Haaga-Helia
University of Applied Sciences

Effectiveness of Defensemen's Play in the Offensive Zone

The impact of defensemen's positional changes on goals and scoring chances in offensive zone offensive play

Juhamatti Yli-Junnila

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Author(s)
Yli-Junnila Juhamatti

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The role of offensive zone offensive play has increased in modern ice hockey with the increase in size of the offensive zone. Teams now need to have various forms of offensive zone team systems in order to increase the puck possession and scoring chances. The fast pace of the ice hockey today requires having all five players involved in team's play system in every zone. In offensive zone offensive play the ability to utilize the offensive effectiveness of the defensemen can be a valuable asset for teams' success.

To better understand the impact of defensemen's offensive effectiveness in offensive zone offensive play, the purpose of this research-based study was to analyze where the defensemen should be situated during offensive zone offensive play and how they should change positions in order to increase the scoring chances. The focus was on 5v5 offensive play. In order to analyze the defensemen's offensive efficiency a performance analysis was used as an approach to conduct observational study to analyze the offensive zone offensive play and defensemen's performance of Finnish national U18 ice hockey team in season 2017-2018. The data was collected from 21 international games. Post-game analysis was conducted based on defined key concepts for offensive zone offensive play in order to observe the impact of the U18 team's defensemen on goals and scoring chances by changing positions in offensive zone.

The results indicate that the defensemen's offensive efficiency does have a positive impact to goals and scoring chances in 5v5 play. The defensemen's activity and position changes in not just traditional high zone, but also in low zone, impacted significantly to the goals and scoring chances in offensive zone offensive play. The position change can be executed either by strong or weak-side defenseman, or both of them. The main purpose of the position changes is to distract the opponent and improve offensive chances.

This study provides a concept to analyze offensive zone offensive play and increase the understanding of key concepts impacting to the team's offensive zone offensive play and how the defensemen's offensive efficiency can be utilized.

Keywords
Offensive zone, offensive play, defensemen's effectiveness, positional changes, goals and scoring chances

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1 Introduction

Ice hockey today is a fast-paced game requiring multidimensional players who are expected to be involved both in offense and defense when being on ice. The evolution of the game has challenged the view of predetermined roles and predetermined game plan (Westerlund & Summanen, 2001). Fuchs (2018) describes that ice hockey today is more of a puck possession game with the aim to get the puck out of one's own defensive zone as fast as possible to create more offensive chances and this often starts with the defensemen (Fuchs, 2018). The speed of the game has increased, and the players need to shift from role to another. This challenges the traditional separation between the offensive and defensive game, and therefore also the roles of forwards and defensemen.

Varmanen (2016) underlines the importance of players sharing common objectives for offensive and defensive game situations (Varmanen, 2016) in order to have all five players involved in offense and defense in all zones in an effective manner. Today the defensemen are expected to have an offensive mindset and systematically participate in the offensive game, for example, by interchanging positions with their partners (Heisler, 2018) or joining the rush systematically (Fusch 2015). Corsi (2017) stated that defensemen abandoning the blueline can also be quantified from the average number of goals scored per game in NHL, which has been increasing since 2015 (Corsi, 2017).

Rule changes are one reason for increased importance of the role of zone play. In 2014, the International Ice Hockey Federation (IIHF) suggested a rule changes (Merk, 2014) and as a result the size of offensive and defensive zones were increased. Teams now needed to improve their offensive zone offensive play and defensive zone defensive play. In order to take advantage of the larger offensive zone and to break the advanced defensive systems, teams need to involve the defensemen more actively in offensive zone offensive play in order to contribute to the effective offensive zone play and increase scoring opportunities.

The main purpose of this study is to investigate whether the defensemen's effectiveness has an impact on goal and scoring chances in offensive zone offensive play in 5v5. The defensemen's offensive effectiveness in this study is measured through their position changes in offensive zone offensive play from these two perspectives:

- Where the defensemen are situated in offensive zone offensive play, the high or low position at the time of goal or scoring chance?
- What kind of position change the defensemen have executed at the time of goal or scoring chance?

To answer these questions, a performance analysis was considered as the most effective approach to carry out a qualitative observational analysis. O'Donoghue (2010) suggests performance analysis as a method to analyze how players perform and use their skills when implementing the strategy and tactics applied in this study in offensive zone offensive play. The main research type for performance analysis is observational research, which enables notational analysis of events and does not control the events. (O'Donoghue, 2010, 2-3, 30.)

In this study the performance analysis enabled the observation of offensive zone offensive play based on player movements and performance. The focus for observational analysis was the Finnish National U18 ice hockey team. In this study 21 international games from Finnish National U18 ice hockey team were analyzed. The games were played during the 2017-2018 season. The team system adopted by the Finnish National U18 team included various forms for defenseman to play actively in offensive zone offensive play. The data was analyzed by using video analysis as primary method. The post-game analysis done with Dartfish and Steva Hockey video analysis system allowed for an analysis of the games from the perspective of key concepts for offensive zone offensive play defined in this study. This provided a method to observe where the defensemen were situated in the five zones defined in this study for the offensive zone and what kind of positional changes the strong and weak-side defensemen made. The key concepts for this study were defined in order to observe the defensemen performance in offensive zone offensive analysis in a unified manner.

The initial setting for the observational research was that the Finnish National U18 team strived to use defensemen effectively in offensive zone offensive game and the playing system supported defensemen to change positions. The main purpose of this study is to investigate whether the defensemen's efficiency does have an impact on goal and scoring chances in 5v5 offensive zone offensive play. From this perspective it is not considered relevant whether the defensemen scored a goal or had a scoring chance. For this reason, their efficiency is measured at the time the goal was scored or the scoring chance created, for measuring the impact of the defensemen's efficiency in these goals and scoring chances.

The study does not analyze opponent's defensive tactics. The analysis focuses on goal or scoring chance moments regardless it ended to a goal or not. Goals from faceoffs were also outside the analysis. The intent of this study is to analyze the tactical perspective on a team level instead of analysis of individual players from the Finnish National U18 team.

2 Ice hockey as a game

Ice hockey is a fast-paced team sport played on an ice rink, with the sole purpose to score the puck into the opponent's net and prevent the opponent from scoring goals. The rapid transition between events and the fast movements of the players makes ice hockey a complex game (Riley, 2018). Ice hockey can be classified as an example of invasive game by being a typical goal striking game, like football (Franjković, Matković & Milanović, 2017). The fast-pace makes ice hockey a fluid game including constant puck possession changes between players with a possibility to score at any time (Buttrey, Washburn & Price, 2011).

2.1 Basics of the game

In ice hockey the teams are allowed to have six players on ice at the same time in equal strength situation, called 5v5. Typically, the team has three forwards, two defensemen and one goaltender. The game is played in three 20-minute stop-time periods. During each period there exists various minor stoppages, either because a goal is scored, the puck goes out of the defined area, the goaltender covers the puck or one of the rules are broken. (Riley, 2018.) In case of a rule violation, the referee, who is in-charge of the game and responsible for ensuring fair, safe and orderly situations during the game, will impose special situations, such as stoppages and face-offs, or penalties. These special situations can affect the number of players on ice. (Shorey, 1995.) Unlike in other team sports, after a stoppage a face-off is used to resume the game (Thomas, 2006).

During an ice hockey game both of the teams are constantly trying to gain possession of the puck and score a goal, when at the same time the other team is trying to prevent the scoring chances. Huovinen, referring to Westerlund (2014), divided ice hockey into offensive play and defensive play, and in a similar way Shorey (1995) divided ice hockey into two main objectives:

- Offensive play: A team controls the puck and tries to score a goal
- Defensive play: A team tries to prevent a goal when the opposition controls the puck

The IIHF described the following objectives to be in common for both teams during offensive and defensive play (IIHF, 2016):

Objectives for offensive play

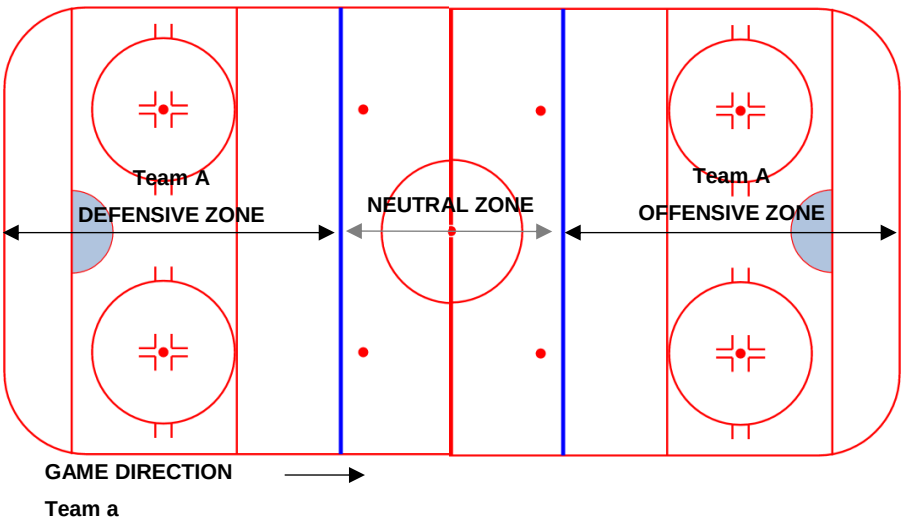
- Scoring a goal
- Winning space
- Creating space
- Defensive capability

Objectives for defensive play

- Preventing goal
- Stealing the puck
- Preventing winning space
- Offensive capability

The main object for offensive play is to score a goal. To score a goal the team needs to win space towards the opponent's goal. If winning space in front of the goal is not possible, keeping the offense requires the team to create space, for example by passing the puck down. If creating space is not possible, for example during the line change, then the object is to lose the puck or dump the puck in a way that enables the best possible defensive capability. For defensive play the main object is to prevent a goal. In order to defend one's own goal, the second objective is to steal the puck. If it's not possible to steal the puck, the objective is to prevent the opponent from winning space in front of one's own goal. After stealing or when the opponent has dumped the puck, offensive play starts, so maintaining offensive capability is important. (IIHF, 2016.)

In ice hockey offensive and defensive play occur in specific zones, which are divided on the ice rink by two blue lines (IIHF, 2016). The defensive zone includes one's own goal and the offensive zone is the area surrounding the opponent's goal. In between is the neutral zone, which is divided by the red central line (picture 1).



Picture 1. Ice rink divided into offensive, defensive and neutral zone (IIHF, 2016)

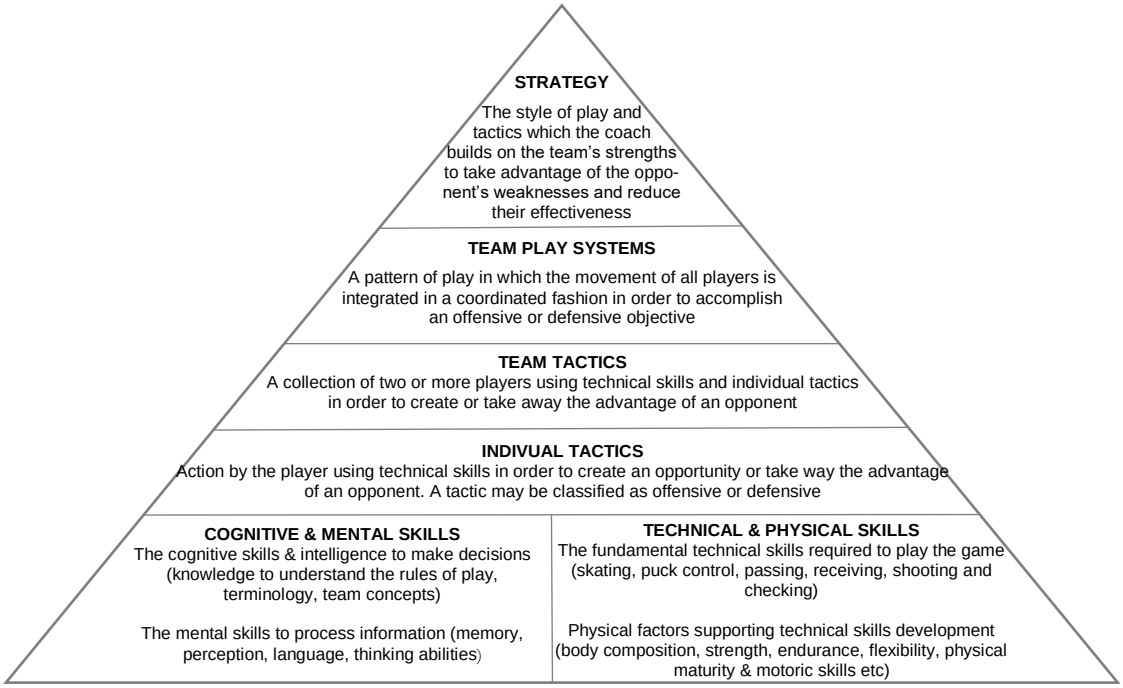
The evolution of ice hockey as a game and the increase in the speed at which the game is played has changed the way teams are playing in the offensive and defensive zone, and therefore the requirements for the individual player's capabilities have changed. Merk (2014) represented the suggested rule changes proposed by IIHF for the international ice hockey rules. One of these was the attempt to standardize and move the blue line in to increase the size of the offensive and, consequently, the defensive zone. The suggestion was to move the blue lines to 22,86 meters from the previous placement of 21,33 meters. Each offensive zone was increased by one and half meters and the length of the offensive zone would be then standardized for all IIHF Championships. (Merk, 2014.) The rule was accepted, and the size of end zones was increased.

