Mechanical CPR

Better CPR or Attractive Nuisance?

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Conflicts

- No conflicts for this talk
- I have received honorarium in past for review of monitor defibrillator data for Physio-Control Corp

Known Knowns

- Humans perform CPR poorly, guidelines not met
- Machines are made to meet guidelines
- Machines reliably provide good circulation
- More can be done with less people
- Transport with CPR can be done safely and effectively
- CPR can be done in challenging environments

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Thoughts

- Do great ideas from the bench always translate to the field?
- Do the current Randomized Controlled Trials on mechanical CPR guide us on whether the technology works?
- What is best practice in the use of piston powered compression devices?

Thank you for your attention

…a couple of details

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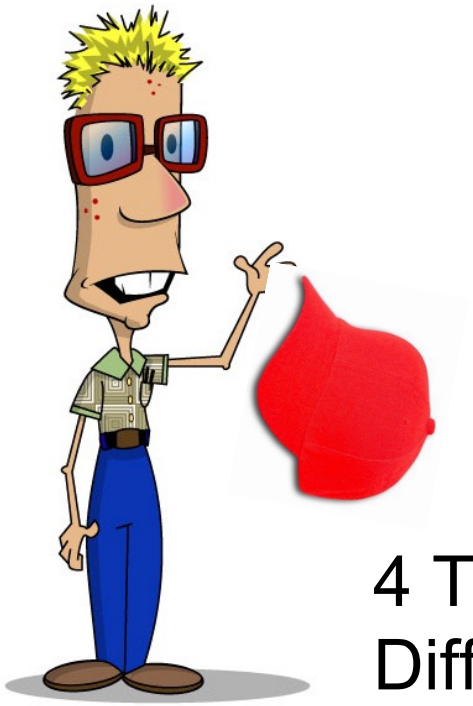
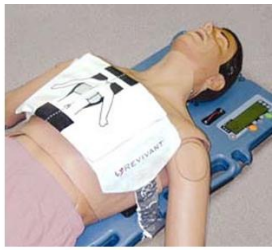
Randomized Controlled Trials



Versus



Versus

4 Trials enrolling ~ 12,000 patients
Different methods, Different end points

Slide compliments of Tom Rea MD

Piston CPR

Hospital Discharge / 30 Day

	Manual Alone	Manual + Piston CPR
LINC Trial	9.2%	9.0%
PARAMEDIC	6.2%	6.8%

Differences were not statistically significant.

Versus

2 Trials enrolling ~7000 patients

Slide compliments of Tom Rea MD

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Mechanical CPR Devices: Increased Risk of Harm without Benefits

Joseph Tennyson, MD

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Mechanical CPR Devices Tied to Worse Outcomes

CURRENT ISSUE

Circulation

CORRESPONDENCE

Association of Mechanical Cardiopulmonary Resuscitation Device Use With Cardiac Arrest Outcomes

A Population-Based Study Using the CARES Registry (Cardiac Arrest Registry to Enhance Survival)

David G. Buckler, Rita V. Burke, Maryam Y. Naim, Andrew MacPherson, Richard N. Bradley, Benjamin S. Abella, Joseph W. Rossano and For the CARES Surveillance Group

DOI https://doi.org/10.1161/CIRCULATIONAHA.116.026053
Circulation. 2016;134:2131-2133
Originally published December 19, 2016

Cares Registry

- Key finding (per Dr Rossano) is that “minority of agencies used these devices and that the use of the devices was associated with (worse) neurologically favorable survivable at discharge”

Other points

- mCPR: more likely to have unwitnessed arrest, airway placement, AED placement, ITD and prehospital cooling
- Analysis was performed with those having ROSC before ALS provided excluded and overall good neurological outcome was less with mCPR (5.9% v 4.6%)
- No difference in outcome between mCPR and CPR was found in agencies using mCPR in 50-75% of cases and >75% of cases.

Axiom 1

Measure

Improve

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Resuscitation. 2015 Jun;91:116-21. doi: 10.1016/j.resuscitation.2015.02.028. Epub 2015 Mar 9.

Mechanical chest compressions improved aspects of CPR in the LINC trial.

Esibov A[1], Banville I[2], Chapman FW[2], Boomars R[3], Box M[4], Rubertsson S[5].

