and Ponseti Mentorship Programme Training Centre at the JPMC, which is recognized by Ponseti International Association. This centre was established in October 2012 and was formally integrated with International Clubfoot Registry in March 2013. Until May 2014, 265 patients with Idiopathic CCFD were registered, including patients treated at PP's private clinic, the Neuro-Medical Institute Hospital (NMI). At the JPMC, the senior residents trained by the PP treated the patients. They had rigorous hands-on Ponseti training at the Club Foot Clinic (CFC). They were allowed to carry out independent but supervised casting to the patients once the PP was satisfied that they had acquired enough skills to do so. At the NMI, the consultant himself treated hospital patients. There was some variation observed in the cotton padding, style of casting, moulding and maintenance of correction by FAB shoes. Hence, it was thought that there must be significant variations in the outcome of treatment given by these two groups. The current study was conducted to compare the outcomes of treatment of Idiopathic CCFD given by these two groups; the residents versus the consultant.

Patients and Methods

The prospective comparative case series study was conducted at CFC, JPMC, Karachi, and comprised idiopathic CCFD patients treated from September 2012 to December 2013. Also included were a few cases treated between September 2006 and September 2012, who had complete record, serial photograph and updated follow-up.. After detailed counselling about the treatment, bracing, and the necessity to complete treatment over age 3 years, informed written consent was taken from the parents at first visit. The consent included observation for research as well as the publication of patient's photographs. The study was approved by the institutional review board.

Children in the age range of one day to three years, irrespective of gender, cast and creed, affected byIdiopathic CCFD, with minimum follow-up duration of six months, were included. The children who had previous incomplete, non-operative treatment with cast, having incomplete correction or relapse, were also included. Those with associated signs of syndromic pathology [Myelodysplasia & Arthrogryposis][12] and post-surgical clubfoot patients were excluded. The standard Ponseti treatment protocol[5,7-9] for weekly manipulation, casting and moulding of cast was strictly observed in every case. A little deviation from Ponseti teaching of cast removal in CFC was that the plaster in every child included was removed by family at home just before coming to hospital by soaking, softening and de-rolling the cast. The FAB (Denis Browne Shoe splint) was applied to the children on the same day when the last cast was removed. The position of shoes on abduction brace was adjusted for unilateral and bilateral CCFD as recommended by Ponseti.[5,9] The FAB was supplied from a readily available stock of 24 pairs, with shoe sizes from 8-13cm (0-6) sizes and abduction rod in three sizes to fit shoulder breadth of individual child.

The children in non-walking age (<12 months age) without previous treatment were labelled as untreated non-walking (Virgin) CCFD patients. The others in walking age (>12 months age) having no previous treatment were labelled as untreated walking CCFD patients. The patients who were previously treated somewhere else, having a "relapse", were labelled as persistent CCFD[5,9,13] patients. Relapse was defined as "clubfoot having a recurrent deformity that required further treatment".[14]

The children treated by residents at JPMC were labelled as Group A and those who got treatment from the consultant himself at his hospital were labelled as Group B. The results of children treated by Group A was compared with the children treated by Group B. The outcomes measures included were number of casts required per patient, the rate of Percutaneous Achilles Tenotomy (PCAT), number of relapses and their treatment outcome and the number of failures. "Failure" was defined as "Persistent CCFD that required additional extensive surgical procedures", including Posterio-Medial Release (PMR).[13] Those feet which responded to treatment with satisfactory outcome i.e. Abduction >50 degrees, Dorsi-flexion >15 degrees[5] and Pirani Score[9] 0.5, and had no relapse were labelled as "Typical Clubfeet".[5,9] The criteria for detection of relapse (early) included; when slight equinous and varus deformity of heal was observed,