The goal with the rule changes was to increase offensive opportunities and the number of goals by increasing the space for offensive game and reducing the space for neutral zone game (Rosen, 2014). Increasing the size of offensive and defensive zones affected the way teams play offensive and defensive game as there is more space to take advantage but also more to take from the opponent. In 2014 Bourne (2014) interviewed Mike Babcock, head coach of the Toronto Maple Leafs, who stated that as the end zones became larger, players need to make the zones smaller by compressing the space and avoiding giving too much to the opponent. This impacted the roles of the players, for example, as wingers now need to be more involved in zone play. (Bourne, 2014.)

Even though the purpose of the larger offensive zone was to increase the number of goals, Sihvonen (2017) stated that the offensive zone offensive play didn't become any easier as also the defensive zone defensive play has also evolved. However, the bigger offensive zone has left space for the defensemen to join the offensive play. (Sihvonen, 2017.) The evolution of the game has affected the flow of the game from the perspective of positional and directional changes. Sihvonen (2019) calls modern ice hockey a stationary war, where offensive zone offensive play is played against defensive zone defensive play. This affects to the way individual players try to create an offensive advantage against an organized defense and this impacts the way coaches create strategies for the zone play. (Sihvonen, 2019.)

The development of offensive and defensive play has prompted the creation of new team systems and also different capabilities for the players when compared to their traditional involvement in zone play. The new generation defensemen and forwards are bringing new kinds of capabilities to the game. This is causing difficulties for the older generation of players to adapt themselves to the changing requirements of the modern ice hockey, from the offensive and defensive perspective.

Franjković et al. (2017) referring to Trninić et al. (2000) define that a team's efficiency and success are determined by players quality, teamwork and tactics within a game (Franjković et al. 2017). IIHF (2010) defined the relationship between individual player and team in five levels, which describe how the capabilities of an individual player enable the wider contribution to team tactics and teamwork in ice hockey (picture 2). The two lowest levels describe how the individual player's cognitive and mental skills create the capabilities to understand ice hockey as a game, and the technical and physical skills allow for the implementation of individual tactics in offensive and defensive situations, thus allowing a group of individual players to execute team tactics to create or take away advantage in offensive or defensive situations. The team's systems create the structure for the team's play whereby the individual players understand how to play the offensive or defensive tactics as a team. The strategy on top forms the shared principles for the team and defines how the team plays offense and defense against opponents. (IIHF,2010.)



Picture 2. Individual player's capabilities building the team play system (IIHF, 2010)

The player's actions and tasks related to offensive and defensive play are defined by the team's system and tactics (Varmanen, 2016). This is also related to the strengths and weaknesses of the individual player and how the players can then contribute to the team's overall play. The individual player needs to understand the game from both the offensive and defensive perspective and the different game situations roles.

2.2 Individual player & game situation roles

Ice hockey as a sport requires multiple attributes from the players. As ice hockey has evolved the intensity of the game and the physical nature has increased substantially and now requires a high level of anaerobic capacity, as well as strong psychological characteristics and tactical knowledge (Roczniok et al, 2016). This combination places a high demand on the players as they need to be able read and react to the changing situations as quickly as possible during the game (Brithén, 2001).

The players ability to read and react to the rapidly changing situations requires the ability to observe the situation and process information quickly in order to select the most appropriate option and execute the correct tactic for the specific situation (IIHF, 2008b). When evaluating the performance of an individual player Varmanen (2016) states that the playing skills are key feature. Playing skills combine hockey sense, the player's ability to observe the environment and make actions during the game, and technical skills. (Varmanen, 2016). Huovinen (2009), referring to Westerlund (1997, 535), describes a player with good hockey sense as one who can utilize the needed physical, mental and technical skills in an optimal way (Huovinen, 2009).

Ice hockey is a game requiring fundamental technical skills in order to play the game. The IIHF (2008a) listed the following technical skills needed in ice hockey: skating, shooting, passing, receiving pass and stick handling. These technical skills enable the player to manage different individual offensive and defensive tactics. (IIHF, 2008a.) An example of an offensive individual tactic is when a player with the puck creates an opportunity to maintain possession of the puck and win space by deceiving an opponent with a fake pass and change of the skating rhythm. In this example the player implements skating and stick handling skills. In this same example the defensive player can use skating skills to maintain a close gap and use defensive skills to poke check and steal the puck from the opponent, which may also be referred to as backchecking and forechecking in offensive and neutral zone.

It is important to understand and separate a player's playing positions and game situation roles. An ice hockey team consists of goaltenders, defensemen and forwards, of whom, the defensemen and forwards are referred to as skaters (IIHF, 2014). These definitions are based on the players' playing position. The center, one of the three forwards, needs to be a strong skater, who is also able to take face-offs. The center passes to the sides, left and right wing, which are the other two forwards. Traditionally, the left-handed shooter

was on left and right-handed on right, but currently, players and coaches may have a preference to be on the off-hand. In addition to the two wings, two defensemen traditionally split the defensive duties on left and right side of the ice. The defensemen's primary purpose is to prevent the opponent from shooting, while the goalie protects the goal.

Westerlund and Summanen (2001) state that at the beginning of ice hockey the players had very specific titles describing their main tasks in the game. The defenders defended, and the forwards attacked according to the game plan which placed players in advance in the most suitable role and created preplanned cooperation between the players. Since then as the speed of the game increased, the players need to be able to react rapidly to the changing playing situations and change from one playing situation role to another. (Westerlund & Summanen, 2001.) For the individual player, possession of the puck determines the four different game situation roles (IIHF, 2016) in following way:

- Role 1: Offensive player with the puck
- Role 2: Offensive player without the puck
- Role 3: Defensive player defending the puck carrier
- Role 4: Defensive player defending the non-puck carrier

IIHF (2008b) states that for the offensive player with the puck (Role 1), the objective is to start offense by creating offensive pressure toward opponent's goal, find open ice or create the time and space with the puck. For the offensive player without the puck (Role 2) the main objective is to head towards the opponent's goal, find open place and look for the passing opportunities while supporting the puck carrier. From the defensive perspective the player defending the puck carrier (Role 3) is focused on attempts to steal the puck and create pressure by skating and taking away the space to prevent shot attempts and passing opportunities. For the defensive player defending the non-puck carrier (Role 4) the key objective is to observe and move constantly for being able to cover passing opportunities and to backcheck. (IIHF, 2008b.)

During play, a player is in one of these roles and as the possession of the puck changes so, too, does the players role (Westerlund & Summanen, 2001). No matter what the player's main playing position is, the player plays in every game situation role. In modern ice hockey the player's playing positions have remained, but during one shift the player must be able to change the game situation roles in order to ensure better flow of the game and minimize delays, regardless of playing position. For example, when the defensive team steals the puck and becomes the offensive team, all five players on the ice must react as quickly as possible for the change of playing direction. Situation like this might open

an opportunity to attack against an unorganized defense. In order to best utilize this opportunity, the players in the best offensive situation on the ice need to join the offense regardless of their designated playing position. The result might be that the two defensemen are the closest players to the opponent's net and the wingers are playing the defensemen's traditional position to keep the offensive team in a state of defensive readiness.

2.3 Strategy & team play system

The general purpose of ice hockey is to get the puck out of own defensive zone as fast as possible and retain the puck possession in the offensive zone as long as possible to increase scoring chances. In this manner the time used for defending is minimized. (Fuchs, 2016.) Thomas (2006) states that, in general, the strategy in sports is divided into offense and defense, to score points for your own team and prevent the opponent from scoring. In games like ice hockey the fast pace of the game makes it difficult to separate offense and defense (Thomas, 2006). This might be because puck possession determines whether the team is on offense or defense, and possession of the puck changes rapidly (IIHF, 2008b).

Due to the fast pace of the game the players need to instinctively know what to do the moment the puck changes possession. Westerlund and Summanen (2001) state that in order for the players to co-operate smoothly on ice in rapidly changing situations the players need to share common objectives in different playing situations (Westerlund & Summanen, 2001.) The common objectives in the different playing situations are determined by team strategy, which drives the playing system and team tactics. The team strategy defines the style of the play which deploys the team's strengths against possible weaknesses in order to take an advantage over opponents' weaknesses and neutralize their strengths. The team strategy guides the team systems, which are the patterns of integrated movement of all players in order to achieve the offensive or defensive objectives in different zones (IIHF, 2008a).

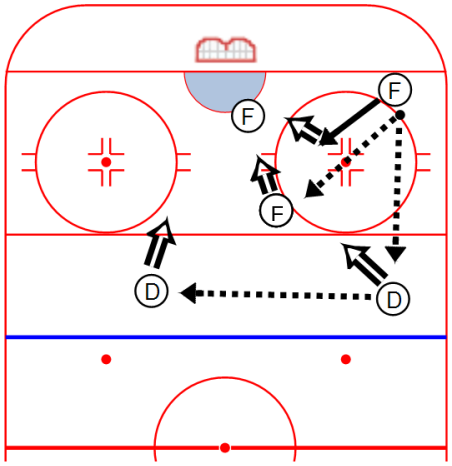
Luimula (2013), referring to Westerlund (1997), specifies that in ice hockey the team system includes different offensive and defensive playing systems for different zones (Luimula, 2013). The team play system can have various forms (Brithén, 2011). For the players the ability to contribute to the team play system requires the ability to execute team tactics. Team tactics are the game situation role-based requirements and individual tactics used to create an advantage over or take away the opponent's advantage (IIHF, 2008).

For the team to succeed, players need to execute the predetermined team system. This provides the basis for the team's tactics and helps players make decisions that contribute

to the team's success. As the ice hockey rink is divided in three zones, the team's systems include offensive and defensive play system for each zone (Luimula, 2013, Vähä-Ruohola, 2016) in the following way:

- Offensive zone offensive play
- Offensive zone defensive play
- Defensive zone offensive play
- Defensive zone defensive play
- Neutral zone offensive play
- Neutral zone defensive play

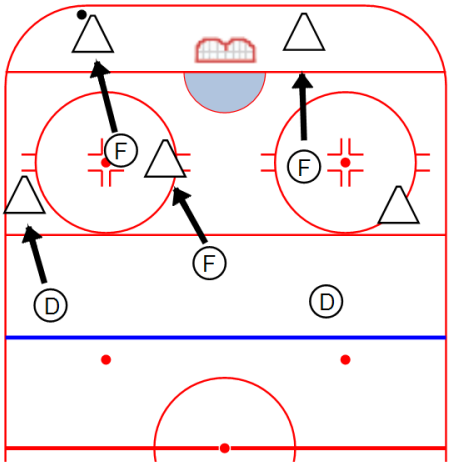
The offensive play starts immediately when the team gains puck possession and the players then start to carry the puck to the offensive zone and create scoring opportunities. The main objective in offensive zone offensive play is to score a goal, maintain puck possession and have defensive readiness. (IIHF, 2008b.) An example of a play system for offensive zone offensive play is to have non-puck carriers at three different levels. While one forward is on the puck in the corner, the second forward is in front of the net, a third forward in the middle, above the dots, and two defensemen along the blue line (picture 3).



Picture 3. Example of play system for offensive zone offensive play

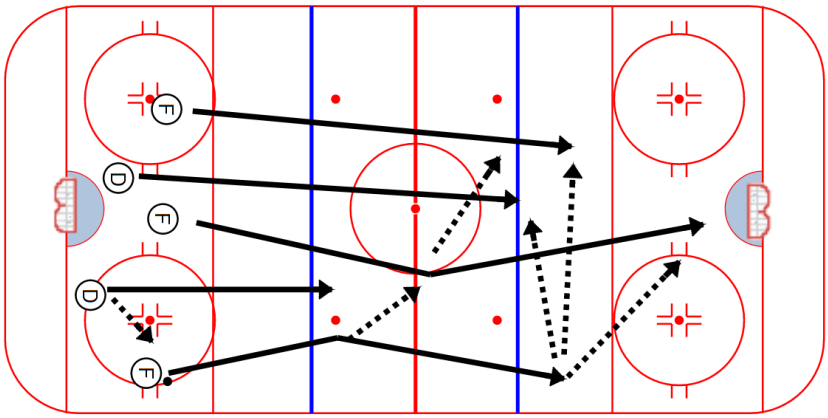
This format of offensive zone offensive play gives the puck carrier the opportunity to shoot the puck in front of the net, because there is a player to screen the goalie and get the rebounds. The higher forward is available for the pass to shoot the puck and also has a readiness to defend and to avoid an odd-man rush against. The defensemen on the blue line are also available to receive a pass, to shoot the puck or pass it back to the forward. Because of their relative closeness to their own net, they are also in a good defensive position. There are multiple variations of offensive zone offensive tactics where, for example, the players can change positions high to low, support the puck carrier close, keep the game wide or stay in constant movement (IIHF, 2008b).

The object of offensive zone defensive play is to steal the puck as close as possible to opponent's net, to prevent the opponent winning space towards own net and try to keep as many players as possible inside the game (IIHF, 2008b). An example of offensive zone defensive play is to give high pressure by skating towards the opponent's puck carrier and non-puck carriers to steal the puck quickly (Luimula, 2013). The purpose of this is to steal the puck as close as possible to opponent's net and create a quick scoring chance against the unorganized defense (picture 4).