⊕ Author information

Abstract

AIM: We studied resuscitation process metrics in patients with out-of-hospital cardiac arrest enrolled in a randomized trial comparing one protocol designed to best use a mechanical CPR device, with another based on the 2005 European Resuscitation Council guidelines for manual CPR.

METHODS: We analyzed clinical data, ECG signals, and transthoracic impedance signals for a subset of the patients in the LUCAS in Cardiac Arr (LINC) trial, including 124 patients randomized to mechanical and 82 to manual CPR. Chest compression fraction (CCF) was defined as the fractic time during cardiac arrest that chest compressions were administered.

RESULTS: Patients in the mechanical CPR group had a higher CCF than those in the manual CPR group [0.84 (0.78, 0.91) vs. 0.79 (0.70, 0.86), p<0.001]. The median duration of their pauses for defibrillation was also shorter [0s (0, 6.0) vs. 10.0s (7.0, 14.3), p<0.001]. Compressions were interrupted for a median of 36.0s to apply the compression device. There was no difference between groups in duration of the longest pause in compressions [32.5s vs. 26.0s, p=0.24], number of compressions received per minute [86.5 vs. 88.3, p=0.47], defibrillation success rate [73.2% vs 81.0%, p=0.15], or refibrillation rate [74% vs. 77%, p=0.79].

CONCLUSIONS: A protocol using mechanical chest compression devices reduced interruptions in chest compressions, and enabled defibrillation during ongoing compressions, without adversely affecting other resuscitation process metrics. Future emphasis on optimizing device deployment r be beneficial.

KEYWORDS: Cardiopulmonary resuscitation (CPR); Chest compression fraction; Defibrillation; Mechanical CPR; Out-of-hospital cardiac arrest (OHCA); Perishock pause

	Mechanical	Manual	p
CCF	0.84 (0.78, 0.91)	0.79 (0.70, 0.86)	p<0.001
Pause for Defib(median)	0s (0, 6.0)	10.0s (7.0, 14.3)	p<0.001
Application	36s		
longest pause	32.5	26	p=.24
CPM	86.5	88.3	p=.47
Defib Success	73.2%	81%	p=.15
Re-Fib	74%	77%	p=.79

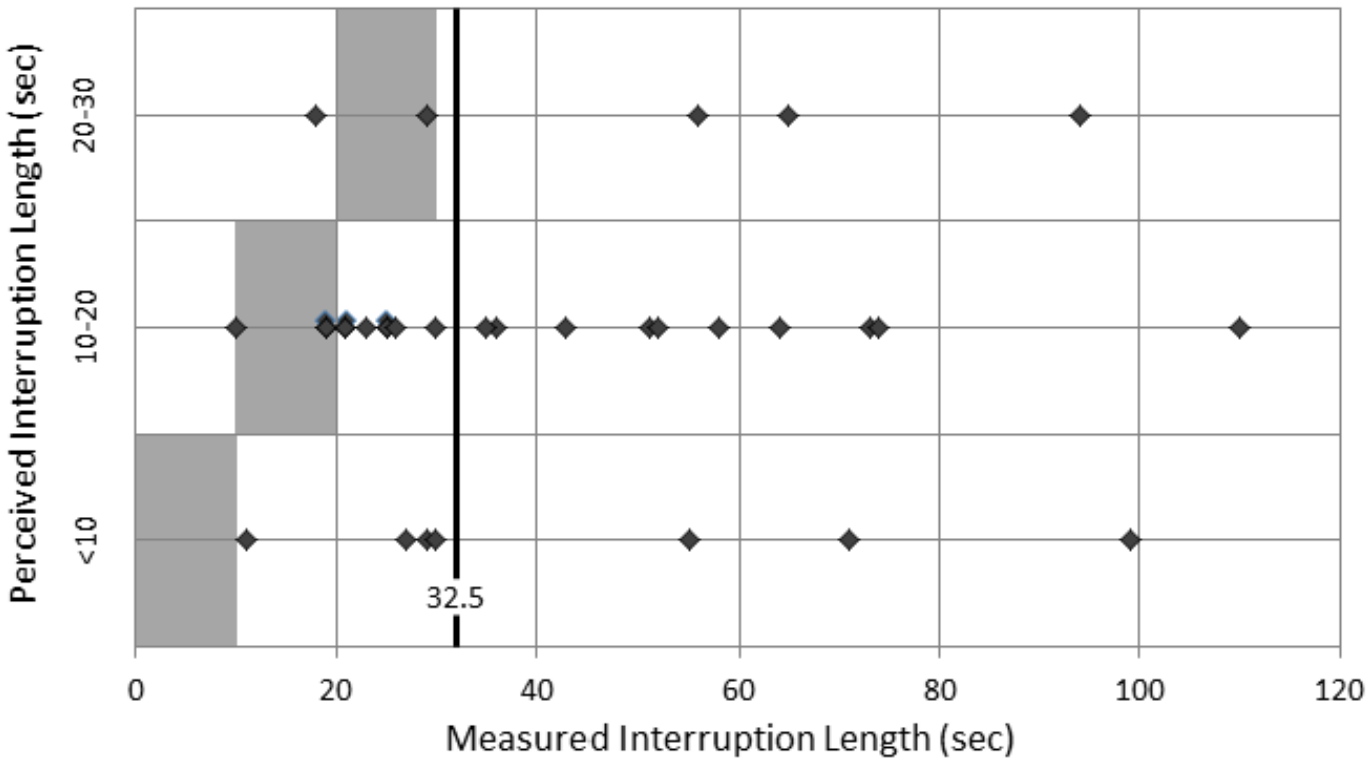
Resuscitation. 2015 Jun;91:116-21. doi: 10.1016/j.resuscitation.2015.02.028. Epub 2015 Mar 9.