usually without increased cavus and adductus deformity of fore foot.[7] The relapsed feet with or without signs of Complex Clubfoot[9] including chubby feet, short hyper-extended big toe and/or have deep complete transverse planter crease (Plantaris)[5,9] and/or up-curved toe nails and got corrected with another 4-6 cast and additional minor surgical procedure; including PCAT and/or Tibialis Anterior Tendon Transfer (TATT) and had no further relapse were labelled as "Atypicalclubfeet".[5,9] Those who did not respond to initial treatment despite more than seven casts, with addition of minor procedures PCAT, TATT and had residual deformity components of cavus/ adduction/varus/equinous (C/A/V/E), were labelled as Resistant/Persistent CCFD.[5,9,13] Some of these resistant feet that required extensive surgical procedure were labelled as "Failures".[13] Others who required additional consultation for neuro-muscular disorders were labelled as Syndromic CCFD.[5,9,12] Thetreatment was defined as "Successful" when there was no further need for extensive soft tissue release such as PMR.[13,15] This included Typical, Atypical and Resistant CCFD that responded to Ponseti treatment with or without minor procedures.[13]

The data of each patient was retrieved from hard files record, maintained for the each patient and double-checked from data collected through apurposive designed questionnaire filed by the residents. The database was developed and analysed on SPSS 13. For comparison of mean age between the two groups Student t-test was employed. To compare difference in proportion of laterality, gender and clubfoot deformity between the groups, Chi-square test of proportionality was used, where it was valid. Otherwise, Yates' corrected Chi-square test was employed. The difference in proportion or mean was considered significant at $p<0.05$.

Results

Out of 268 children registered for treatment with Groups A and B till May 30, 2014, only 172 children affected with Idiopathic CCFD matched the inclusion criteria. Of the 172 patients in the study, 111(64.5%) patients with 185 feet were treated by the residents (Group A), while 61(35.5%) patients with 96 feet were treated by the consultant (Group B). The overall mean age of the two groups was 25.8±32.88 weeks (range: 1-156 weeks). The difference in age between the groups was statistically significant (p=0.01) (Table-1). Overall, 99(57.56%) children were upto the age of 12 weeks. The unilateral-to-bilateral ratio was 1:1.73 (63:109), and girls-to-boys ratio was 1:4.8 (38:134) (Table-2). A total of 73(42.44%) patients — 39(35%) in Group A and 34(56%) in Group B — had received initial treatment elsewhere before attending CFC. The treatment they had received previously included manipulation, stretching, bandaging and cast (above or below the knee) from Potters/family/Orthopaedist. Treatment in majority of them was followed by Cobblers shoes or Ankle Foot Orthosis (AFO) and very few of them used FAB for short durations of 3-6 months. Once the child outgrew the shoes, FAB was discontinued. The number of casts previously given to the mranged from 2-14 in Group A and 3-8 in Group B; 4(8.3%)of them (two in each group) already had PCAT. All these patients reported with relapsed CCFD from Pirani score 4-6 and 1(0.05%) of them had gross Rocker bottom deformity after having more than 10 casts and was using FAB that frequently slipped off. The patient with Rocker bottom deformity was treated with PCAT, followed by two more casts before being placed on FAB. At 18 months follow-up this patient behaved excellent and maintained the correction without further relapse and Rocker bottom deformity. The pre-treatment Pirani score ranged from 4-6, median Pirani score was 5. The post-treatment Pirani score ranged between 0-1, with a median of 0.5.

The median number of casts given in Group Awere 6 per patient and 5in Group B. The number of 8+ casts given in Group A were 46 (24.86%) and 17 (17.71%) in Group B. PCAT performed in Group A was 106 (57.27%) and 70 (73.0%) in Group B; overall PCAT performed was 183

Table-1: Patient's profile, age distribution (n=172).