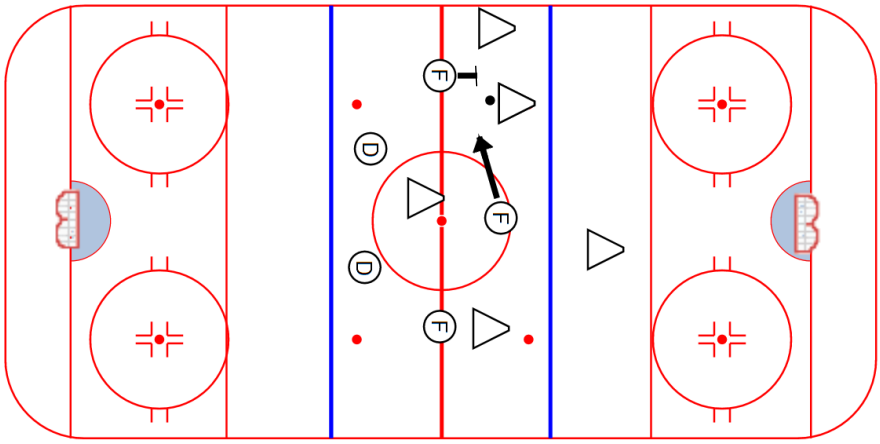
Picture 4. Example of play system for offensive zone defensive play

The objective of neutral zone offensive play is to get the puck in the offensive zone and create odd-man situations. Thomas (2006) describes that when a team is in the neutral zone controlling the puck, they can either dump the puck and then chase after it or attempt to carry it directly into the offensive zone (Thomas, 2006). As an example, a team can dump the puck in the offensive zone to avoid losing it in the neutral zone and gain it back in the offensive zone, or the team can try to carry the puck through the neutral zone to keep the balance of the offensive play by using the three lanes. By doing this the team can attack together and have a close support to the puck carrier, which can open passing options and odd-man situations (picture 5).



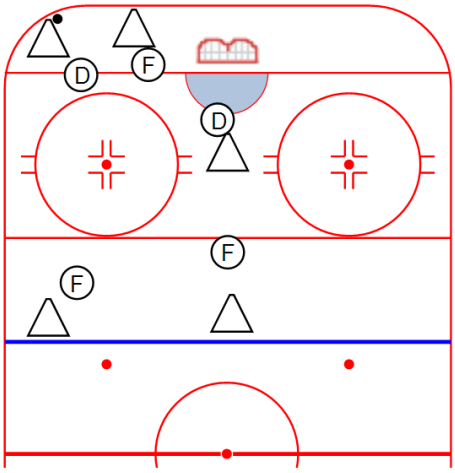
Picture 5. Example of play system for neutral zone offensive play

The neutral zone defensive play aims to steal the puck or slow down the speed of opponent's offense and make them to dump the puck in the zone to make it easier for the own team. This creates better defensive coverage and limits the opponent's options. (IIHF, 2008b.) It's also important to keep as many players between the puck and one's own net to avoid odd man situations for the opponent. For example, using a 1-2-2 trap formation, a team can have all five players inside the game, meaning that the players are between the puck and own net, slow down the opponent's offensive speed and steer the puck carrier in a situation where the puck carrier has no space and is forced to dump the puck in. The purpose of this is to break the opponent's forechecking rhythm and give one's own team time and space to play the puck out from under the pressure (picture 6).

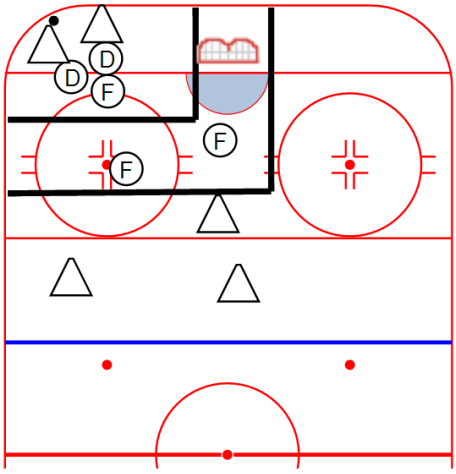


Picture 6. Example of playing system for neutral zone defensive play

Defense starts when a team loses the possession of the puck. Thomas (2006) describes this situation for the team in defensive position as having the option to either try to remove the puck from own zone by clearing or attempt to gain the possession by pressing (Thomas, 2006). In defensive zone defensive play, the primary responsibility is to prevent the opponent from scoring a goal, to prevent the opponent from winning the space in the middle of the zone in front of the net, and to steal the puck for one's own team. The focus is on limiting an opponent's options and reducing the time and space available for offense (IIHF, 2008b). Examples of defensive tactics is to defend man-against-man (picture 7), in which each player is responsible for defending one opponent, or to defend the area, in which each player has a defined space for which they are responsible (picture 8).

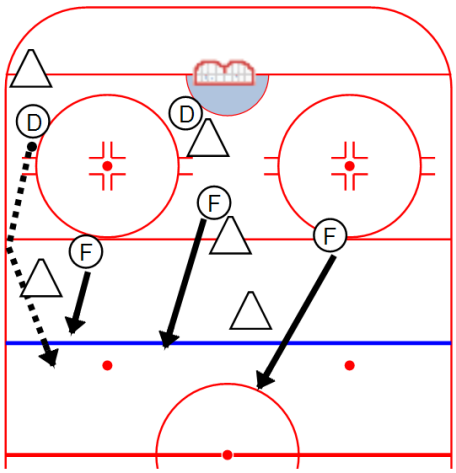


Picture 7. Example of playing system for defensive zone offensive play: Player-against-Player

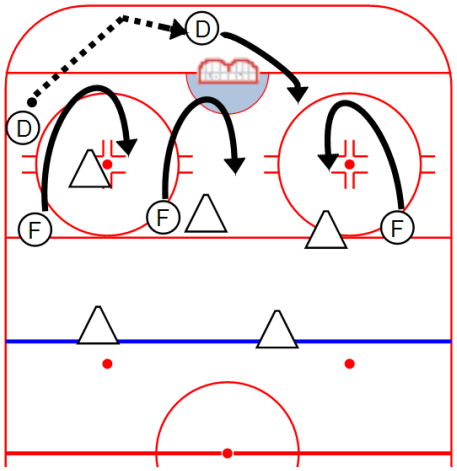


Picture 8. Example of playing system for defensive zone offensive play: Area Defense

In defensive zone offensive play, the object is to win the space towards the opponent's net or create the space to maintain the puck possession. One defensive principle is to make quick transitions from situation to other (IIHF, 2008b). For example, the team can try to play quickly upwards every time they gain possession of the puck (picture 9). Conversely, they can offense slowly with a controlled breakout to assure that they always have five players in offense together (picture 10).



Picture 9. Example of playing system for defensive zone offensive play: Quick Breakout



Picture 10. Example of playing system for defensive zone offensive play: Control Breakout

The team strategy defines how the team utilizes its systems against an opponent. By understanding the strategy, the individual player is able to play as a part of the five-man unit. For example, the strategy could be to defend with five players inside the game for the entire duration. This strategical line is formed because the opponent may have a better offense. In order to be able to execute this tactic, a team can select the1-2-2 trap as their defensive zone defensive game play system, and the team tactic is that the highest defending player needs good skating skills to be able to steer the opponent player into the trap while the next highest player needs good defensive stick-checking skills to be able to steal the puck.

In addition to the strategies for every zone's offensive and defensive game, special situations such as face-offs require strategies from both an offensive and defensive perspective to gain the advantage (Jalonen, 2006). Often teams have predetermined task for faceoff for every player depending if the faceoff is won or lost. Teams also have special units for power play and penalty kill situations. Not all rostered players are involved in special units, as power plays often involve offensive-oriented players, while penalty kill utilizes more defensive-oriented players. In professional ice hockey, there have even been power play units which consist of only five forwards.

3 Efficiency in ice hockey

In goal striking invasion games like ice hockey the team's and individual player's efficiency can be analyzed by using performance indicators. Indicators such as passing, tackling, shots, goals, time in possession and field possession can be seen the key factors to contribute to the efficiency and improved performance. With these key indicators it's possible to create models related to team efficiency or individual player performance in defense and offense and also compare teams and players. (Franjković et al. 2017.) For example, mapping the location of the defensemen's position in offensive zone offensive play could reveal their effectiveness and impact on goals or scoring chances.

3.1 Individual player's efficiency

The evolution of the game has challenged the view of predetermined roles, which traditionally have specified the efficiency expected in different roles. In today's fast-paced ice hockey, winning a playing situation requires faster reaction than the opponent and co-operation is based on mutually agreed playing situation objectives, ensuring that regarding the game situation the players are able to make fast, creative and efficient decisions. (Westerlund & Summanen, 2001.) On a professional level the one-dimensional player has been almost eliminated organically as the trend is for multi-dimensional players who can contribute to the team's play in a variety of ways (Campbell 2015). In the past a player could be considered to have performed well even though their strengths were merely in offensive or defensive roles. Gone is the defensive role player who stays on the puck as least as possible by dumping the puck in and out of the zones rather than maintain possession.

Kearns (2016) questions the position-based roles in total as players roles have started to blend together. The fast pace of the modern game requires all five skaters as a five-man unit and the individual players need to be sliding in and out of different roles instead of being selected for specific role. The change towards fast play with the five-men unit being involved all the time requires the change of conventional thinking for being able to target puck control with all four lines and all players. (Kearns, 2016.) By involving all five men on the offense and defense, the play system is more efficient than by playing with only two or three players in these same situations.

One reason behind the evolution of the player's role is the rule change that increased the size of end zones. By increasing the space, the requirements for all players to contribute

to the zone play became more evident, despite their main playing position. For example, Bourne (2014) analyzed the change of role-based responsibilities from the perspective of wingers. The wingers' role has changed significantly and become more complex. Previously when the zone was smaller, and the defensemen were not so involved in the offensive game, the wingers only needed to be involved in one-on-one against the defenseman and prevent shots from the blue line. Now when the offensive zone is bigger the wingers need to compress the zone, triangulate constantly and stay between the puck and his defensive player, instead of staying in place. (Bourne, 2014.) The wingers need to read the game and be ready to perform a defensive switch of the player whom they are defending with the own team's centreman, defenseman or another winger. They need to be more active in order to contribute to the defensive effectiveness.

In conjunction with the wingers, the defensemen's role has changed significantly. Previously the defensemen defended but now they are required to take an active part in offense also. Lukan (2016) interviewed John Tortorella, the head coach of Columbus Blue Jackets, who described the change of defensemen role by stating: "It's not always about being in your position. We're doing a number of different things with our defensemen in the offensive zone as far as not just staying in the backend and looking for a shot or looking for a pass and trying to get a shot on the net." (Lukan 2016.) This bigger involvement from the defensemen can be seen as an attempt to improve the offensive effectiveness. Murphy (2017) stated that the trend towards offensive-minded defensemen with good puck-moving and skating capabilities can be seen also from the recent year's NHL draft trends (Murphy, 2017).

As players' role have evolved in modern ice hockey, the multidimensional players are expected to be involved in both offense and defense when being on ice. To have all five men involved in team's system in all zones improves the efficiency. Varmanen (2016) underlines the importance of player cooperation in order to achieve the shared targets in different play situations. The mutually shared objectives for offensive and defensive play situations help the players to make the right decisions in constantly changing situations. (Varmanen, 2016.)

3.2 Efficiency of team play

Within one game, the team's efficiency and competitive success is primarily determined by the quality of the players, teamwork and tactics (Trninić et al. 2000 in Franjković et al. 2017). Ice hockey consists of complex technical-tactical structures to gain advantage over

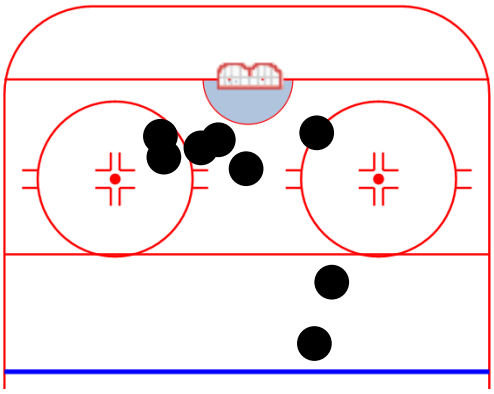
the opponent (Franjković et al. 2017). There exist a variety of methods a team can utilize in an attempt to best exploit the strengths of a team's players and cover the weaknesses in comparison with an opponent's just as there are variations in how teams may want to play in offensive and defensive zones. (Varmanen, 2016.)

One reason affecting the team's system has been the rule changes that, for example, increased the offensive zone and aimed to increase the number of goals and, therefore, offensive efficiency. This can be easily analyzed with statics. Wharnsby (2019) states that a sign of increased offense can be seen from the statistics of the NHL. The average goals-per-game has increased to 6.1 from 5.9 in middle of the season 2018-2019, meaning that a in an individual game a team has scored seven or more goals 41 times. (Wharnsby, 2019.)

Sihvonen (2017) states that the increased size of the offensive zone has affected the way that teams play their offensive zone offensive game, and also the offensive zone defensive game has evolved in order to minimize the space for the offensive team (Sihvonen, 2017). The evolvement of team systems for offensive and defensive zone has affected, for example, the defensemen's role in offensive zone offensive play. Traditionally in offensive zone play, the defensemen have stayed near the blue line to keep good defensive capability. Today the defensemen contribute to the offensive play more by pressuring aggressively and actively interchanging positions with their partners (Heisler, 2018).

The increased activity can also be seen from the defensemen's involvement in both high and down-low cycles (Wharnsby, 2019). According to Smallwood (2016) in the 2016 season, the defensemen for the Washington Capitals joined more actively in the rush and the offensive zone play than previously. To create scoring chances, they used high cycling to switch the places of defensemen and forwards. This kind of switches force the opponent to make quick decisions and they often create space as they lose the player, they are defending. (Smallwood, 2016.)

One example of defensemen's contribution to offensive zone offensive play is Kelly's (2018) analysis of Ottawa Senator's defensemen activity in the offensive zone offensive play during the first five games in season 2018-2019. During this time eight out of twenty (8/20) goals were scored by Ottawa's defensemen, and six out of these eight (6/8) were finished below the dots (picture 11).