Mechanical chest compressions improved aspects of CPR in the LINC trial.

Esibov A1, Banville I2, Chapman FW2, Boomars R3, Box M4, Rubertsson S5.

Esibov Study

- Mean time to application was 36 sec



Measured vs Perceived Interruption Time

Yost, et al., Assessment of CPR interruptions from transthoracic impedance use of the LUCAS mechanical compression system, in press

Continuous Complete

Incident ID:
Patient ID:
Patient Name:
Power On:
Speed/Size:
Frequency:

*Times have been adjusted by the user.

LifeNetReports Version:15.0.15

Circulation

Conclusions—In patients with cardiac arrest presenting in a shockable rhythm, longer perishock and preshock pauses were independently associated with a decrease in survival to hospital discharge. The impact of preshock pause on survival suggests that refinement of automatic defibrillator software and paramedic education to minimize preshock pause delays may have a significant impact on survival.

Arrest

Sheldon Cheskes, MD; Robert H. Schmicker, MS; Jim Christenson, MD; David D. Salcido, MPH; Tom Rea, MD; Judy Powell, RN; Dana P. Edelson, MD; Rebecca Sell, MD; Susanne May, PhD; James J. Menegazzi, PhD; Lois Van Ottingham, RN, BSN; Michele Olsufka, BSN; Sarah Pennington, RN; Jacob Simonini, ACP; Robert A. Berg, MD; Ian Stiell, MD, MSc; Ahamed Idris, MD; Blair Bigham, MSc; Laurie Morrison, MD, MSc on behalf of the Resuscitation Outcomes Consortium (ROC) Investigators

AFD Changes in Protocol

- All CPR is manual to start
- Mechanical device is NEVER placed until after the second round of CPR is completed
- Mechanical device is ALWAYS placed in two steps
  - Backplate when convenient in first two cycles
  - Compression tower while CPR is ongoing
- Device immediately removed and manual resumed if any failure

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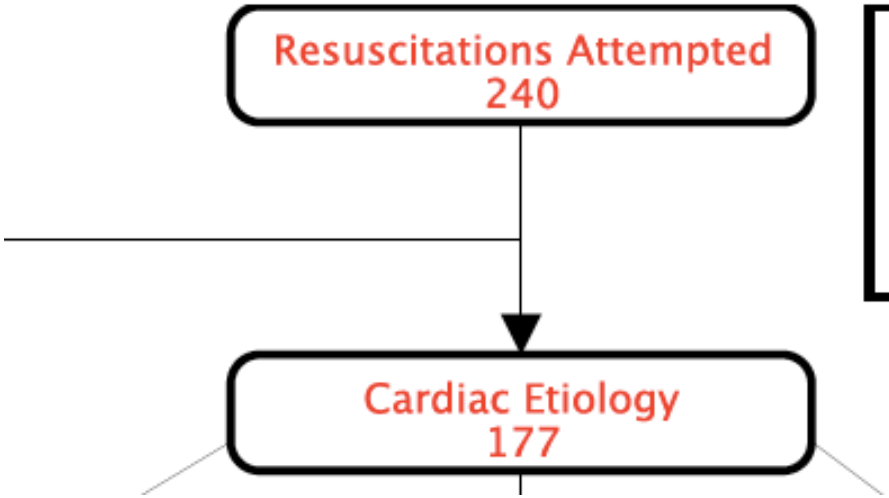
Anchorage mCPR