Age at First Cast	Group A (n=111)	Group B (n=61)
◆ 0-3 months	59 (53.20%)	40 (65.6%)
◆ 3-6 months	10 (9%)	9 (14.75%)
◆ 6-12 months	20 (18%)	8 (13.11%)
◆ 1-2 years	11 (9.9%)	2 (3.27%)
◆ 2- 3 years	11 (9.9%)	2 (3.27%
Mean±S.D (weeks)	30.32±36.08	17.6±23.12, p=0.01
Age range (weeks)	1 - 156 weeks	1 - 156 weeks

Table-2: Patient's profile, laterality &gender distribution: (n=172):

	Group A	Group B	Total
◆No. of children	111 (64.5%)	61 (35.5%)	172
Laterality:			
◆Bilateral	74(67.8%)	35(32.2%)	109(100%) p=0.001, χ^2 =27.9
◆Unilateral	37 (58.7%)	26 (41.3%)	63(100%) p=0.05, χ^2 =3.8
◆Total Feet	185 (65.8%)	96(34.2%)	281 (100%) p=0.001, χ^2 =55.8
◆UL vs BL Ratio			1:1.73
Sex Distribution:			
◆Girls	25(89.2%)	13 (10.8%)	28 (100%) p=0.001, χ^2 =34.5
◆Boys	86(64.2%)	48 (35.8%)	134 (100%) p=0.001, χ^2 =21.5
◆Girls Vs Boys Ratio			1: 4.8

Table-3: Type of clubfoot deformity & results (n=172).

	Group A	Group B
Typical feet Patients	97 (87.38%)	50 (81.96%) p=0.33, n.s χ^2=0.93
Early Relapse Patients	14 (12.61%)	11 (18.03%) p=0.33, n.s χ^2=0.93
Atypical feet patients	6 (5.4%)	7 (11.4%) p=0.25, n.s χ^2 (corrected)=1.3
Atypical late responsive Patients	4 (3.6%)	5 (8.2%) p=0.34, n.s χ^2 (corrected)= 0.88
Atypical Complex feet Patients	2 (1.8%)	2 (3.2%)[C] p=0.93, n.s χ^2 (corrected)= 0.01
Persistent CCFD Patients	8 (7.2%)	4 (6.5%) p=0.87, n.s χ^2 (corrected)= 0.02
Persistent CCFD: Failures required PMR	3 (2.7%)	2 (3.2%) p=0.79, n.s χ^2 (corrected)= 0.07
Persistent CCFD with acceptable C/A/V/E	5 (4.5%)	2 (3.2%) p=0.98, n.s χ^2 (corrected)= 0.0
Successful results	103 (92.79%) Over all successful Results 93.02%	57 (93.44%) p=0.87, Chi-square=0.02 n.s.

A= 1 patient had TATT. B= 2 patients had TATT. C=1 patient had TATT.

Table-4: Follow-up duration (n=172).

Clinical Status	Number of patients		Total
	Group A	Group B	
◆6-12 months, Corrected, Non-Walking, Night Brace FAB	103	35	138 (80.23%)A
◆1-2 years, Corrected, Walking, Using Night FAB:	8	15	23 (13.37%)
◆2-3 Years, Corrected Walking, Using Night FAB:	0	5	5 (2.90%)
◆3 + years, Corrected walking, Not using FAB:	0	5	5 (2.90%)

(65.12%). The typical foot children in Group A were 97(87.38%)compared to 50(81.96%) in Group B. The early relapse rate in group A was 14(12.61%) and 11(18.03%). Overall, early relapse rate was 25(14.53%) (Table-3).

In Group A, the patients with early relapse were treated with 3-4 extra weekly casts, with second PCAT in 3(2.7%) and third PCAT in 1(0.9%) more patient. Six (5.4%) of there lapsed patients responded and maintained correction till last follow-up. Two (1.8%) of these patients who developed signs of complex CCFD (Atypical feet)[9] during further casting, and 1(0.9%) more who developed dynamic supination deformity were operated upon with TATT at 32 months of age, and they all responded and maintained correction till last follow-up. However, 8(7.2%) patients in Group A did not respond and they developed Persistent Deformity. Three (2.7%) of children had significant component of C/A/V/E deformity requiring PMR. The other 5(4.5%) children had residual forefoot varus deformity, which was passively correctable, plantigrade feet and acceptable to parents. The success rate in Group A was 103(92.79%).