Picture 11. Goals made by Ottawa Senator's defensemen during offensive zone offensive play

When comparing this example of Ottawa Senator's defensemen's efficiency in offensive zone to the study of Luimula (2013), the role of defensemen has changed significantly. Luimula (2013) analyzed the offensive zone offensive play from six teams playing in the men's ice hockey tournament in 2006 Olympic Games in Torino, Italy, by dividing the offensive zone offensive play in two models. Model A was co-operation between the forwards including categories which were actions that forwards made when playing in model A. These actions were a) pass in the corner, b) pass to the front of the net, c) pass to the middle, d) pass to the blue line, e) pass to the other side of the zone f) shot, g) pressing towards the net with the puck and h) other situations. In Model B teams used defensemen to help the offensive zone offensive game. However, based on the results all the teams had similar style of offensive zone offense play. In Model B there was no significant actions from the defensemen other than shots from the blue line. (Luimula, 2013.)

The defensemen can increase the offensive efficiency even though the defensemen still have their main role to ensure the defensive capabilities. Their offensive efficiency can be employed if the team's offensive zone strategy and play system supports it. Utilizing the defensemen's offensive efficiency is one important aspect in modern ice hockey to increase a team's efficiency and competitive success.

3.3 Measuring efficiency of individual player & team play

There is an increasing demand for effective metrics to quantify the factors leading to team success and evaluate how the individual players are contributing to that success (Found, 2016). In ice hockey, the relatively low scoring rate compared to other sports makes it difficult to analyze team or player performance. The randomness of goals limits the ability to

properly analyze current performance and predict future performance by using goals alone. Therefore, in addition to the traditional plus-minus stat, the shot-based statistics, such as shot differential, Fenwick differential and Corsi differential, have become popular. (Macdonald, 2012.)

The performance of an individual player is considered to be difficult to quantify because of the continuity of the play, line changes and infrequency of the goals (Gramacy, Jensen & Taddy, 2013). The traditional plus-minus measure has been the primary measure for individual skater performance indicating how many scores were scored by a player's team minus the number of opponent goals while the player was on ice. From individual player's perspective the plus-minus measure has some weaknesses, as it does not depend solely on the efficiency of the individual player but also the involvement of the teammates and opponents. Also, the player's ice-time influences the score. (Gramacy, Jensen & Taddy, 2013.)

Riley (2017) defines Corsi as the total number of shots that were on net, missed the net or were blocked. It can be further divided into a number of different metrics:

- Corsi For (CF): corsi events against the opposing team
- Corsi Against (CA): corsi events against the player's team
- Corsi For percentage (CF%): corsi for divided by the sum of corsi for and corsi against.

Each of these can be further divided according to different grouping values, such as 60 minutes of ice time. Corsi events are recorded for every player on ice. (Riley, 2017.) The Fenwick rating is a variation of Corsi with blocked-shots excluded (Macdonald, 2012).

Lukan (2016) analysed defensemen's offensive efficiency and noticed the impact of defensemen's contribution to the Columbus Blue Jackets offensive play. By analyzing the 5v5 Corsi and defenseman Seth Jones, it could be noticed that after joining the team in January 2016, Jones was leading the all players 5v5 Corsi for/60 (62,22%), meaning that when he was on ice, the team had the highest offensive shot attempts percentage. He also ranked 10th for primary points during the seaon. (Lukan, 2016.)

Found (2016) suggests that shot-based metrics provide better ability to evaluate the performance of individual player who may only be infrequently involved in goal scoring events but is more involved in shots-based events. Also, Macdonald (2012) states that the benefit of using shot-based statistics, such as Corsi and Fenwick, to evaluate the performance of individual player is the goaltenders have a smaller impact on the players' ratings and also the shot-based statistic provides a better indicator of territorial advantage and possession advantage at the team level than goals, and can be employed to predict the team's future

performance. (Macdonald, 2012.) For example, the team with better puck possession has more shots than the opponents.

Found (2016) states that it's generally thought that a team shot differential predicts winning, and players who contribute most to that shot differential are therefore contributing the most to the team's success. However, winning or losing a game depends how many goals each team scores, not the number of shots. Goals can only come from shots, shots only from puck possession and possession results from beating the opponent in different situations. From this perspective, the goal or shot-based metrics might not be the best metrics to evaluate, for example, the defensemen's contribution. (Found, 2016.)

To overcome the difficulty of goal-based metrics and shot-based metrics, Found (2016) suggest that an optimal way would be to use a combination of both measures (Found, 2016). In addition to this, Tulsky et al. (2013) suggest that shots and goals should be measured per possession rather than game and use zone entry data to understand what drives success in different zones. Using zone entry data could overcome the difficulty of separating offensive and defensive contribution to shot differential, because a player who allows few shots or goals might achieve this through good defense or by puck possession and giving fewer opportunities. (Tulsky et al. 2013.)

In general Riley (2017) describes that the prior research in the field of ice hockey has been challenged by the problematic nature of the game. A single measure such as goals or points can't fully capture offense, possession can't be captured by corsi for percentage or defense by goals against. The multivariate concepts such as offense, defense and possession require a number of different measured variables. Still, based on data it's difficult to say what specifically drives offensive success. (Riley, 2017.)

Statistics alone don't reveal what has occurred when the player has been without the puck. Therefore, it's difficult to see from statistics what type of performance has had most impact to the team's or individual's game. Because ice hockey is a low scoring game and the impact of one single goal is significant, offensive zone play especially requires a deeper understanding of the game systems that contribute to the successful offensive.

By analyzing deeper, the playing systems for different zones would enable an understanding what kind of playing systems impacted the number of goals and scoring chances. For example, Thomas (2006) and Tulsky et al. (2013) investigated what drives the success in offensive zone and suggest that carrying the puck into the offensive zone is a superior

strategy because more offensive chances resulted when the puck was carried in. However, these studies do not suggest any play systems that would increase the scoring chances after carrying the puck into the offensive zone.

The score reveals the outcome, but in order to understand what the players have been doing before the goals, the performance of the players must be studied more in depth. By going behind the numbers it's possible to understand how for example the increased size of the end zones has impacted the team's playing system and how the defensemen can contribute to the team's success by increasing their offensive efficiency.

4 Methodology

The objective of this study is to form an understanding the defensemen's effectiveness in offensive zone offensive play and what is the impact of their position changes to goals and scoring chances. The aim is to analyze how the defensemen have performed in offensive zone offensive play.

4.1 Research approach

O'Donoghue (2010) referring to Hughes & Bartlett (2008) states that in sports the performance analysis can be referred as the actual analysis of sport performance in training or competition. Performance analysis is usually used to develop an understanding of sports for those who are trying to enhance the sports performance, because it provides objective information and can overcome some limitations of subjective analysis. In many sports the complexities and dynamic nature of the sport requires observation and measurements in order to gain greater understanding, which then can assist for example coaches to make decisions. (O'Donoghue, 2010, 2-3.)

Performance analysis is an approach that combines biomechanical analysis, for example technique analysis, and notational analysis, for example match analysis, in order to provide objective perspective to performance. Usually specific dimensions of sport performance are captured by numerical indicators and quantitative analysis focuses on analyzing performance numerically. However, also qualitative analysis is also used to analyze movements non-numerically. Qualitative research can be interpretive, naturalistic, ethnographic or phenomenological, and, from this perspective, can be used in performance analysis to understand the meaning of events and actions, to understand context, identify unanticipated phenomena and understand processes. However, in performance analysis it's at some point difficult to separate qualitative and quantitative research, because studying biomechanics might include qualitative analysis of movements (Poizat, Saury & Carole, 2013.)

In this study the object is to form an understanding of the defensemen's effectiveness in offensive zone offensive play and how they can impact goals and scoring chances by changing positions. In order to understand how they have changed positions and what has been the impact, the interpretative approach was chosen in this study to form an understanding of different events and actions that the defensemen executed during offensive zone offensive play. Because the main purpose is to generate understanding, this study is more qualitative than quantitative.

The performance analysis can be used to analyze technique, technical effectiveness, movement, behavioral aspects or evaluate tactical decisions. In tactical analysis it's essential to separate strategy and tactics, as the strategy has been decided before the event and the tactical decisions are moment-to-moment decisions during the event. When analyzing how the players performed and used their skills, the locations where they performed and the timing of actions, it's possible to understand how the strategy and tactics were applied. (O'Donoghue, 2010, 6.) However, when analyzing the actions that players have performed, it's important to understand what other options the player had. In this study performance analysis was chosen as a method to investigate how the defensemen have performed in offensive zone offensive play. It also supports the attempt to analyze how they have used their skills and locations in order to impact the goals and scoring chances with increased efficiency in offensive zone.

Qualitative methods can be used to gather and analyze data within different types of research, including observational research. In performance analysis the main research type used is observational, which provides methods to do notational analysis of events. In contrast to observational research, experimental research usually includes controlled conditions and the participants actively engage in the action, sometimes even in laboratory settings. Observational research does not include a control at this level. (O'Donoghue, 2010, 30.) This study is observational research, where the observer analyzed how the players performed and used their skills during offensive zone offensive play to understand how the strategy and tactics were applied in offensive zone offensive play.

This study was completed by analyzing the offensive zone offensive play of Finnish National U18 team during the 2017-2018 season. The initiative for the observational research was that the Finnish National U18 team strived to use their defensemen's offensive efficiency in offensive zone offensive play and the playing system supported defensemen to change positions.

4.2 Data collection

There are various methods that can be used to gather and analyze data for performance analysis. For example, biomechanical analysis represents quantitative analysis, where as there are various ways to do qualitative analysis, which has some strengths for performance analysis because the data can be recorded but it's not restricted to predefined

events. The methods for analysis in the field of movement analysis have developed extensively when compared to ancient way of using hieroglyphs. Today video and real-time notations can be integrated. (O'Donoghue, 2010, 16-17.)

In observational research notational analysis can be seen as a qualitative type of research instead of quantitative, even though the notational analysis includes behavior to be observed and subjectively classified according to a pre-determined set of categories. Therefore, the counts and timing of movements are just quantitative counts that have been qualitative judged by the observer. Notational analysis involves empirical observation. Empirical observational research can be done live while watching games or on television, or post-match analysis from match video recordings. (O'Donoghue, 2010, 30, 211.)

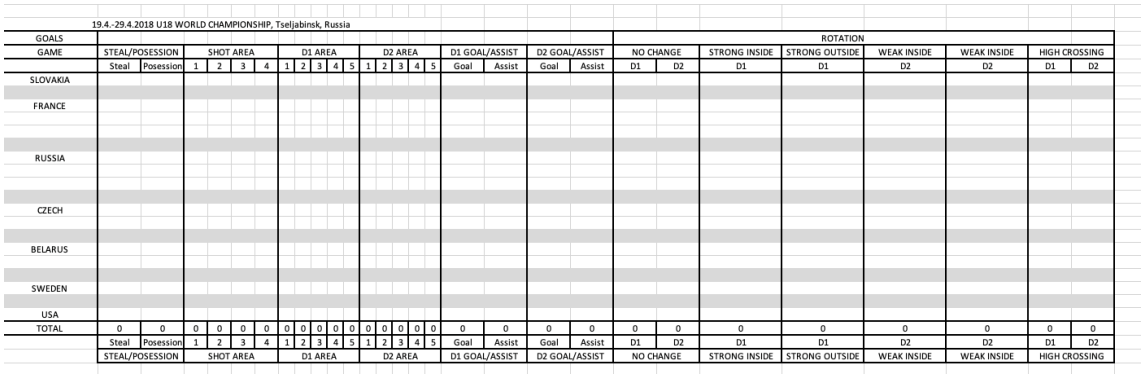
In this study the data regarding the offensive zone offensive play of Finnish National U18 team was collected during season 2017-2018 from five tournaments:

- Hlinka Memorial Tournament. Bratislava Slovakia, 7th – 13th August 2017
    - Games against 1. Slovakia, 2. Canada, 3. Russia, 4. USA
- 5 Nations Tournament. Hämeenlinna, Finland, 8th-12th November 2017
    - Games against 1. Czech, 2. Switzerland, 3. USA, 4. Sweden
- 5 Nations Tournament. Plymouth, USA, 13th – 18th February 2018
    - Games against 1. Czech, 2. Russia, 3. Sweden, 4. USA
- IIHF U18 World Championships exhibition game. Chelyabinsk, Russia, 16th – 19th April 2018
    - Games against 1. Switzerland, 2. Canada
- IIHF U18 World Championships. Chelyabinsk, Russia, 19th – 29th April 2018
    - Games against 1. Slovakia, 2. France, 3. Russia, 4. Czech, 5. Belarus, 6. Sweden, 7. USA

The data was analyzed using video analysis as the primary method. The analysis was done by using Steva Hockey and Dartfish analysis software. The recordings from the game events were provided by the event organizer. During the events the games were analyzed by the team's video coach, who is the writer of this study. The video coach used special notational system that includes specific notations for shots, goals, faceoffs, etc., and also for zone plays. During each game the video coach made approximately 600-1000 notations. These notations could be used for this analysis as all the offensive zone offensive play events could be collected and collated.

In qualitative research the samples are usually small and purposeful. In performance analysis the samples are rarely random. (O'Donoghue, 2010, 210.) In this study the sample for the study was selected with a purpose, because it was known that the Finnish U18 team's system increased the defensemen's offensive efficiency in offensive zone offensive play. This was possible through preplanned, practiced and defined offensive zone offensive play systems.

In total 21 games were analyzed. The data analysis was done post-game from video material recorded in five tournaments and including all Finnish U18 team's games in those tournaments. Where Finland was not involved, those games were not analyzed. In order to utilize notational analyses with pre-determined notations, an excel sheet was created to collect the data from offensive zone offensive play in unified way. Example below is the excel sheet for goals in Chelyabinsk's tournament, which was similar for scoring chances in Chelyabinsk tournament and for all other tournaments (picture 12).