- 78% of cardiac arrest of presumed cardiac etiology
- Survival shockable (PCE) mCPR 28.85%, CPR 25%
- Survival nonshockable(PCE) mCPR 2.3%, CPR .8%
- Survival (PCE) mCPR 9.9%, CPR 7.7%

Utstein Survival Report

Anchorage Fire Department

First Responder: Anchorage Fire Department I Service Date: Last Year



Cardiac Etiology Survival Rates	
Overall:	17.5% (177)
Bystander Wit'd:	32.5% (80)
Unwitnessed:	3.5% (86)
Utstein[1]:	60.0% (40)
Utstein Bystander[2]:	63.9% (36)

Bystander Intervention Rates[3]	
CPR:	84.7% (150)
AED Use:	1.3% (150)

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ELSEVIER

Resuscitation

Volume 92, July 2015, Pages 32–37

Clinical Paper

A quality improvement initiative to optimize use of a mechanical chest compression device within a high-performance CPR approach to out-of-hospital cardiac arrest resuscitation ☆

Michael Levy[a, b], Dana Yost[c, d], Robert G. Walker[e], Erich Scheunemann[a, b], Steve R. Mendive[a, b]

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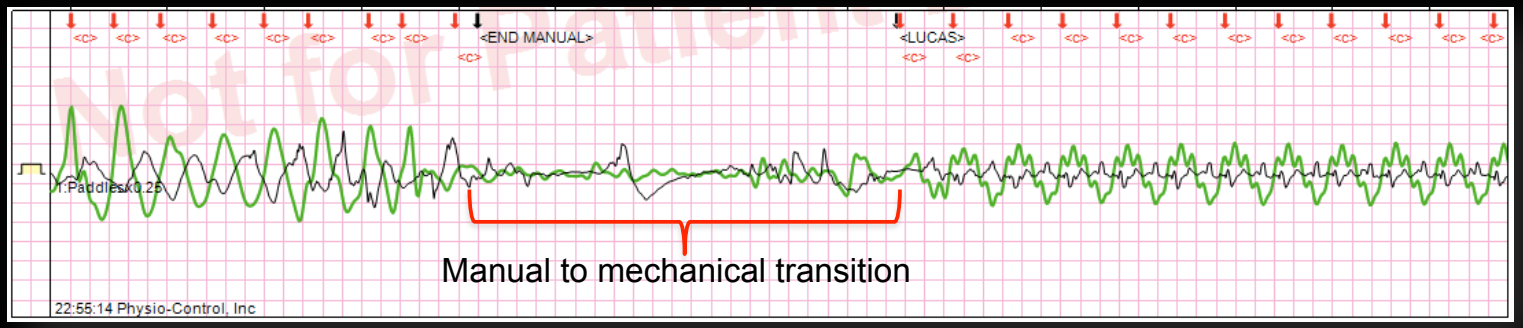
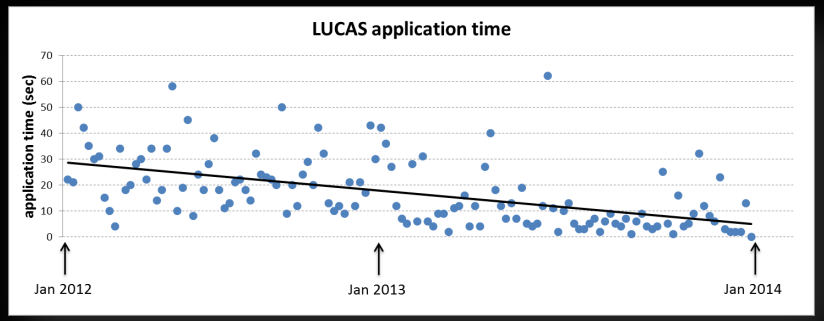
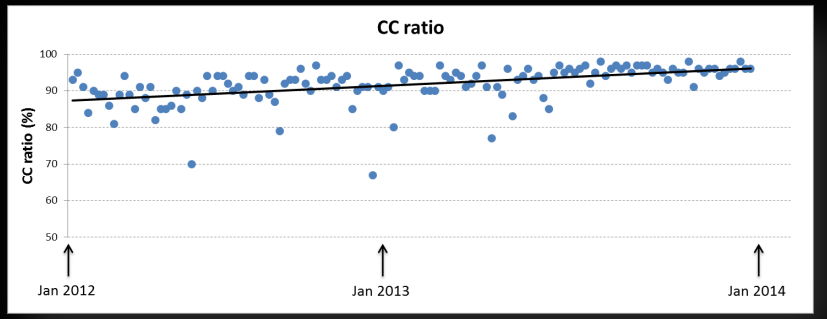
Results