In Group B, 11(18.03%) patients with early relapse were treated with 3-4 casting. Two (3.2%) of them needed second PCAT before resuming to FAB, and the other 2(3.2%) responded to casting only. Three (4.9%) patients with bilateral CCFD having early relapse had more than 8 casts and developed Dynamic Supination Deformity, which was treated with additional TATT at the age 30 and 36 months. One (1.6%) of these three, who had already undergone open Tendo-Achilis Lengthening (TAL) somewhere else, needed second open TAL. Two (3.2%) of these three patients also had signs of complex clubfoot during the course of the treatment. All these 7(11.5%) patients responded to additional treatments and maintained correction till last follow-up. The remaining 4(6.5%) patients had Persistent Deformity/Resistant CCFD. Two (3.2%) of these had significant component of C/A/V/E deformity, and had over 10 casts and signs of complex CCFD. They were operated upon with PMR on persistent demand of parents. The other two (3.2%) children had residual forefoot varus deformity, passively correctable, plantigrade feet and acceptable to parents. One (1.6%) of the four patients having had TATT in this series could not improve. He had Persistent Deformity despite good FAB compliance and additional manipulations and multiple casts, along with duck waddling gait and recurrent Dynamic Supination. The neurological evaluation, magnetic resonance imaging (MRI) lumbo-sacral spine, nerve conduction and electromyography examination revealed duralectasia and agenesis lumber 5 and Sacral 1 root. The neurospinal opinion advised no spinal surgery and continued non-operative treatment for persistent CCFD, which he is having with few more casts till date. The

success rate in Group B was 57(93.44%).

Comparative results of the two groups showed no significant difference. The average number of casts per patient and 8+ casts given by residents was higher than the number of 8+ casts given by the consultant. Whereas, the number of Achillestenotomy performed by the consultant was higher than the residents. The residents were more enthusiastic in correcting feet with more number of casts rather than to achieve dorsiflexion with tenotomy. The residents were also less vigilant to pick early relapsed deformities. The overall success rate had a difference of less than 1% between the two groups. The residual forefoot varus deformity without significant functional deficit, acceptable to parents was 7(4%) and the failure rate was 5(3%).

None of our patients had major complications. The minor problems of short-term apprehensions for parents were seen in 17(10%) patients. These included excessive blood soaking of cast after PCAT, pressure sore by casts, problems related to FAB and Genu Valgus deformity in a few cases despite shoulder breadth size of the abduction bar.

Discussion

With the limited resources and expertise in Ponseti technique, the overall successful results (93%) in the present study were nearly comparable to the published studies which report success rates between 86% and 98%.[5,10,11,13,16,17] All these reports belong to the developed world, "where highly trained practitioners with special interest in Paediatric Orthopaedics"[18] and experienced plaster technicians "perform the manipulation and casting".[18] They give the best possible counselling for regularity in follow-up and completions of the treatment, picking up early relapse cases and provide treatment as soon as possible. Referring to comparative results between residents' versus consultant's in our study, the results are very encouraging. With a relatively short but intensive Ponseti training of residents, and strict adherence to Ponseti protocol of treatment, the results are almost similar between the two groups, with only few acceptable differences. Similarly, the average number of casts per patient given by residents vs the consultant was also nearly the same. However, 8+ casts given by residents were more than those given by the consultant. The consultant relied more on early PCAT (73.032%) than the residents (57.272%). The residents seemed to be more enthusiastic in correcting feet with more number of casts andto exert more pressure to achieve dorsiflexion than opting for PCAT, to achieve remaining 100 dorsiflexion above neutral9. Probably, they were less aware of "flattening of Talus Dome, which become evident in these children during their adulthood".[5,19,20] The manipulation with excessive pressure exerted to achieve dorsiflexion without PCAT "may cause an osteochondral compression fracture or ischemic necrosis, which in the long term, complicate with talus dome flattening.[20] The overall number of PCATs performed in this study were 65.15% that is significantly less than the series published earlier that showed rate of PCAT as 70%-85%.[5,10,11,16,17] Whereas, our PCAT rate was more than some studies that showed PCAT rate as low as 38%.[2]

