# Putting Theory into Practice, Part I: Newer Perspectives in Preclinical Training

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## ABSTRACT

**Aim**: To evaluate the perceived difference in convenience and speed of task completion between the conventional method of setting and the Speed Setting Technique.

**Materials & Methods:** 86 Preclinical students were asked to perform four ideal Class I teeth settings using the conventional method taught to them and were then taught the Speed Setting Technique. They were then asked to perform four more settings, this time using the Speed Setting Technique. The department of periodontics was requested to assist in the final evaluation of esthetics with reference to gingival contours. A Likert item questionnaire was issued to elicit feedback at the end of each interval of four settings. The student feedback was evaluated for preference of technique and confidence of execution of the task.

**Results:** Statistical Z test analysis revealed a significant p value (0.01684) when comfort levels were evaluated, a p value(0.64552) when time management was evaluated and p values (0.0114,0.02382) when the number of students capable of mistake identification was evaluated. Introduction of Speed Setting helped boost confidence, induce comfort and allow for better time management with a minor improvement in error management.

**Keywords:** Newer Perspectives, Preclinical Training, Dentistry.

## INTRODUCTION

Theoretical knowledge can be memorized, quite blindly, by learning by rote.[1] There are students with almost photographic memory who can recite passages from textbooks and important definitions by rote. But in most instances, the same students seem to face quite a bit of difficulty in being able to produce comparable results when their application skills with regard to hand skills are evaluated. This requires meaningful learning. [1]

Imparting practical training with regard to high-performance skills requires students to understand how to apply their theoretical knowledge in a manner that maximizes precise & consistent performance output.[2] This poses two challenges.

The first is in the execution of the task in a manner that can be consistently reproduced with the same standards of quality & the second is in being able to self-assess the completed work with a systematic approach that can identify faults so that they can be remedied.[3] In industrial processes of manufacturing, regulation of quality control is normally evaluated and maintained by documented methods like Six Sigma ( a data-driven approach towards perfection, the 6 sigmas referring to 6 standard deviations), DMAIC (Define, Measure, Analyze, Improve, Control),PDCA (Plan, Do, Control, Act), 5S(Sort, Straighten, Shine, Standardize, Sustain) & Lean Manufacturing (eliminate wasteful processes).[4-7] All these processes are aimed at simplification of a sustained quality controlled workflow.

Fig 1: Quality control methods.

Fig 2: A standardized evaluation sheet used for evaluation.



| Category | Acceptable | Unacceptable | Marks ( 10 marks per category) |
|---|---|---|---|
| Articulation | Casts parallel with each other and u/l members of articulator. Casts centered. Incisal pin & vertical pin correctly aligned. Adequate interarch space & rims overlap. Smooth plaster finish – tidy & neat articulation | Any deviations from norms | |
| Anterior setting | Glass plate relations, overjet overbite. Incisal pin midline. Symmetry. Canine prominence. | Any deviations from norms | |
| Canine & molar relation ( keys of occlusion) | Tip of upper canine corresponding to a line drawn behind lower (mesial arm upper-distal arm lower). Mesiobuccal cusp molar buccal groove lower | Any deviation from norms | |
| Arch form | Anterior canine to canine curvature with canine prominence. Posteriors in straight line lowers on ridge crest ( neutral zone) | Any deviations from norms | |
| Posterior setting | Glass Plate relation. Curve of spee. Maximum intercuspation when viewed buccally/lingually | Any deviation from norms | |
| Finishing | No excess wax or abrupt cuts/gouges – smooth wax finish. Preferable to have festooning & stippling | Any deviation from norms | |
| TOTAL (60) | | | |



Fig 3: Teeth setting awaiting evaluation after an internal examination.



Fig 4: The Likert Questionnaire issued after four conventional settings.



Fig 5: The Speed Setting Technique.

A modification of the existing training technique is proposed by way of the Speed Setting Technique that eliminates waste of effort and time and follows the principles of PDCA & 5s as illustrated (Fig.1).

Pre – clinical training is aimed at equipping students with adequate hand skills and the

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**Feedback Form :** Kindly tick to indicate your choice

• Are you comfortable with Speed Setting

| 5 Strongly Agree | 4 Agree | 3 Neither Or N/A | 2 Disagree | 1 Strongly Disagree |
|---|---|---|---|---|

• Should we revert back to conventional setting

| 5 Strongly Agree | 4 Agree | 3 Neither Or N/A | 2 Disagree | 1 Strongly Disagree |
|---|---|---|---|---|

• Do you feel two hours is sufficient

| 5 Strongly Agree | 4 Agree | 3 Neither Or N/A | 2 Disagree | 1 Strongly Disagree |
|---|---|---|---|---|

• Can you finish a setting in an hour in the final exam with Speed Setting

| 5 Strongly Agree | 4 Agree | 3 Neither Or N/A | 2 Disagree | 1 Strongly Disagree |
|---|---|---|---|---|

• If given adequate time to perform the teeth setting and check before submission are you sure you can avoid silly mistakes

| 5 Strongly Agree | 4 Agree | 3 Neither Or N/A | 2 Disagree | 1 Strongly Disagree |
|---|---|---|---|---|