19.4.-29.4.2018 U18 WORLD CHAMPIONSHIP, Tseljabinsk, Russia																															
GOALS																					ROTATION									
GAME	STEAL/POSESSION		SHOT AREA				D1 AREA					D2 AREA					D1 GOAL/ASSIST		D2 GOAL/ASSIST		NO CHANGE		STRONG INSIDE		STRONG OUTSIDE		WEAK INSIDE		WEAK INSIDE		HIGH CROSSING	
	Steal	Posession	1	2	3	4	1	2	3	4	5	1	2	3	4	5	Goal	Assist	Goal	Assist	D1	D2	D1		D1		D2		D2		D1	D2
SLOVAKIA																															
FRANCE																															
RUSSIA																															
CZECH																															
BELARUS																															
SWEDEN																															
USA																															
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0		0		0		0	0
	Steal	Posession	1	2	3	4	1	2	3	4	5	1	2	3	4	5	Goal	Assist	Goal	Assist	D1	D2	D1		D1		D2		D2		D1	D2
	STEAL/POSESSION		SHOT AREA				D1 AREA					D2 AREA					D1 GOAL/ASSIST		D2 GOAL/ASSIST		NO CHANGE		STRONG INSIDE		STRONG OUTSIDE		WEAK INSIDE		WEAK INSIDE		HIGH CROSSING	

Picture 12. Example of table to analyze goals scored in offensive zone offensive play

In order to analyze the offensive zone offensive play, the key concepts for analysis were defined in the following way, which then guided the analysis in this study:

1. **Offensive zone offensive play:**
   From each game the offensive zone offensive play situations were selected and then analyzed. In this study offensive zone offensive play was defined to be a situation where the offensive team has possession of the puck in the offensive zone. The offensive team can get the puck inside the offensive zone by carrying, passing, dumping it in, from the face-off or forcing the opponent to create space with the puck in their defensive zone and then stealing the puck.

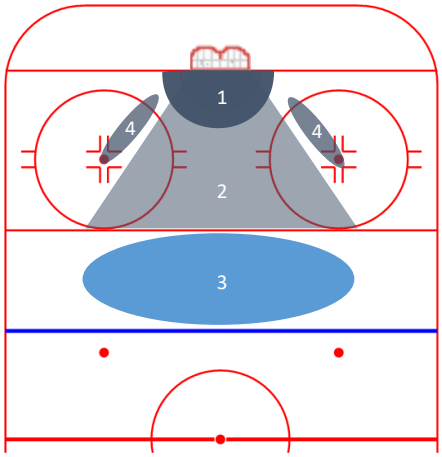
   In order to separate the offensive zone offensive play from straight attack, there must be a space-creation phase after the straight attack in offensive zone. Both teams also must have five players in zone, despite a situation where the offensive team changes players on puck possession.

From the offensive zone offensive play analysis straight attack, the following situations were excluded: where the puck was played to the second wave in the offensive zone; situations straight from the faceoffs without the space-creation phase; special teams; and situations where the puck was stolen from the forecheck situation without the offensive zone offense.

2. **Defensemen:** The player who was defined to play defense in team's roster

3. **Goal:** Accepted goals in games

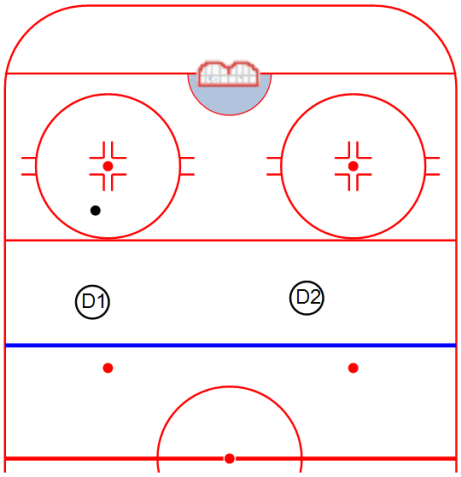
4. **Scoring chance:** Four goal scoring zones were defined according to Finnish Ice Association (FIHA, 2017) (Picture 13). All shots from the scoring Areas 1 and 2 were counted as scoring chances. From Area 3 those shots which had deflected, or goalie was screened in a way that the goalie had to search the puck from left or right side of the screening player were calculated. From Area 4, counted shots were those which were preceded by a cross-ice pass or where the puck was carried over the central line. Shots which missed the net were also counted, but blocked shots were not.



Picture 13. Goal scoring zones (FIHA, 2017)

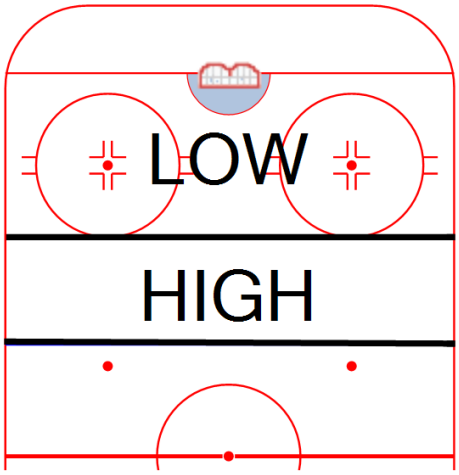
5. **Goals or scoring chances in offensive zone offensive play from situation were the puck was in possession or stolen from the opponent:** Puck possession in offensive zone offensive play where space was created before the goal or scoring chance. A steal where there has been a situation in offensive zone offensive play leading to a loss of puck possession and the puck was stolen back, and after getting the puck back winning the space straight towards the net.

6. **Strong-side defenseman & weak-side defenseman:** Strong-side defenseman was closer to the side of the ice where the puck is located, and the weak-side defenseman was further away (picture 14).



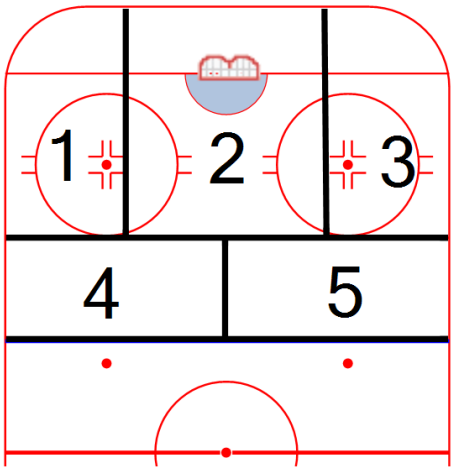
Picture 14. Strong- and weak-side defensemen, D1= strong side, D2=weak side

7. **Defensemen positional areas in offensive zone:** The defensemen's positional area was divided into high and Low Areas. The High Area consists of the space above the faceoff circles and under the blueline. Low Area is below the faceoff circles. The defensemen's position was determined at the time when the goal was scored, or the scoring chance created (picture 15).



Picture 15. Defensemen positional areas high and low

8. **Defenseman positional zones:** The High Area was divided in two same-sized zones from the middle, Zone 4 on left and Zone 5 on right. The Low Area was divided in three zones, with Zone 1 on left, Zone 2 in the middle and Zone 3 on right. The defensemen's position in different zones was determined at the time when the goal was scored, or the scoring chance created (picture 16).



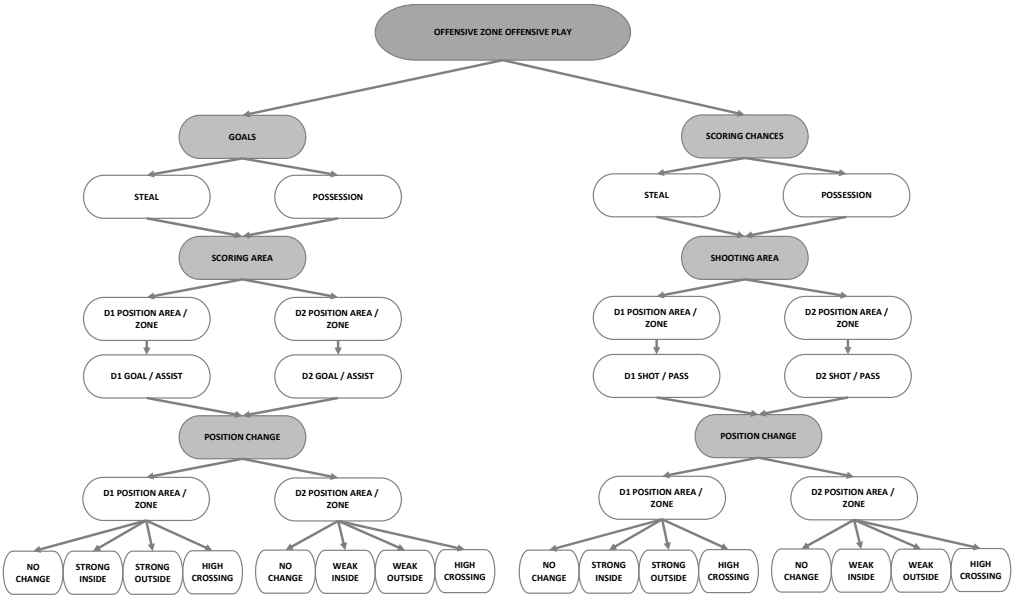
Picture 16. Defensemen positional zones 1, 2, 3, 4 & 5

9. **Defenseman offensive zone positional changes:** In a strong-side Outside positional change, the defenseman moved from the High Area Aones 4 or 5 to the Low Area Zones 1 or 3. During a weak-side Outside positional change, the defenseman moved from the High Area Zone 4 or 5 to the Low Area Zones 1 or 3. In strong-side Inside positional change, the defenseman moved from the High Area Zone 4 or 5 to the Low Area Zone 2. In weak-side Inside positional change the defenseman moved from the High Area Zone 4 or 5 to the Low Area Zone 2. In high crossing, the defenseman changed positions from Zone 4 to 5 or from 5 to 4. In situation when there was positional change, one defenseman stayed in High Area Zones 4 and 5. The defensemen's position change was determined if it had affected how the goal was scored, or the scoring chance was created.

The sample data set for this study was from the data set that was pre-analyzed during the games in live situation in tournaments. In live situation the notational analysis was conducted to mark the goals, scoring chances and offensive zone offensive plays. In post-game analysis the live analysis was refined to separate and collect the offensive zone offensive play situations for inclusion on the excel sheet and utilizing the definitions of the key concepts in this study.

4.3 Data analysis

In qualitative research the data is analyzed using more interpretive methods than when analyzing quantitatively (O'Donoghue, 2010, 213). In this study the data from different excel sheets was first combined and all goals and scoring chances from offensive zone offensive play sorted. After this the goals and scoring chances were analyzed based on the key concepts defined for this study. The process continued to analyze whether the goal was from steal or possession, what was the scoring or shooting area, and did the defensemen rotate and what was the rotation like (Picture 17).



Picture 17. Process for analyzing the offensive zone offensive play situations

5 Findings

In this study the purpose is to form an understanding about the defensemen's offensive efficiency in offensive zone offensive play in increasing goals and scoring chances with position changes. The post-game analysis was done to 21 games to analyze how the Finnish National U18 team utilized the defensemen in offensive zone offensive game, and what was the impact of defensemen's position changes in offensive zone for the goals and scoring chances.

5.1 Goals in offensive zone offensive play

In these 21 games Finland scored 70 goals in total. From these 70, 44 goals (63 %) were scored in 5v5 situation. Of these 44 goals scored on 5v5 situation, half (n=22) were scored on offensive zone offensive play. From those 22 goals (n=22) made in offensive zone offensive play in 5v5 game, four goals (18 %) came from stealing the puck and 18 (82 %) from puck control (Table 1).

Table 1: Goals made by Finnish National U18 team in 21 games

Goals in 21 games	**n**	**%**
Goals	70	100 %
Goals in 5v5	44	63 %
Goals from offensive zone offensive play in 5v5	22	50 %
Stealing the puck	4 / 22	18 %
Possession	18 / 22	82 %
Goals scored by defensemen	2 / 22	9%

The defenseman made a positional change in one out of the four of the goals (25 %) scored when a goal was made from stealing the puck, and the positional change did not occur in the other three (75 %). When the goal was made from puck possession the defenseman made a positional change in two-out-of-three goals (67 %) and the positional change was not executed in the remaining one-third of goals (33 %) (figure 1).

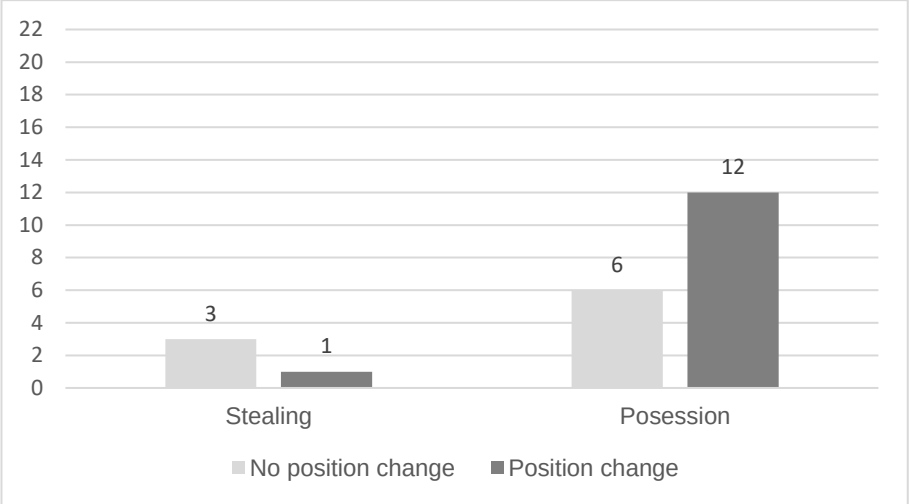


Figure 1. Position change in goals (n=22) in offensive zone offensive play

When a goal was scored in offensive zone offensive play, the strong-side defenseman was in the Low Area for seven out of 22 goals (32 %), and the High Area during 15 of the 22 goals (68%). The weak-side defenseman was in the Low Area on just two of the 22 goals (9 %) and in the High Area for 20 of the 22 goals (91 %) (figure 2).