Referring to an important finding that children aged below 12 months were more in percentage terms in Group B than in Group A, it must be noted that older children [neglected, untreated, incompletely treated, walking CCFD patients] were more in Group A than in Group B. This indicates that the poor parents' illiteracy, cultural barriers[9] regarding CCFD treatment and non-affordability of time and cost that they have to bear for long distance travel for attending public hospital were basic considerations. They opt to have their kids' CCFD treatment from a nearby 'bone setter'[21] or they themselves keep on massaging and bandaging. The other few parents are scared of having cast on infants with tinny legs in the superstitious belief that plaster may burn skin.[9,20] As such, they linger on without treatment until the child becomes older, and the CCFD becomes stiffer and rigid. At this stage they often get an advice for an extensive surgery by Orthopaedist, which they do not afford and neglect the child, and let them walk with clubfoot disability. However, the more affording parents attending private care are ofcourse more literate, vigilant and are scared of disability with late treatment. Some of them do have acquired knowledge of CCFD treatment through the internet, are not scared of the cast and opt for early intervention.[22] These walking aged patients needed PCAT in almost 100% feet in your study. Lourenco and Morcuende[23] have also reported similar rate of 100% PCATs in children over 2 years of age. In our view, the overall low rate of PCAT in this series may be due to 'learning curve phase' in the early phase of the study, as we were scared of carrying out PCAT in outpatient, and tried to correct equinous more with manipulation and casting than to do PCAT. In the later phase of this study number of PCAT rose. The residents were also less vigilant to pick early 'signs of relapse',[7] as their relapse rate was lower than the consultant's. The residents often missed these early sign of relapse and continued to treat relapse with FAB treatment and exercises until a consultation was made with the PP, relapse was identified and treated further with 4-8 weekly manipulations, casts and also have 2nd and/or 3rd PCAT to recover 'original correction'.[7] To prevent further relapse, TATT was carried out in four

cases. Similar to earlier observations[14,19] that ''50% relapse are preventable, and 50% of these occur between age 10 months and seven years (average two and one half year)'', our majority patients had developed relapse after 3rd or 4th shoe change i.e. 9-12 months. Often due to delayed procurement of new FAB shoes, feet were left without FAB or discontinued for that period. The overall early relapse rate of 15.53% in this study is not discouraging, as it is in accordance with published data, which reported 8%-31%[16,17,24] early relapse rates and as high as 47%[1,14] including both early and late relapses. The late relapse has been seen to occur up to four years of age.[14] Similarly, the failure rate of 2.7% vs 3.27% in groups A and B was also comparable to reported rate of 2.5%-16%.[13,16-18,24,25] Our result of correction achieved in 50% of early relapsed feet was also comparable to a study[13] which reported similar rate of correction and failures in early relapsed feet.

Interestingly, very few patients in this study achieved Pirani score 0, and majority had Pirani score 0.5 i.e. their deformity remained corrected without residual C/A/V/E, but there was persistent empty heal sign for over 18 months of age or having posterior crease score 0.5 or lateral curved border score 0.5, they were correctable on passive manipulation. In the current study, 4% patients in age range 2-3 years were having residual CCFD, with some component of residual C/A/V/E, especially forefoot varus and less than 150 dorsiflexion. The deformity in these patients was acceptable to parents since they had no functional deficit. Similar group of patients has also been reported,[18] and the remarks for these patients "that many of them may not turn back to clinic" and few feet may "revert to its deformed position over the time"[18] were also true for our study. Long-term follow-up till adolescence in these cases becomes a real necessity in patients with residual deformity. The other significant finding seen in our patients, often referred by parents to their apprehension, was soft tissue atrophy in the area over the head of the talus to lateral malleolus. This has not been yet discussed in published literature as far as we know. However, it may be due to manipulative technique with excessive pressure exerted on this area while casting.

The majority (80%) of our patients had follow-up duration of nine months to one year, 14% had 13 months to 2 years follow-up, 3% had over two years' follow-up and 3% had completed treatment successfully without residual deformity (Table-4). This shall be considered a limitation of this study; but, as majority of patients were behaving with good FAB compliance, we hope for further continued successful results in future too.