Levy M, Yost, D et al Resus 92, 2015

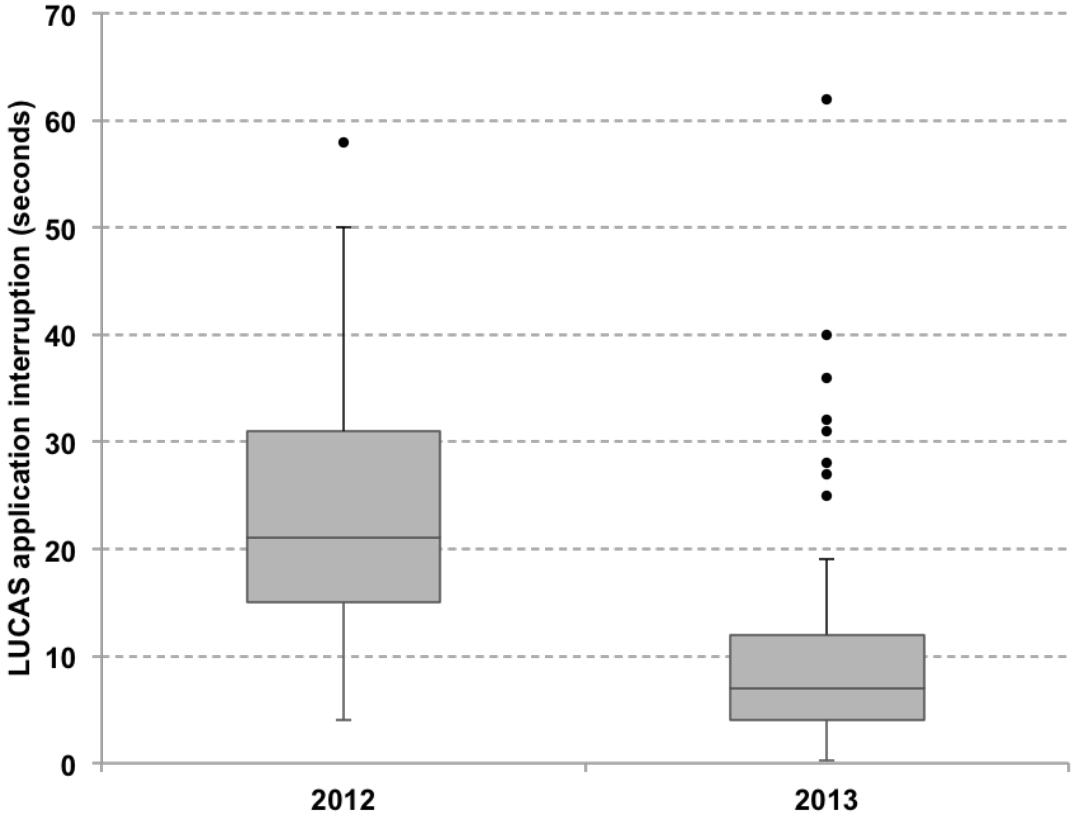
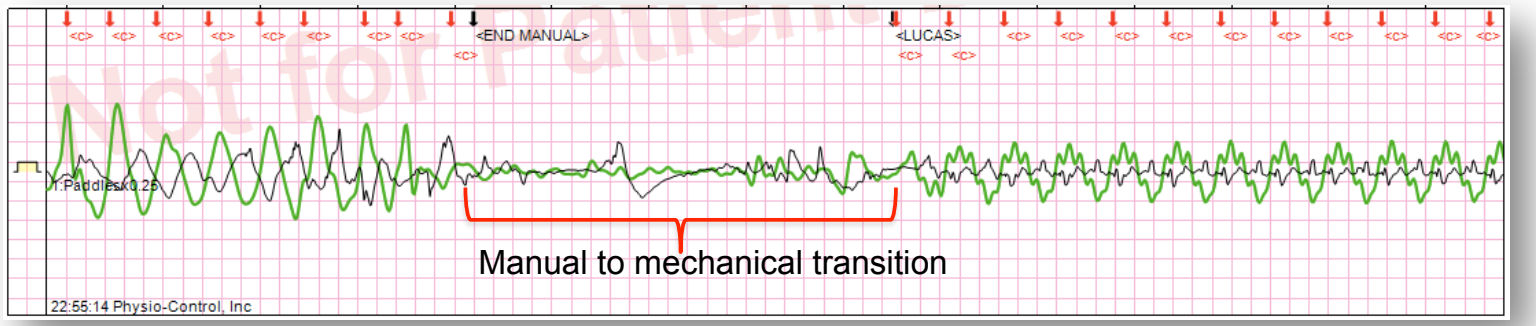