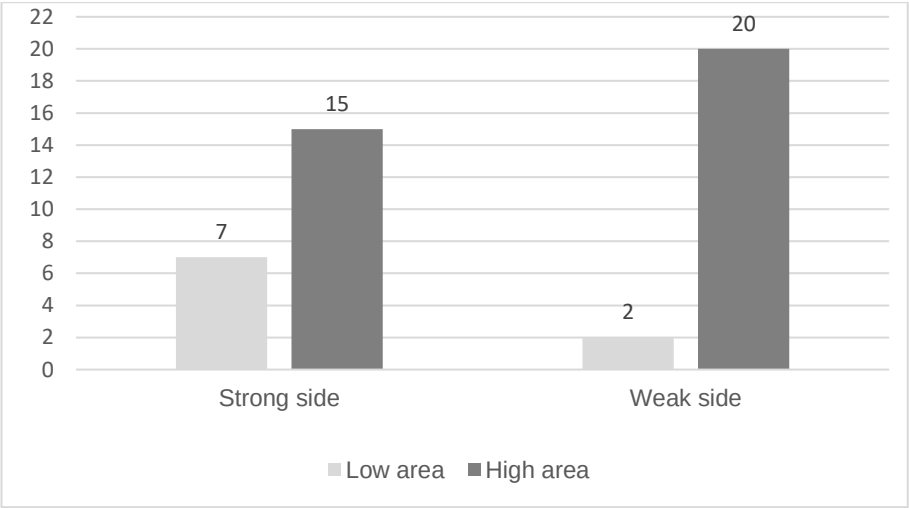


Figure 2. Defensemen's position on Low and High Area in goals

While in the Low Area, the strong-side defenseman was in the position change Zone 1 in the offensive zone four of seven times (57 %) and in Zone 2 for three of seven (43%) and in zone number 3 the defenseman was 0/7 times (0 %). The strong-side defenseman was in the position change Zone 4 in the High Area in the offensive zone on 10 of 15 occurences (67 %) and in Zone 5 for five out of 15 (33 %) (Figure 3).

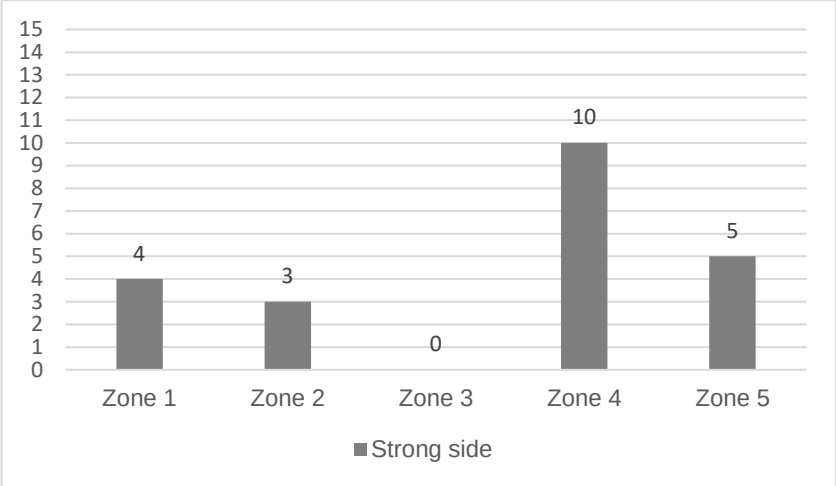


Figure 3. Strong-side defenseman position changes in the five position change zones

For the weak-side defenseman, he occupied the Low Area in a position change in Zone 1 in the offensive zone zero out of two attempts (0 %), in Zone 2 for one out of two (50 %) and in zone number 3 the defenseman was there also one out of two occasions (50 %). In the High Area the weak-side defenseman was in the position change Zone 4 in the offensive zone six out of 20 times (30 %) and in Zone 5 for 14 of 20 (70 %) (Figure 4).

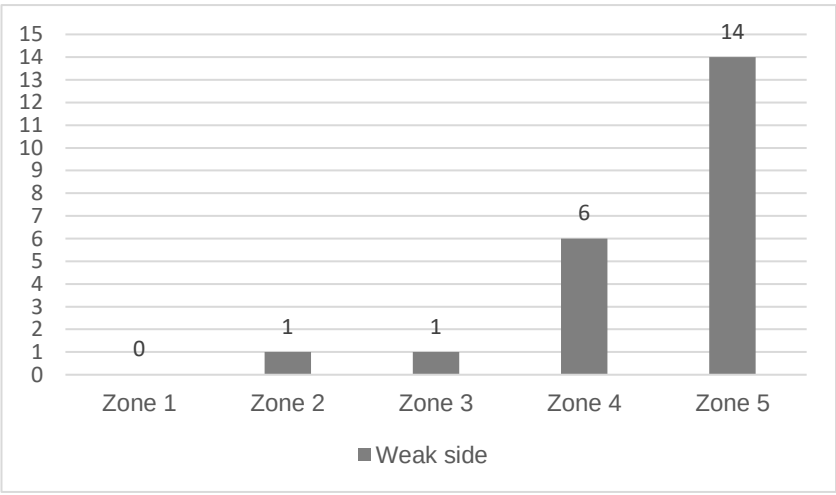


Figure 4. Weak-side defenseman position changes in the five position change zones

The weak-side defensemen changed positions during 13 of the 22 goals (59 %). During these position changes there were situations when both of the defensemen changed positions, meaning that there was more than one positional change prior to scoring these goals. On six of the 13 goals (46%) scored where the weak-side defenseman changed position, both defensemen moved, and in total there were 19 positional changes recorded concurrent to these 22 goals. In total there was 11 positional changes made by the strong-side defenseman, and an additional eight made by the weak-side defenseman (Figure 5).

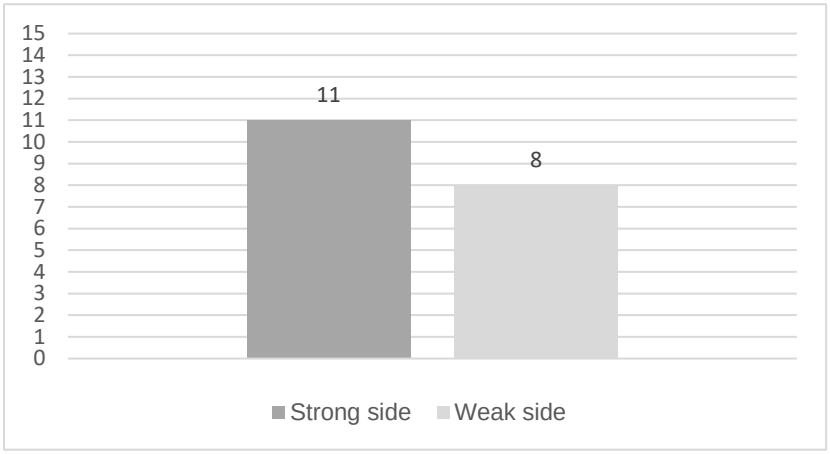


Figure 5. Defensemen position changes in 13 goals

The strong-side defenseman made an Outside positional change from the High to Low Area in seven of the 11 goals (64 %) and an Inside positional change from the High to Low Area in two (18 %). A High crossing positional change occurred twice in the 11 strong-side movements (18 %) (Figure 6) which resulting in a goal or scoring chance.

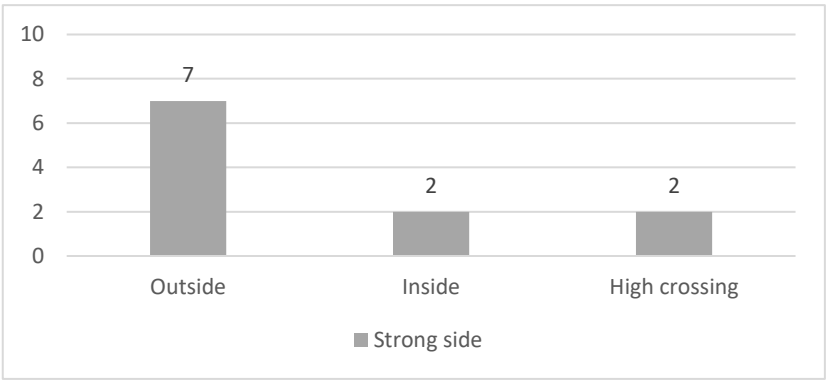


Figure 6. Strong-side defenseman position changes (n=11)

The weak-side defenseman made an Outside positional change from the High to Low Area once (13 %) during the 21 games, while zero (0%) Inside positional changes from the High to Low were attempted. A High crossing positional change occurred in seven of eight situations resulting in a goal or scoring chance (88 %) (Figure 7).

Figure 7. Weak-side defenseman position changes

Defensemen scored two goals of the total 22 goals during offensive zone offensive play. Both of these goals were scored by the strong-side defenseman. In both plays, the strong-side defensemen made an Outside positional change from the High to Low Area. The weak-side defenseman made one high crossing position change, and no positional change was recorded during the second goal.

Offensive zone offensive play has a significant impact to the number of goals: 50 % (n=22) of the goals made in five tournaments during 5v5 play were scored as a result of offensive zone offensive play. Puck possession in offensive zone offensive play was a key factor in the goal scoring. In over half of the goals (n=13/22) the defensemen made a position change. One of the defensemen was in Low Area during almost half (9/22) of the goals scored. In position changes for strong-side defenseman the outside high to low position change (7/8) was most common in goal scoring situation. For weak-side defenseman high crossing was most common position change (7/8). Because the defensemen's position change in offensive zone offensive game was made in over half of the goals it can be seen to have a significant impact on goal scoring.

5.2 Scoring chances in offensive zone offensive play

In 21 games, the Finnish National U18 team created 79 offensive zone offensive play scoring chances in 5v5 play. From these 79 scoring chances, 27 (34 %) were from stealing the puck and 52 (66 %) from puck possession (Table 2).

Table 2. Goals made during 21 games for Finnish National U18 across five tournaments

Scoring chances in offensive zone offensive play in 21 games	**n**	**%**
Scoring chances	79	100 %
Stealing the puck	27 / 79	34 %
Possession	52 / 79	66 %
Defensemen scoring chances	24/79	30 %

When a scoring chance was made from stealing the puck, the defenseman made a position change during seven of the 27 events (26 %), while no positional change was recording during the other 20 events (74 %). When the scoring chance was from puck possession the defenseman made a positional change in 35 of the 52 opportunities (67 %) while only 17 (33%) occurred without a positional change (figure 8).

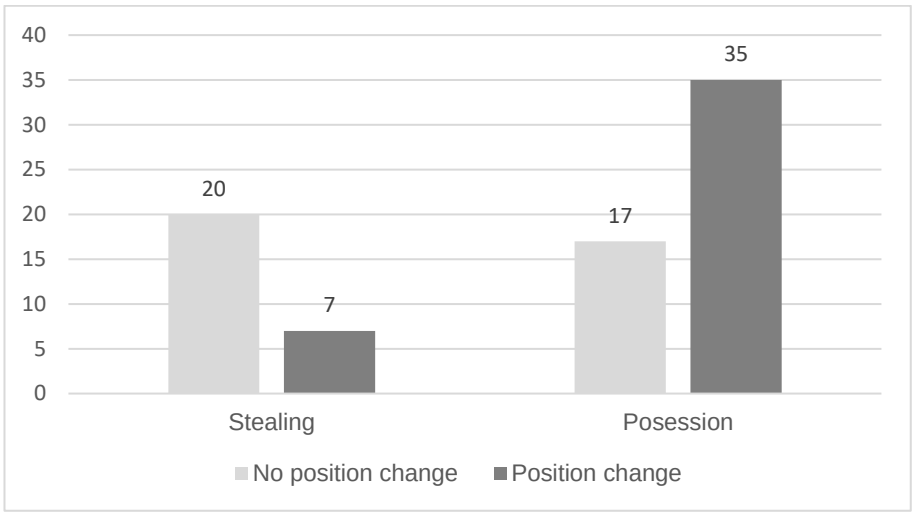


Figure 8. Position change in scoring chances (n=79) in offensive zone offensive play

When a scoring chance was created in offensive zone offensive play, the strong-side defenseman was in the Low Area during 29 of the 79 chances (37 %), and in the High Area for 50 of these chances (63%). The weak-side defenseman was in the Low Area during nine opportunities (11%) and in the High Area for 70 of the 79 chances (89 %) (figure 9).

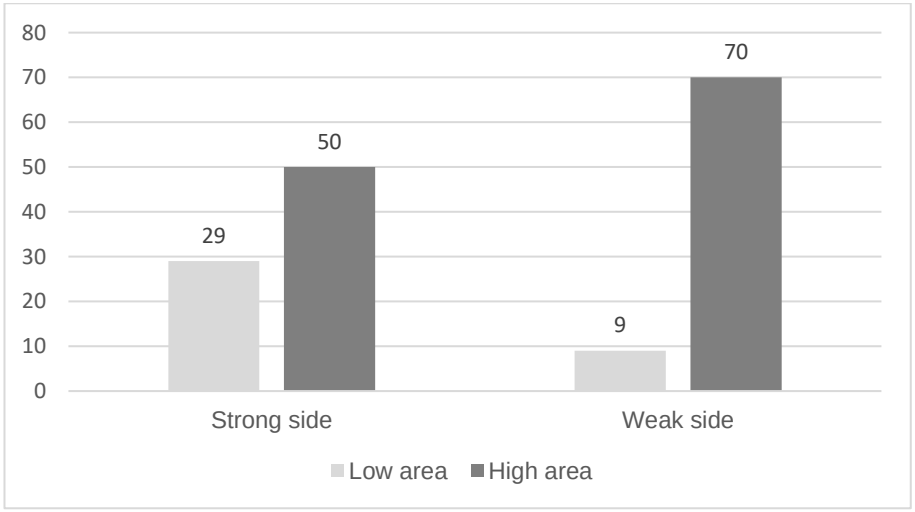


Figure 9. Defensemen's position on Low and High Area in scoring chances

During 29 scoring chances where the strong-side defenseman moved to the Low Area, he ended in Zone 1 four times (14%), Zone 2 on 12 occurrences (41%), and Zone 3 for the remaining 13 chances (45%). 50 scoring chance events were recorded while the strong-side defenseman was in the High Area, of which the defenseman was located in Zone 4 on 25 (50%) occasions and in Zone 5 for the other 25 (50%) of the recorded events. (Figure 10).