Fig 6: The Likert questionnaire issued after four Speed Settings.

| Q.No CONVENTIONAL METHOD | 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|---|
| 1 principles of setting clarity | 75/86 | 11/86 | ----- | ----- | ------- |
| 2 comfort with conventional method | 47/86 | 29/86 | ----- | 10/86 | ------- |
| 3 time management | 36/86 | 23/86 | ----- | 27/86 | ------- |
| 4 excess time requirement | 10/86 | 61/86 | 3/86 | 12/86 | ------- |
| 5 mistake identification & prevention | 6/86 | 7/86 | 3/86 | 59/86 | 11/86 |

5 = strongly agree , 4 = agree,     3 = undecided/N.A. ,     = disagree , 1 = strongly disagree

| Q.No SPEED SETTING TECHNIQUE | 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|---|
| 1 comfort with Speed Setting | 62/86 | 22/86 | ------- | 2/86 | ------- |
| 2 revert back to conventional method? | ------- | ------- | 4/86 | 30/86 | 52/86 |
| 3 time management | 39/86 | 40/86 | ------- | 7/86 | ------- |
| 4 possibility of setting in less time | 41/86 | 42/86 | 3/86 | --------- | --------- |
| 5 mistake identification & prevention | 18/86 | 9/86 | 2/86 | 49/86 | 8/86 |

5 = strongly agree , 4 = agree,     3 = undecided/N.A. ,     = disagree , 1 = strongly disagree

Fig 7: Consolidated results of both feedback forms.

confidence to cope with patients whilst rendering actual clinical treatment. This requires the basic knowledge of what, when & how in executing relevant clinical steps along with the knowledge of problem solving.[8-10] In most critical training scenarios like training to be a pilot or a dentist the instructor cannot afford to take risks with the performance capabilities of a novice in a real-life setting for practice and hence various forms of simulation are used like the flight simulators for

| | Strongly agree | agree | disagree | Strongly disagree | Total agree | Total disagree |
|---|---|---|---|---|---|---|
| Conventional | 47/86 | 29/86 | 10/86 | -------- | 76/86 | 10/86 |
| Speed Setting | 62/86 | 22/86 | 2/86 | -------- | 84/86 | 2/86 |
| Z-score | -2.374 | 1.1687 | | -------- | -2.3944 | 2.3944 |
| p-value | 0.01778 | 0.242 | | -------- | 0.01684 | 0.01684 |
| Result significance at p <0.05 | YES | NO | | -------- | YES | YES |
| | | | | | | |
| Inference | Students felt more comfortable with the Speed Setting technique | | | | | |

Fig 8: Comfort of using the conventional method vs Speed setting technique

| | Strongly agree | agree | disagree | Total agree | Total disagree |
|---|---|---|---|---|---|
| Conventional | 36/86 | 23/86 | 27/86 | 59/86 | 27/86 |
| Speed Setting | 39/86 | 40/86 | 7/86 | 79/86 | 7/86 |
| Z-score | -0.4613 | -3.8293 | 3.8293 | -3.8293 | 3.8293 |
| p-value | 0.64552 | 0.00012 | 0.00012 | 0.00012 | 0.00012 |
| Result significance at p <0.05 | NO | YES | YES | YES | YES |
| | | | | | |
| Inference | There was an increase in the number of students who could manage the time required better after using the Speed setting technique. | | | | |

Fig 9: Time management.

| | Strongly agree | agree | disagree | Strongly disagree | Total agree | Total disagree |
|---|---|---|---|---|---|---|
| Conventional | 6/86 | 7/86 | 59/86 | 11/86 | 13/86 | 70/86 |
| Speed Setting | 18/86 | 9/86 | 49/86 | 8/86 | 27/86 | 57/86 |
| Z-score | -2.6406 | -0.525 | 1.5775 | 0.7297 | -2.5268 | 2.2553 |
| p-value | 0.0083 | 0.59612 | 0.65272 | 0.4654 | 0.0114 | 0.02382 |
| Result significance at p <0.05 | YES | NO | NO | NO | YES | YES |
| | | | | | | |
| Inference | There was an increase in the ability of students to analyse their mistakes after having done a number of settings and after having tried the Speed Setting technique. | | | | | |

Fig 10: Mistake perception, prevention of recurrence – nconventional vs speed technique.

pilots, robotic typodonts for tooth preparation training and model set ups for the instruction and practice of ideal teeth setting.[11] Pre-clinical prosthodontics training in teeth setting follows the guidelines required to produce bilateral balanced occlusion.[12-15] Much of what is learned in ideal case scenarios will have to be slightly modified to suit the clinical scenario. What a student sees or assumes to see during a demonstration is imitated

or emulated to attempt reproducing the same specified task. [16]