The current trends in the treatment of idiopathic clubfoot have shifted from extensive surgical release to more conservative Ponseti technique,[16,17,25] ''due to its simplicity, high success rate''.[18] Shack,[15] Tindall[18] and Janicki[26] observe that the Ponseti technique "best suits the developing world",[15,18] and recommend that this "philosophy" should be followed "in developed as well as in less developed world''[15] as it is easy to master, easy to achieve "high success rates of 98%-100% with relatively short basic medical education and a simple training course to Orthopaedic Clinical Officers (OCOs) such as paramedics".[18] They[15,18] further claimed that the Ponseti technique has ''low demands on health resources'', "does not require the presence of highly trained surgeons in specialist centres''. They[15,18,26] therefore recommended to transfer the responsibility of Ponseti initial correction and bracing to non-medical, OCOs and physiotherapists. These recommendations were based on their findings of ''no significant difference in results between physiotherapist-directed vs consultant-directed Ponseti treatment, and high success rate of 86%-98% achieved by non-medical Ponseti practitioners. The current study is nearly similar one, with little deviation that we trained senior Postgraduate Orthopaedic Trainees instead of physiotherapists and plaster technicians because the trainees already have sufficient basic "knowledge of applied anatomy and understanding of clubfoot deformity".[7] We trained them in a relatively short duration of one month, but intensive "hands-on training'' in the Ponseti's "skill of manipulation and plaster application and continued care,[7,15] in the well-attended twice-a-week Club Foot Clinic. We evaluated their ability of giving Ponseti treatment and compared their results with the results of their mentor's treated cases, as well as on few other parameters as per the design of this study. The findings of this study were very encouraging, as the results of both groups were nearly similar in terms of average number of cast and overall success rate (difference <1%), relapses and failures. The combined success rate of 93%, relapses and failures in this study were in accordance with published data.[2,5,15,18,26] We may not agree with Tindall's,[18] Janicki's[24] and Shack's[15] above opinions to involve non-medical professionals as it is not suitable in our country to confidently allow them to treat clubfeet independently. Since their basic curriculum of graduation is not in accordance with the recommendation of Ponseti[7] and Shack,[15] that the practitioner should to have basic knowledge of applied anatomy, and understanding of clubfoot deformity, therefore to rely on MNPs will encourage creation of more potter's/bone-setters 21 than to produce real Ponseti practitioners to deal with this preventable disability. Secondly, these non-medical professionals are scarcely

available in this country and it is better to let them to focus on their job rather than to manage clubfoot deformity as an independent practioner. However, we do believe that this technology must be transferred to junior Orthopaedic surgeons and senior Orthoapedic postgraduate trainees by providing them a short duration of "Mentorship Training", not less than four weeks, seven days a week, intensive training. And let them to learn real "highly skilled Ponseti manipulation, casting and continued care".[7,15] Thereafter, let these trainees to treat clubfeet under the supervision and also independently with the confidence of experienced Ponseti practitioner to achieve results comparable with other series that quote success rates of 83%-98%.[2,5,11,16-19,23] With this continued supervised training, they must be acquainted with "thorough understanding of the deformity",[7] and "highly skilled manipulation and casting"7, and observe "a holistic approach and good continuity of care"[15] before they are allowed as an independent practitioners. These future practitioners shall then be the backbone of sustainable national programme for clubfoot disability prevention in Pakistan. Through this network of clubfoot clinics, CCFD patients shall be able get due treatment soon after birth and close to their homes.

Conclusion

The Ponseti method due to its simplicity and applicability is readily transferable to postgraduate Orthoapedic trainees and junior consultants with a short duration of rigorous training by a skilled Ponseti practitioner. They need to be acquainted with thorough understanding of Clubfoot Deformity, and appropriately trained in the skill of manipulative technique, application of cast and continuity of good care. They must be supervised to ensure quality, to achieve fewer recurrences and less frequent need of additional procedures.

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