Figure 3. Duration of chest compression interruptions prior to first mechanical chest compression for the years prior to and after initiation of the quality improvement initiative, illustrated by Tukey boxplot. Individual dots represent outliers.

Results



Measure…Improve

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Piston Driven Mechanical CPR Summary

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Better than world class manual CPR?

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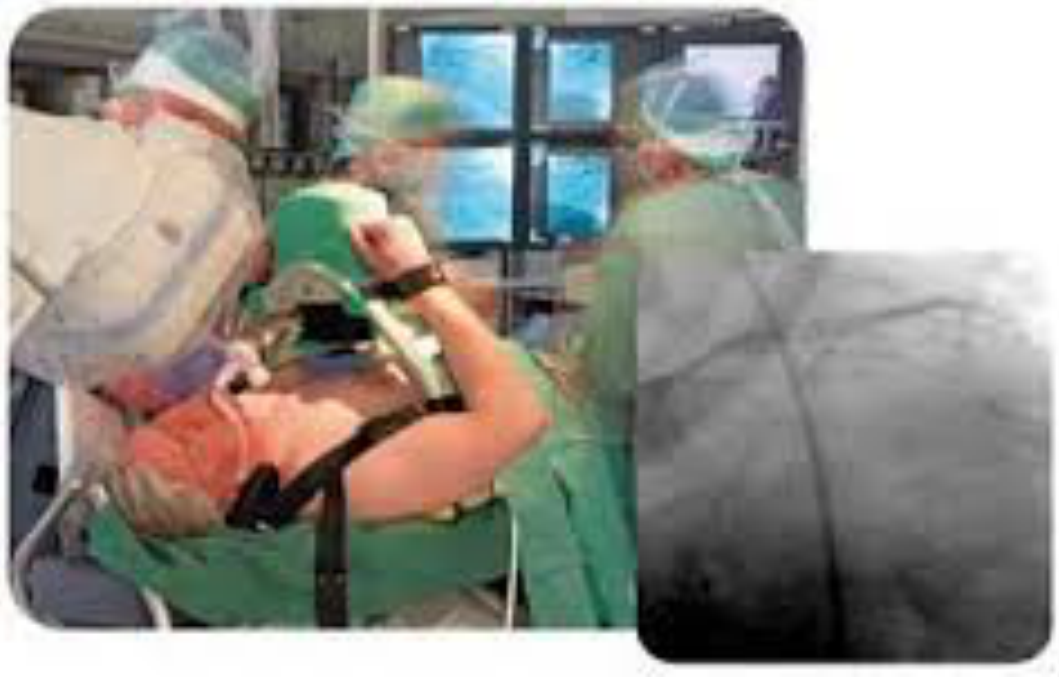
Does it provide a better solution for re-arrests?