Training involves stress levels and it is the role of the educator to nudge and push within the volatile boundaries of current student tolerance limits by cajoling and encouraging when on the right track and by offering advice and remedial instruction when not on the right track. Goal setting is of significance and has to be in balance with the commitment and efficacy of the students and the desired outcome of performance.[17] A grading system often helps indicate a transparency of evaluation without any bias. In the concept of gamification of education, strategies employed in video games are applied to education to balance the perception of objective accomplishment based reward based on levels. One way of applying the concept of levels is in evaluating the assigned task in stages as in evaluating anterior teeth setting separately followed by posterior teeth setting. The author proposes another approach based on the complexity of task completion. Games allow completion of more complex levels by offering workaround methods like cheat codes offered by game designers used in gameplay to overcome tough situations or obstacles incorporated into the game.[18] In a real-life scenario, this can be mimicked to a certain extent by first teaching conventional methods and then by allowing the students to 'upgrade' to the next level of performance by introducing certain tips and tricks. After having been introduced to conventional teeth setting principles and the conventional method of setting teeth students were now given a demonstration of a simpler and faster method of setting proposed by the author. To inculcate some enthusiasm the technique is referred to as the Speed Setting technique. This was similar to stepping back to a simpler level in a game or using a cheat code to accomplish the task easier in a game. The next was to add a degree of added professionalism by seeking a second opinion.[19] The department of periodontics was asked to offer their inputs with regard to gingival contouring as related to removal and shaping of wax during festooning.

The first of this two-part article focuses on modifying the training and the second on enhancing the self-evaluation ability of the student thus making it easier to accept evaluation made by an examiner or instructor.

## MATERIALS & METHODS

86 preclinical students were chosen for a two part study. The first part of the study involved modification of the method of practical teaching aimed at making execution of the specified task easier. The second part of the study was aimed at a modification of self-assessment structured in an OSPE pattern exposing students to certain specific mistakes as test question and eliciting correct responses related to these mistakes.

In the first part of the study, the students were first taught teeth arrangement using standard principles and were asked to perform four teeth settings during their two hour pre-clinical practical sessions. The settings were evaluated, one on one, using criteria standardized by the author for accuracy and repeatability of the evaluation thus ensuring transparency and to allow immediate feedback.(Fig.2) This was aimed at positively influencing the development of the skill in a process referred to as 'knowledge of result' in the subject of human motor learning.[20] Faculty members of the department of periodontics were requested to cross verify mistakes made in gingival contouring. Mistakes were noted down for future reference with an objective of preventing the same mistakes from recurring. A grade based rating of their performance, divided into 4 categories A, B, C & D, was shared with the students for them to assess their performance as a group and within the group. The first internal examination was conducted at this point to induce a sense of seriousness and competitiveness.(Fig.3) The students were issued a feedback questionnaire focussed on comfort levels, time required & performance satisfaction and this data was recorded.(Fig.4) This was followed by an introduction to the Speed Setting Technique, a modification of the conventional technique to allow a much faster execution of the task.(Fig.5) The students were instructed to perform four settings using this modified technique. The second internal examination was conducted at this point. Feedback by way of a similar questionnaire was collected once again and the collected data recorded. (Fig.6)

## RESULTS

The students were issued a simple Likert item feedback questionnaire on both occasions. The cumulative result of both questionnaires is shown in Fig.7. The real purpose of the questionnaire was to elicit whether the students had understood their concepts clearly enough to avoid committing mistakes  but to divert their attention other questions related to the speed or convenience of the technique being used were asked first to avoid creating a bias. A Z-test was performed to statistically analyse the results. The results revealed that as per both Likert item questionnaires students preferred the Speed Setting technique for its speed and convenience but were still not able to perform their teeth settings without mistakes in spite of being given time to check their finished settings before submission. (Fig.8 to 11)

## DISCUSSION

The main intent of the study was to apply the findings towards quality control of the training process. There were two issues to address. The first issue to address was the comfort of performing the task within the stipulated time. This was made possible by introducing concepts of Lean manufacture (avoiding wasteful steps) by way of the Speed Setting technique and in part took care of few aspects of the **5s** approach (Sort, Straighten & Shine) & half of the **PDCA** approach (Plan & Do)   In the second part of this study the focus was shifted towards work efficiency by stressing on the other factors in these quality control processes ; Control & Act with regard to PDCA approach & Standardize & Sustain with regard to the 5s approach.

An improvement in confidence levels was noticed as students became more familiar with the repetitive task of teeth setting. They welcomed the added inputs provided by the Department of Periodontics as a scientific basis for their festooning. As teeth setting is repetitive and has finer aspects that are not readily appreciable a sense of over confidence could be an added cause of students being blind to their own mistakes. The second part of the study was aimed at this over confidence by systematically attacking the mistakes in a way that would allow better self-evaluation.

## CONCLUSION

In a collaborative effort between the departments of Prosthodontics & Periodontics an effort was made to identify and rectify problems related to the comprehension and execution of practical work as related to pre-clinical teeth setting. The introduction of the Speed Setting technique after first learning the conventional method allowed students to feel that they had been provided with an easier work around, much similar to cheat codes in gameplay, thus enabling easier completion of the allocated task within the stipulated time frame.

## CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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