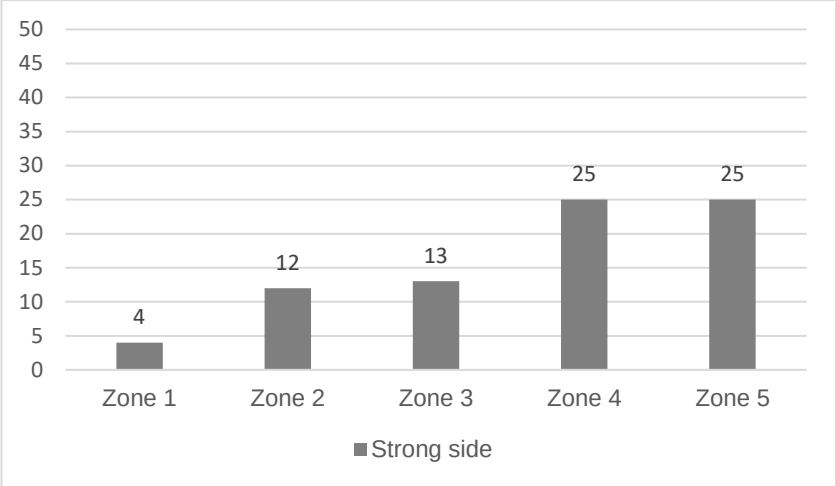


Figure 10. Strong-side defenseman position changes in five position change zones

The weak-side defenseman was in the Low Area Zone 1 in the offensive zone once (1/9) (11%) and situated in Zone 2 and Zone 3 each during four out of nine (44%) scoring chances. The weak-side defenseman was in positional change Zone 4 in the High Area 32 out of 70 (46 %) recorded events and in Zone 5 in High Area during 38 of these 70 (54 %) occurrences (Figure 11).

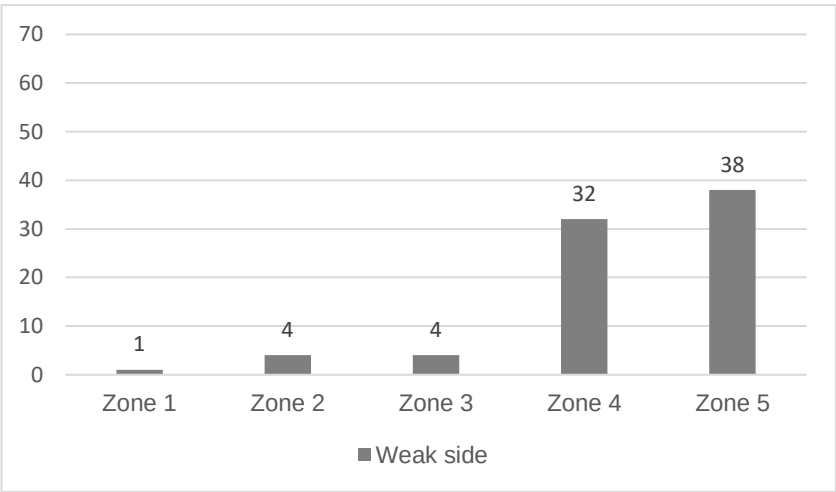


Figure11. Weak-side defenseman position changes in five position change zones

Of the 79 scoring chances generated, the defensemen changed positions on 42 occasions (53 %). In 16 of these scoring chances (20 %) both of the defenseman changed positions, meaning that there was more than one positional change preceding a scoring opportunity and in total there were 58 positional changes concurrent with the 79 opportunities. The weak-side defenseman accounted for 22 positional changes while 36 positional changes were made by the strong-side defenseman (Figure 12).

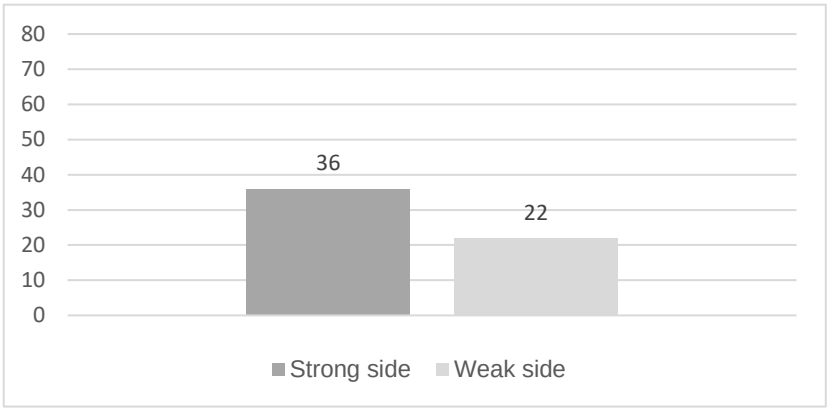


Figure 12. Defensemen position changes in 79 scoring chances

When a scoring chance was created, the strong-side defenseman made an Outside positional change from the High Area to the Low Area in 25 of 36 events (32 %). From High to Low, an Inside positional change occurred in ten of these 36 scoring chances (28 %), while a High crossing positional change happened once (3 %) (Figure 13).

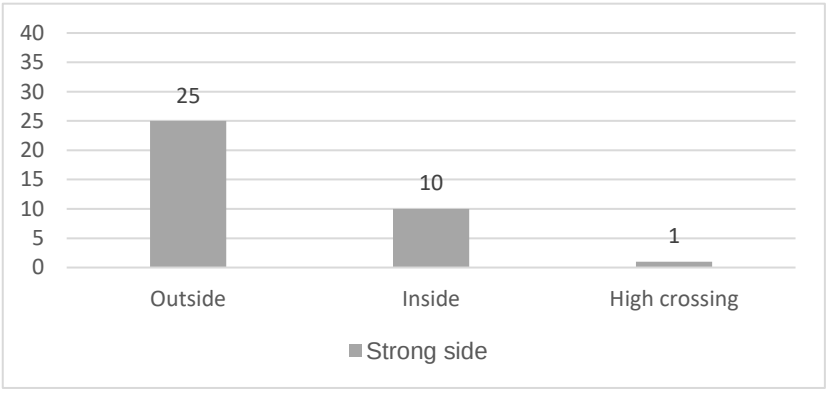


Figure 13. Strong-side defenseman position changes

When creating a scoring chance, the weak-side defenseman made an Outside positional change from the High to Low Area in seven of 22 occurrences (32 %). From High to Low, an Inside positional change happened once (5 %), while High crossing positional change was made in 14 of the 22 opportunities (63 %) (Figure 14).

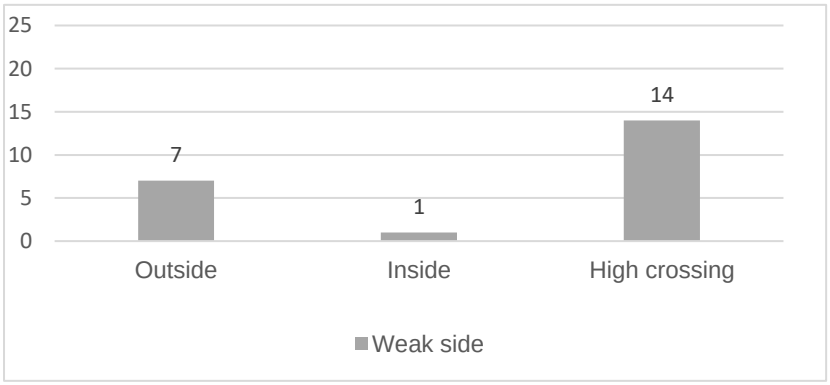
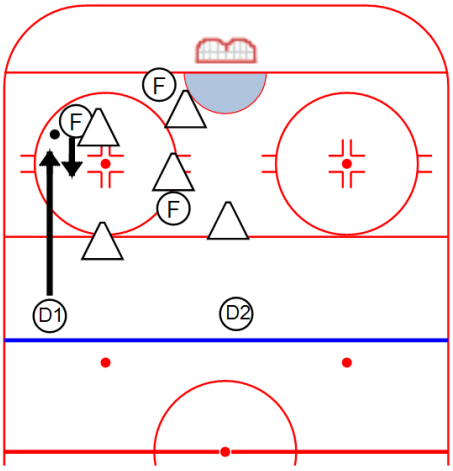


Figure 14. Weak-side defenseman position changes

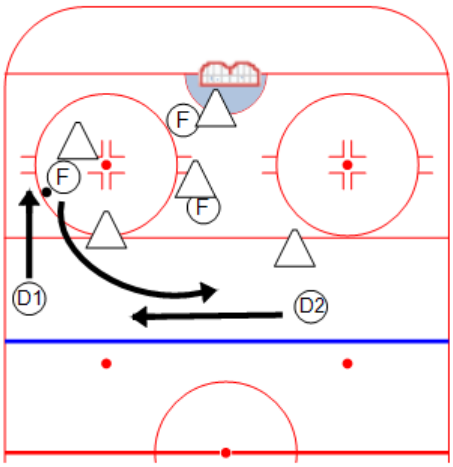
5.3 The types of defensemen position changes

When analyzing the type of positional changes, the defenseman made, the most common was the strong-side defenseman making a High to Low Outside positional change, which occurred in 32 out of 77 total positional changes (42 %). During these recorded events, the defenseman moved from Zone 4 to Zone 1 or Zone 5 to Zone 3 (picture 18).

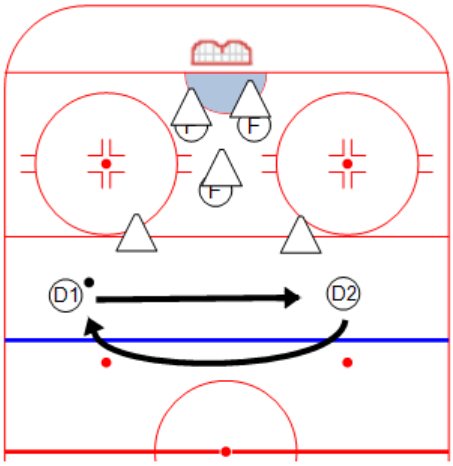


Picture 18. Most common positional change from High to Low from Zone 4 to Zone 1.

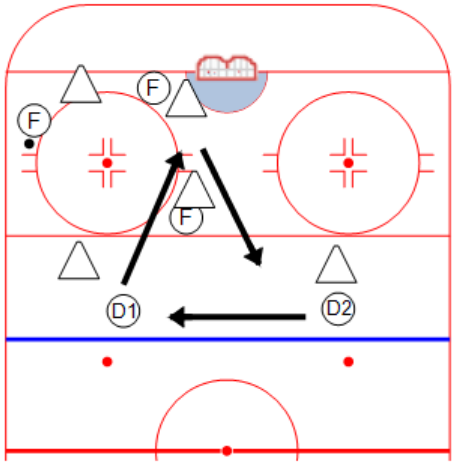
For the Weak-side defenseman, the most common positional change was a High crossing from Zone 4 to 5 or from Zone 5 to 4. For example the weak-side defenseman crossing with a forward who is carrying the puck in the High Area (picture 19), the weak-side defenseman crossing with the strong-side defenseman who's carrying the puck in High Area (picture 20), or weak-side defenseman filling the empty space, which the strong-side defenseman leaves after a High to Low Inside position change and returns to the middle of the High Area (picture 21).



Picture 19. Weak-side defenseman crossing with a puck-carrying forward

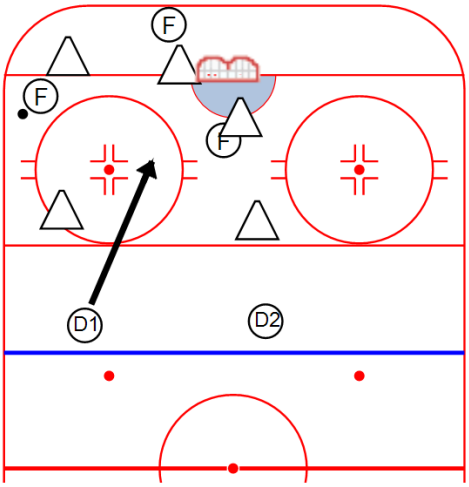


Picture 20. Weak-side defenseman crossing with the strong-side defenseman

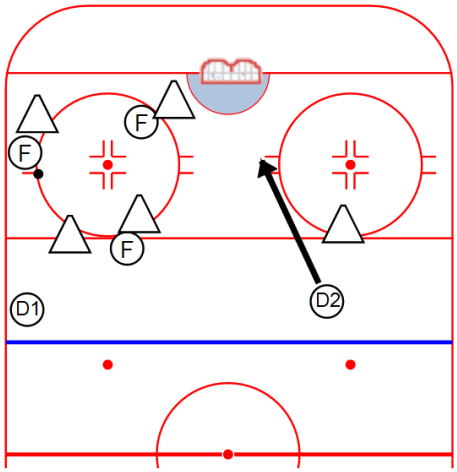


Picture 21. The weak-side defenseman filling the empty space

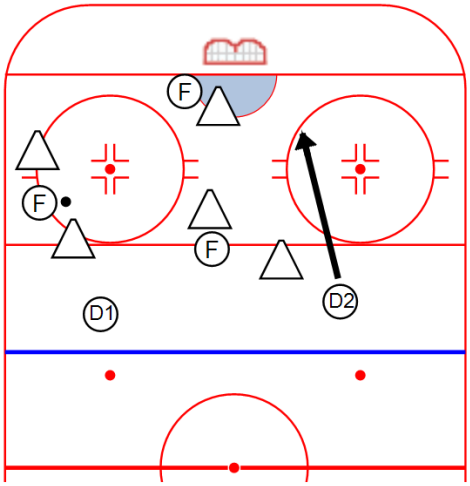
In addition, the Finnish National U18 team's strong-side defensemen made 12 High to Low Inside positional changes (picture 22). The weak-side defensemen made one High to Low Inside changes (picture 23), and the weak-side defensemen made eight High to Low Outside positional changes (picture 24).