Applicable to Unique and Important Situations?

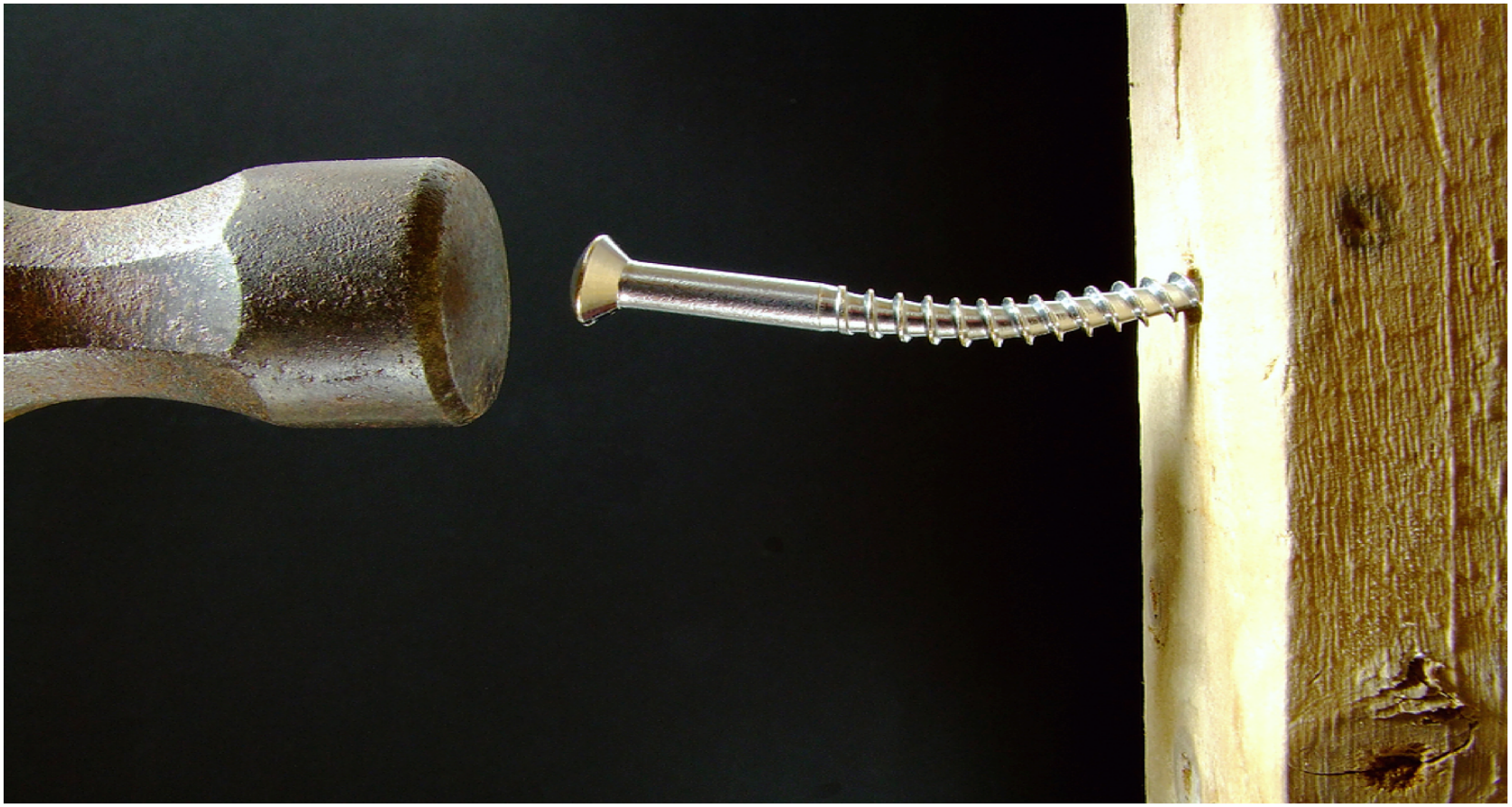


Does It Affect Scene Dynamics?

安

tranquility

A Carefully Reasoned Position



Get the Right Tool for the Job
…and Know How to Use It