Picture 22. The strong-side defensemen High to Low Inside positional change



Picture 23. The weakside defensemen High to Low Inside positional change



Picture 24. The weakside defensemen High to Low Outside positional change

6 Discussion

The objective of this study was to form an understanding about the defensemen's offensive efficiency in offensive zone offensive play and the impact of positional changes on goals and scoring chances. The aim was to analyze how the defensemen have been involved to offensive zone offensive play, and to suggest how the defensemen should be changing positions in offensive zone offensive play to improve scoring chances and offensive efficiency.

The main purpose in this study was to discover whether the defensemen's offensive efficiency does have an impact on goal and scoring chances in 5v5 play. The defensemen's effectiveness in offensive zone offensive play was measured from these two perspectives:

- Where the defensemen are situated in offensive zone offensive game, the high or low position at the time of goal or scoring chance?
- What kind of positional changes the defensemen have executed at the time of goal or scoring chance?

To answer the questions a performance analysis was adopted as an approach to carry out an observational analysis. O'Donoghue (2010) suggests the performance analysis as a method to analyze how players perform and use their skills when implementing the strategy and tactics. The main research type for performance analysis is observational research, which enables notational analysis of events and does not control the events. (O'Donoghue, 2010, 2-3, 30.) Performance analysis provided an opportunity to observe the offensive zone offensive game based on players' movements and performance.

The target for observational analysis was the Finnish National U18 team. In this study 21 international games from Finnish National U18 national ice hockey team were analyzed. The games were played during the 2017-2018 season. The team system of the Finnish National U18 team included various forms for defenseman to play actively in offensive zone offensive play. The game system included structured forms and pre-determined rules for the defenseman to recognize when and where to change positions in offensive zone offensive play. These situations were also practiced with different drills during on-ice trainings and by reviewing video of these situations.

The primary method for analyzing data was through the use of video review. The post-game video review enabled analysis of the games with the focus on key concepts for offensive zone offensive play as defined in this study. This provided a method to observe

where the defensemen were situated in the five zones defined in this study for the offensive zone and what type of positional change the strong and weak-side defensemen made.

The results indicate that the defensemen's offensive efficiency does have an impact on goals and scoring chances in 5v5 play. The defensemen's effectiveness and positional changes, not just traditional High Zone switches but also to the Low areas, impacted significantly on goals and scoring chances during offensive zone offensive play. These positional changes can be executed by either or both the strong- or weak-side defenseman, but the results indicate that the positional change may be more beneficial from the strong-side defenseman. In some situations, both can change positions, and even multiple times during the offensive zone offensive game. The main purpose of this is to create offensive chances as well as to distract the opponent's defensive players.

The defensemen had 24 scoring chances, which was one-third of total scoring chances (n=24/79). The strong-side defenseman had 16 while the weak-side defenseman had eight of these scoring opportunities. Of the 16 scoring chances from the strong-side defenseman, a positional change occurred 13 times. Nine of these 13 were from High to Low Outside, while four were High to Low Inside positional changes. Of the eight scoring chances the weak-side defenseman generated, a positional change occurred five times, with four occurring from High to Low Outside and once, a High crossing positional change. These findings underline the significant changes in defensemen's offensive zone efficiency when compared to the results of Luimula (2013), which indicated that the defensemen did not make any noted actions in the offensive zone other than to shoot from the blue line (Luimula, 2013).

In offensive zone offensive play extended puck possession preceded more than half (n=52/79) of the scoring chances. This finding is in line with the results on Thomas (2006) and Tulsky et al. (2013) when they suggest that puck possession creates offense. With puck possession the defensemen changed positions on over half of the scoring chances (n=35/52). Thus, the defensemen's positional change has a positive effect on creating scoring opportunities. One of the defensemen was in Low Area on almost half of the scoring chances (n=38/79). For the strong and weak-side defensemen it didn't seem to be significant in which High Area they were located. The most common positional change was for the strong-side defenseman to move from High to Low and Outside. When stealing the puck, the defensemen changed positions in just over a quarter (N=7/27) of the scoring chances, suggesting a reduced impact offensively and possibly a result of the transition to Role 4 on lose of possession before a teammate has regained possession.

The results support the statement of Brithén (2011) that team system can have various forms. The Finnish National U18 team's offensive zone offensive play had various forms and the defensemen made different types of positional changes. The results support also the statements of Varmanen (2016) and Westerlund and Summanen (2001) that the players need to have mutually shared objectives for offensive play in order to help the players to make appropriate decisions. The Finnish National U18 team practiced the team systems for offensive zone offensive play and the risk of losing defensive readiness was minimized as the Finnish National U18 team players knew when and where to move according to the team tactics.

Like Riley (2017) states offense and defense can't be captured by a single measure. (Riley, 2017.) Based on key statistics or statistical analysis it's difficult to say how all five players have contributed to goals or scoring chances, what has happened when the players have been off the puck, and what the role of the defensemen has been. Thus, it was essential to define the key concepts for analysis in this study in order to measure the performance of the defensemen in a unified manner and also to provide the results in a form that enables analysis of where the defensemen where situated in the offensive zone and what kind of positional changes they executed.

Traditionally the defensemen have been situated in the High Area close the blue line in offensive zone offensive play. As Westerlund and Summanen (2001) have stated, the players need to change from playing one situation role to another rapidly. They also stated that previously the defensemen defended, but now the players need to be able to play in every playing situation role (Westerlund & Summanen, 2001). When analyzing where the Finnish National U18 team's defensemen were situated in offensive zone offensive play at the time of goals or scoring chances, the strong-side defenseman was situated in the Low Area on 36 occasions and 65 times in the High Area. The weak-side defenseman was situated in the Low Area 11 times and in the High Area for 90 recorded events. The results indicate that the defensemen still remain close to the blueline for a majority of scoring chances, but the strong-side defenseman was in Low Area every third time, indicating that it is not so rare to have a defenseman, for example, in front of the net during a scoring situation. The results indicate that the role of the defensemen have changed from the traditional one.

The research from the Finnish National U18 team's games supports the concept of defensemen's increased offensive efficiency and the importance of changing positions during offensive zone offensive play. The Finnish National U18 team scored 44 goals in 5v5

situations and half of those goals were from offensive zone offensive play. Of these, half over again (13/22) were scored when at least one of the defensemen on ice changed position. Both defensemen changed positions before the goal in six out of 13 offensive zone offensive situations. According to these numbers it is beneficial for defensemen to change positions for the team during the offensive zone offensive play.

This research is beneficial for ice hockey coaches to improve an understanding of the offensive zone offensive game. To make offensive zone offensive play more effective, a team needs to have an offensive zone play system that increases the defensemen's offensive efficiency and incorporates positional changes from High and Low Areas. Coaches need to implement the defensemen's offensive zone efficiency in the game plan and create drills that can be practiced systematically. Systematic training helps the defensemen perceive when and where they should change positions. If it's not systematic the defenseman can't contribute to the offensive zone efficiency and position changes are only up to the individual defenseman's reactions and game sense. If the position changes are random, the full offensive potential of defensemen is not used, and other players may lack a readiness to defend.

The research also exposed the difference in activity between strong-side and weak-side defensemen. Most of the positional changes that strong-side defensemen made were from the High Area to the Low Area. Weak-side defensemen mostly stayed in the High Area, moving laterally. This needs to be taken into account when creating the play system because the weak-side defenseman should actively participate and change position, even if only in the High Area.

In this study the validity of the results can be ensured because the sample data was collected from real game events. The observational performance analysis provided an objective way to analyze the results, the events could not be manipulated, and the analysis can be repeated by another person based on the key concepts defined for this study. The sample data represented real events and the findings represent these events accordingly and provide an answer to the research questions in this study. The findings can be generalized and used to increase the understanding of how to utilize the offensive effectiveness of defensemen on other teams, as well. Also, the data was collected from various games, against different opponents, increasing the reliability of the results. Lastly, the data was analyzed by a person, who has operated as video coach and has a long history in the field of ice hockey.

7 Conclusions

The role of offensive zone offensive play has increased in modern ice hockey. Teams need to have various forms of offensive zone offensive play systems in order to extend puck possession and increase scoring opportunities. In modern ice hockey the defensemen are much more active in offensive zone offensive play in order to utilize the full potential of their offensive efficiency. The fast pace of modern ice hockey requires having all five players involved in a team's system in every zone and all five need to be able to contribute to the team's success in every zone.

To understand how the defensemen's offensive efficiency can be utilized in offensive zone offensive play, this study focused on analyzing where the defensemen should be situated in the offensive zone, as well as how they should change positions in order to increase the scoring chances. By selecting performance analysis as the research approach and using observational analysis, it was possible to conduct post-game analysis to dissect the offensive zone offensive play and focus on the effectiveness of the Finnish National U18 Team's defensemen. In total 21 international games from five tournaments during the 2017-2018 season were analyzed based on the key concepts defined in this study for offensive zone offensive play. The season concluded at the 2018 IIHF World Championships, which the Finnish National U18 team won the Gold.

The results indicate that a defensemen's offensive efficiency does have a positive impact to goals and scoring chances in 5v5 offensive zone offensive play. The defensemen's activity and positional changes in not just traditional High Area but also in Low Area impacted significantly to the goals and scoring chances in offensive zone offensive play. Both the strong- or weak-side defenseman can execute a positional change, but the results indicate that the positional change might be more beneficial from a scoring efficiency perspective from the strong-side defenseman. In some situations, both can change positions once or multiple times during the offensive zone offensive play.

The main purpose of a positional change is to create offensive chances and also to distract the opponent's defensive players—by changing positions the defensemen force the opponent to make quick decisions which results the speed difference and often creates space as the defensive players may lose the players they are defending.

7.1 Contribution

This study focused on investigating the offensive zone offensive play in order to increase an understanding of the defensemen's offensive efficiency in offensive zone. The study has some contributions to both practice and research.

From a research perspective the findings of this study support the general thought that the role of offensive zone offensive play has increased, and the defensemen can have a surprisingly large role in creating offense. Because the previous research has mostly focused on the statistical analysis of goals and scoring chances, the future research should focus more on the team playing system and strategies in different zones to understand how goals and scoring chances can be created from a tactical perspective. This study only points out the defensemen's potential in offensive zone. Their activity and the impact of other roles could be studied more deeply in all zones of play. Also, the models and concepts used in this study for the notational analysis should be tested with other team's data in order to strengthen the understanding of the key concepts for the offensive zone offensive play. Lastly, similar concepts should be defined for the other zone's play system.

From a practical perspective the findings of this study suggest that coaches need be tactically aware of the offensive potential that the defensemen in modern ice hockey provide. As the ice hockey has become more of a puck possession game, the role of zone plays, especially the offensive zone play, has increased. Coaches need to be aware of the skill an increased offensive role requires from the defensemen in order to ensure that the team develop and select the right kind of players.

7.2 Limitations

This study has some limitations. The study was done only for one team and only during the one season. The team was a national team and the players changed during the season. Conversely, the coaching staff, key players, and the game system stayed the same during the entire season

In the research it is not taken into consideration which hand the defensemen played. It might be beneficial for shooting and passing if the left defenseman plays left hand lower and right defenseman plays right hand lower. On the other hand, it might be easier for defensemen to protect the puck if the sticks are other way round.

Research was done only from an offensive point of view. Readiness to defend and did the defensemen's positional changes cause puck losses and scoring situations in the team's own end was not considered. Since this was the first study of defensemen's activity in offensive zone offensive play with this model and the data was analyzed by one observer, the study writer might have interpreted some findings inaccurately. The study writer, however, has over 30 years of background in ice hockey, first as a professional player and currently as a coach. However, the findings were in line with the current understanding among some ice hockey coaches and players who aim to increase the active participation and offensive capabilities of the defensemen.

This study does not reveal how the positional changes impact on goals or scoring chances against different defensive zone defensive play systems and tactics. Results might be different if the study would have been done only on the games played against teams playing the same defensive system. For example, against a team protecting only the middle, position changes might not be as beneficial.

7.3 Future research

The purpose of this study was to measure the impact of a defenseman's offensive effectiveness in offensive zone offensive play on goals and scoring chances. From this perspective it was not relevant to measure how many goals the defensemen scored or how many scoring chances they created. Instead relevancy lay in measuring their positional changes at the time a goal was scored, or a scoring chance occurred, in order to understand the impact of their activity. However, with a larger sample size it might be interesting to also measure goals and scoring chances made by the defensemen, and where they were situated in the offensive zone.

It would be beneficial to study how much the defensemen's active participation in offense affects a team's defensive readiness. Most likely that research would also expose what kind of positional changes forwards have to make to maintain defensive readiness. In addition to this study, it could be interesting to investigate the positional switches of forwards with the defensemen in order to ensure zone balance and defensive readiness. This might provide the next steps towards a non-positional offensive zone offensive play. Additionally, these subjects could be investigated in other zones.

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